The relationship between mathematics performance and self-efficacy beliefs of Grade 9 mathematics learners

by

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Prof. Dr J. G. Knoetze

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Declaration

I declare that the thesis, which I hereby submit for the degree MED General at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution.

Sign…………………………… Date…………………...

Chewachong Patience Meninkele Akih

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Abstract

Title	The relationship between mathematics performance and self-efficacy beliefs of Grade 9 Mathematics Learners
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Supervisor	Prof. Dr J.G. Knoetze
Department	Science, Mathematics and Technology Education
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The aim of the study is to explore the relationship between Mathematics performance and self-efficacy beliefs of Grade 9 learners in South African schools. This research focuses on Mathematics learners that participated in the Trend in International Mathematics and Science Study (TIMSS) 2011 project.

The study investigated the poor performance as reflected in TIMSS 2011, an international survey that was carried out by the International Association for the Evaluation of Educational Achievement (IEA), indicating that South Africa Grade 9 learners had the lowest performance among the TIMSS 2011 participating countries for Mathematics.

The present study followed a secondary data analysis of the TIMSS dataset that related to South African Grade 9 Mathematics learners and adopted an integrated qualitative-quantitative approach. Three research questions and three hypotheses guided this study.

The target population was 9 504 schools and 988 632 learners in the South African educational system. However, a sample of 285 schools and 11 969 Mathematics learners in South Africa was considered for the study, using a stratified random sampling technique. The instrument used for data collection was a learner questionnaire on Mathematics. Data collected was analysed using mean, frequencies, percentages, effect size, one-way Chi-square and Mann-Whitney U techniques.

Findings from the study indicate that there is a need for South African Mathematics learners to develop positive self-efficacy beliefs in Mathematics, as there was a significant difference in the influence of self-efficacy beliefs on learners' performance in Mathematics. There was also a significant difference between learners speaking English, which is the language of test at home, and learners whose home language is not English.

Keywords: Secondary data; Mathematics education; attitudes towards Mathematics; Mathematics performance; self-efficacy; self-efficacy beliefs; TIMSS 2011; TIMSS dataset; Grade 9 learners; qualitative-quantitative approaches.

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Chapter 1

Introduction and Background

1.1 Introduction

The Trends in International Mathematics and Science Study (TIMSS) constitutes one of the significant assessment projects that have resulted in many significant international comparative studies on educational achievement. TIMSS has constantly examined the Mathematics and Science achievement for the fourth and eighth grades in various participating countries every four years since 1995.

Findings indicate that East Asian countries have continuously been the top performers among the participating countries of the world (Mullis, Martin & Foy, 2008; OECD, 2004, 2010).

The good performance of East Asian countries has triggered the interest of educational researchers and policy makers around the world concerning in Mathematics and Science performance in schools. A fast growing body of studies have been carried out to investigate East Asian education from diverse respects in order to reveal the key to their success (Leung, 2001, 2006; Park, 2004; Wößmann, 2005; Zhu & Leung, 2011).

The issue of low performing developing countries is very crucial in the current educational arena. It is therefore necessary to develop a good understanding of the educational practice of these countries and the factors that relate to their low performance in Mathematics and Science.

1.2 Background to the study

TIMSS was carried out for Grade 8 learners in 45 countries in 2011. From 45 countries in 2011, 42 countries involved their Grade 8 Mathematics learners while three countries (Botswana, South Africa and Honduras) involved their Grade 9 learners. These three countries have continuously been performing at the lowest end of the performance scale in both Mathematics and Science. The most remarkable phenomenon is that the best performing learners in Mathematics and Science in South Africa are close to those in the top performing countries (Reddy, 2014).

The Human Sciences Research Council (HSRC) carried out the study in 2011 in South Africa in 256 public schools and 27 independent schools and approximately 12 thousand Grade 9 learners participated. South Africa participated in TIMSS in 1995, 1999 and in 2002.

The results of 1995, 1999, 2002 and 2011 show that the national average scores of the learners were almost the same. They also indicate that there was some improvement in both Mathematics and Science but the improvement was minimal – just one and half grade level (*Ibid.*).

South African learners performed very low in almost all the indicators of the TIMSS 2011 project (*Ibid.*), especially in Mathematics achievement scoring (20 %), even though they assessed the Grade 9 Mathematics learners instead of Grade 8 learners as compared to other countries (*Ibid.*).

Most South African Grade 9 Mathematics learners that participated in the TIMSS project showed a low frequency of “always speaking English at home” (*Ibid.*). The South Africa results for TIMSS 2011 showed a high correlation with English language proficiency in Science (Howie, Scherman & Venter, 2008) as well as Mathematics (Howie, 2004).

There is also evidence that learners with a lack of English proficiency provided mostly wrong answers in TIMSS Mathematics and Science test booklets (Dempster, 2006). Knowing that there are many concepts involved in Science that are counter-intuitive, complex and often abstract in nature, it is likely that poor language ability makes scientific understanding more difficult (Brophy & Good, 1986; Inglis, 1993; Gray, 1999).

According to Gray (1999) the language of Science instruction is the single most significant obstacle to better understanding in the subject. South African learners’ poor performance in Science cannot be completely accounted for by language problems (Dempster & Reddy, 2007).

The poor achievement in developing countries has been attributed to poor resources. It is true in the case of South Africa (Reddy, 2005) as the legacy of the Apartheid system has resulted in inequality of resources distribution that is more serious than in other countries. There are also achievement differences between advantaged schools and disadvantaged schools (Reddy, 2006) and it is particularly true in rural areas where many schools still suffer from lack of basic necessities such as water, electricity, sanitation, etc. (Perry, 1997).

Interestingly, South African learners actually showed positive attitudes towards Mathematics and thought that they had performed well in Mathematics, which is not true according to the TIMSS results (Martin, Mullis, Gonzalez & Chrostowski, 2004).

Research studies have been carried out to investigate the relationship between self-efficacy and Mathematics achievement (Ayotola & Adedejib, 2009; Shkullaku, 2013; Liu & Koirala, 2009; Shih-hsien, 2012; Tenaw, 2013; Dehgani, 2011). Research literature is silent about the relationship between self-efficacy beliefs and Mathematics performance in South Africa.

Furthermore, no study has been carried out on self-efficacy and Mathematics performance in TIMSS 2011 for Grade 9 Mathematics learners in South African schools. Therefore this study used TIMSS 2011 data to conduct an analysis of Grade 9 Mathematics self-efficacy beliefs and learners' performance in Mathematics in South Africa.

1.3 Rationale for the study

The insights gained from this study should inform stakeholders about the relationship between self-efficacy beliefs of learners so that more effective Mathematics teaching structures can be developed. It is also anticipated that the findings of this study will assist in identifying elements of self-efficacy beliefs that affect learners' performance.

1.4 Statement of the problem

Mathematics and factors that influence learners' achievement in Mathematics have become important aspects in educational systems (Wan, Sharifah, Habsah, Hamzah, Mat, Mohd & Rohani, 2005). Mathematics is introduced as early as possible at the primary school level in most of the countries but learners still have problems in solving basic Mathematics questions that extend to the higher levels of their education (*Ibid.*).

Learners are expected to have reached a certain level or standard as far as Mathematics knowledge is concerned before they enter university. However, the importance of Mathematics in all walks of life has triggered debates among researchers, parents and educational authorities (Khairum, Najiyah, Iskandar, Nurul amiral, Siti Haryanti, & Nor Hafizah, 2014). Most studies on Mathematics performance are associated with psychological factors with the most prominent psychological factor associated with Mathematics performance being Mathematics self-efficacy (*Ibid.*).

According to Bandura (1997), self-efficacy is not just about the skills learners have but the beliefs concerning what learners can do under different conditions, no matter their skills. Research has shown the importance of self-efficacy beliefs that predict learners' performance in Mathematics. For instance, Bandura (1977) attests that self-efficacy as a person's belief system involves the ability to perform a given behaviour successfully and is a major factor that relates to whether a person will attempt given tasks, and contributes to the amount of effort and perseverance produced in pursuing the task. Self-efficacy beliefs are based on social cognitive theory wherein learners' self-efficacy in the judgement of confidence in performing academic tasks determines the subsequent capacity to accomplish such tasks (Bandura, 1986).

Parsons et al. (2009) carried out a study on learners' confidence concerning their ability in Mathematics and it was discovered that most of the learners were quite confident during their first year of study. The same authors also carried out a similar study in 2011 that revealed that learners who had confidence during their first year of study were confident in their future use of Mathematics (*Ibid.*).

Ayotola and Adedeji, (2009) and Kheri, Erdogan and Sahin (2010) indicate a very strong positive relationship between Mathematics self-efficacy and Mathematics achievement. Wan and Mahd (2010) also found a positive correlation between Mathematics performance and self-efficacy. Shams et al. (2011) studied the role of academic self-efficacy in the relationship between the Five-Factors Model (FFM) of personality and Mathematics performance and the findings indicate a positive and significant correlation between FFM and Mathematics performance.

A study by Ünlü and Ertekin (2013) investigated the relationship between Mathematics teaching self-efficacy and Mathematics self-efficacy beliefs and found that there was a positive relationship. The study on Mathematics self-efficacy beliefs is important to identify how self-efficacy contributes to Mathematics performance. Therefore the aim of this study was to explore Mathematics performance and self-efficacy beliefs of South African Grade 9 Mathematics learners that participated in TIMSS 2011. National leaders, policy makers and educators share the desire to understand and identify factors that have significant and reliable relationships with Mathematics performance (Phan, Sentovich, Kromrey, Derick & Ferron, 2010).

South African researchers and educators are concerned about the low performance of learners in International Mathematics Assessments. For instance, in the TIMSS 2003, the five lowest performing countries were the Philippines, Botswana, Saudi Arabia, Ghana and South Africa. In TIMSS 2011 the same situation occurred where South African Mathematics learners' performance was among the lowest in the world. Furthermore, TIMSS reports indicate that South Africa is among the developing countries where learners struggle to solve mathematical problems on their own (Jurdak, 2009). The performance of South African Mathematics learners is actually a call for concern as another international study, the Second Southern Africa Consortium for Monitoring Educational Quality (SACMEQ II) also revealed low performance (Moloi & Straus, 2005).

To date no study has been carried out on self-efficacy beliefs and Mathematics performance of Grade 9 Mathematics learners in South African schools for TIMSS 2011. In order to understand the issue of low performance in Mathematics, it was necessary to carry out a quantitative study to explore the relationship between performance and self-efficacy beliefs of learners in Mathematics and elements of self-efficacy that affect learners' performance in Mathematics.

Learners' Mathematics self-efficacy beliefs and other variables could be of great interest to researchers and educators and can also be regarded as a means to improve learners' grades. It should be the desire of educators to both identify and understand elements of self-efficacy that affect learners' performance in Mathematics.

1.5 Purpose of the study

The purpose of the study is to explore the relationship between Mathematics performance and the self-efficacy beliefs of Grade 9 Mathematics learners that participated in TIMSS 2011 in South African schools.

1.6 Research questions

Taking the purpose statement into consideration, three research questions were formulated.

Research Question 1:

What is the relationship between the Mathematics performance of learners and their self-efficacy beliefs relating to Mathematics in South African schools?

Research Question 2:

How do learners' self-efficacy beliefs towards Mathematics affect their performance in Mathematics in South African schools?

Research Question 3:

What are the elements of self-efficacy that affect learners' performance in Mathematics in South African schools?

1.7 Statement of the hypotheses

The null and alternative hypotheses are indicated in Table 1.1.

Table 1.1: Research questions and the null and alternative hypotheses

1	What is the relationship between the Mathematics performance of learners and their self-efficacy beliefs relating to Mathematics in South African schools?	**H_0:** There is no significant relationship between Mathematics performance of learners and their self-efficacy beliefs relating to Mathematics in South African schools. **H_1:** There is a significant relationship between Mathematics performance of learners and their self-efficacy beliefs relating to Mathematics in South African schools.
2	How do learners' self-efficacy beliefs towards Mathematics affect their performance in Mathematics in South African schools?	**H_0:** There is no significant relationship between how learners' self-efficacy beliefs towards Mathematics affect their performance in Mathematics in South African schools. **H_1:** There is a significant relationship between how learners' self-efficacy beliefs towards Mathematics affect their performance in Mathematics in South African schools.
3	What are the elements of self-efficacy that affect learners' performance in Mathematics in South African schools?	**H_0:** There is no significant relationship between the elements of self-efficacy that affect learners' performance in Mathematics in South African schools. **H_1:** There is a significant relationship between the elements of self-efficacy that affect learners' performance in Mathematics in South African schools.

1.8 Significance of the study

This study is grounded in the belief that since Mathematics plays a very important role in the nation's economic, social and political life and in learners' future, supporting learners in developing a positive attitude to Mathematics will assist in improving their performance. Akinsolo and Olwojaiye (2008) point out that learners' successful experience in Mathematics tasks can make them develop positive attitudes to learning Mathematics. Speaking the language of test at home and providing learners with basic human needs may also contribute to positive self-efficacy beliefs in Mathematics.

1.9 Assumptions of the study

This study is based on the following assumptions: The data in the International Association for Evaluation of Education Achievement (IEA) data repository is precise, consistent and without errors. This assumption is based on the fact that IEA has had more than fifty years of experience in carrying out research in education.

Furthermore, TIMSS has carried out many assessment projects in Mathematics and Science surveys that indicate that its researchers have a good knowledge of carrying out surveys and for this reason their data is trustworthy.

1.10 Limitations of the study

The idea of using secondary data analysis is a limitation because the data was collected to address different research questions and for this reason specific information that may be useful and relevant to one's research may not be included (Baslaugh, 2007). Sometimes the way in which the data has been categorised may be a limitation; for example, it may have been categorised in categories and not as continuous variables (*Ibid.*).

Some of the information collected may not be made available to the secondary researcher for reasons of confidentiality (*Ibid.*). The problem of not having been there has serious effects when it comes to the interpretation of the data (Heaton, 2008).

This study is limited to a small sample of the South African Mathematics Grade 9 learners that participated in the TIMSS 2011 study. The sample size is therefore too small to draw conclusive conclusions. The study analysed data collected from learners and normally the data reflects the perspective of their attitude towards Mathematics and the impact they believe certain variables have on their Mathematics learning and performance.

1.11 Delimitations of the study

Mathematics performance should be regarded as having a relationship with the self-efficacy beliefs of the learner. However, from the variables that affect Mathematics performance, this study concentrated on Mathematics efficacy statements, basic human needs and speaking English at home, which is the learners' language of assessment.

The study explores learners' self-efficacy beliefs regarding Mathematics. It is limited to the South African Grade 9 Mathematics learners for the TIMSS 2011 and not any other country or subject area.

1.12 Structure of the dissertation

Table 1.2 outlines the structure of the chapters in the dissertation.

Table 1.2: Outline of the chapters

Chapter	Title	Description
1	Introduction and Background	An overview of and background to the study.
2	Literature Review	Literature that relates to the study and the theoretical framework that governs the study.
3	Research Design	Research design and methods used. Highlighting of the research procedures and processes.
4	Data Analysis	Detailed data analysis procedures that were conducted for the study.
5	Conclusion and Recommendation	Summary of the study results with concluding remarks, recommendations and suggestions.

Chapter 2

Literature Review

2.1 Introduction

The ability of learners to study Mathematics has been the concern of many researchers over the years. Research studies that concern learners' success in Mathematics have recently proliferated. There are also many discussions about learners and self-efficacy beliefs concerning Mathematics.

In an attempt to improve learners' cognitive and affective outcomes in Mathematics, Mathematics educators have continued to search for personal and environmental variables that could influenced learners' academic performance in the subject (West Africa Examination Council Report, 2009).

Looking at all the personal variables that attract researchers in the area of Mathematics performance, self-efficacy belief in Mathematics seems to enjoy much attention (Ayotola & Adedeji, 2009). Self-efficacy is very important in social cognitive theory and has been acknowledged as one of the most important theories that concern human learning (Ormrod, 2008).

Although several studies have been conducted on the relationship between the attitude towards Mathematics and Mathematics achievement, there is a lack of empirical research that explores the relationship between Mathematics self-efficacy beliefs and Mathematics achievement (Liu & Koirala, 2009). This study aims at exploring the relationship between Mathematics performance and self-efficacy beliefs.

According to Jesson, Matheson and Lacey (2011) there are two types of literature review, namely traditional and systematic review. The traditional review is based on building existing work while the focus is on describing and bringing the work together in a critical manner. A traditional review does not follow a particular methodology while systematic review means doing things in a methodological way and defines the purpose clearly; it also states exclusion and inclusion criteria. In Paragraph 2.2 a traditional review was carried out to analyse the literature that is relevant to the topic under study. Paragraph 2.5 is a systematic review that was used to explore how the relationship between Mathematics performance and self-efficacy beliefs has been evaluated in secondary education and TIMSS 2011.

2.2 Mathematics education

Mathematics is one of the subjects that are needed to obtain a degree in most of the universities and future career opportunities. This aspect might motivate learners to learn Mathematics (Akay & Boz, 2010).

Mathematics education research shows that many studies have been conducted relating to the relationship between attitude towards Mathematics and Mathematics achievement (Ma, 1997, Ma & Kishor, 1997; and Ma & Xu, 2004).

Mathematics is also a major concern in the context of South Africa; looking at the TIMSS 2011 results, South Africa ranked low out of the 63 countries that were assessed in the domain of Mathematics.

2.2.1 Attitudes to Mathematics

In Mathematics education literature, attitudes to Mathematics are operationally defined as enjoying or not enjoying Mathematics**.** An attitude to any subject has a positive relationship with achievement and success in that subject, but when it comes to Mathematics, it is either a positive or negative emotional stance to Mathematics (Zan & Martino, 2007). Learners' successful experience in Mathematics tasks can make them develop positive attitudes to learning Mathematics (Akinsola & Olowojaiye, 2008). Wang (2008) states that the way in which South African learners value Mathematics has a significant effect on their Mathematics performance.

2.2.2 Mathematics achievement in South Africa

Many countries in the world view Mathematics as a subject with the lowest learner achievement rate (Reddy, 2006; Howie, 2010). Despite all the effort that is being made by the various stakeholders in education to promote the subject, still very few learners succeed. South Africa is not an exception. The South African National Department of Basic Education has the mandate to design national education policies. The implementation of these policies depends on the individual nine provinces of the country (Reddy, 2011).

As the present study explores Grade 9 Mathematics learner performance, findings from the Trends in International Mathematics and Science Study (TIMSS) are assessed as the TIMSS is the only study to explore Grade 9 learners' Mathematics performance in South Africa. Therefore a brief description of the TIMSS study is necessary.

2.2.3 TIMSS

TIMSS is a worldwide assessment endeavour of Mathematics and Science in the fourth and eighth grades that is conducted every four years since 1995. TIMSS is a study that investigates learner achievement in Mathematics and Science (Mullis, Martin, Foy & Arora, 2012).

The IEA is an international cooperation institution that comprises government and national research centres and institutions that are based in the Netherlands and its focus is on education achievement (SITES, 2006; SITES, 2008). Since 1995 South Africa has participated in a number of TIMSS events under the auspices of IEA in Mathematics and Science education. South Africa has just started implementing a learner tracking process.

The annual National Assessment was also introduced in 2011, while national standardised testing of literacy and numeracy is being conducted in Grade 3, 6 and 9. There are still some unclear judgements since the assessments are not reported taking into consideration learners' background data, culture and parents' education background.

South African Grade 9 learners started writing the test that was meant for Grade 8 learners according to the TIMSS assessment project in 2003, the reason being that the test was too difficult for Grade 8 learners. In 2011 South Africa and two other countries used their Grade 9 learners to write the TIMSS Grade 8 test but the South

African performance was so poor that the Grade 8 learners of all other participating countries outperformed them, except those of Ghana (Muller, 2014).

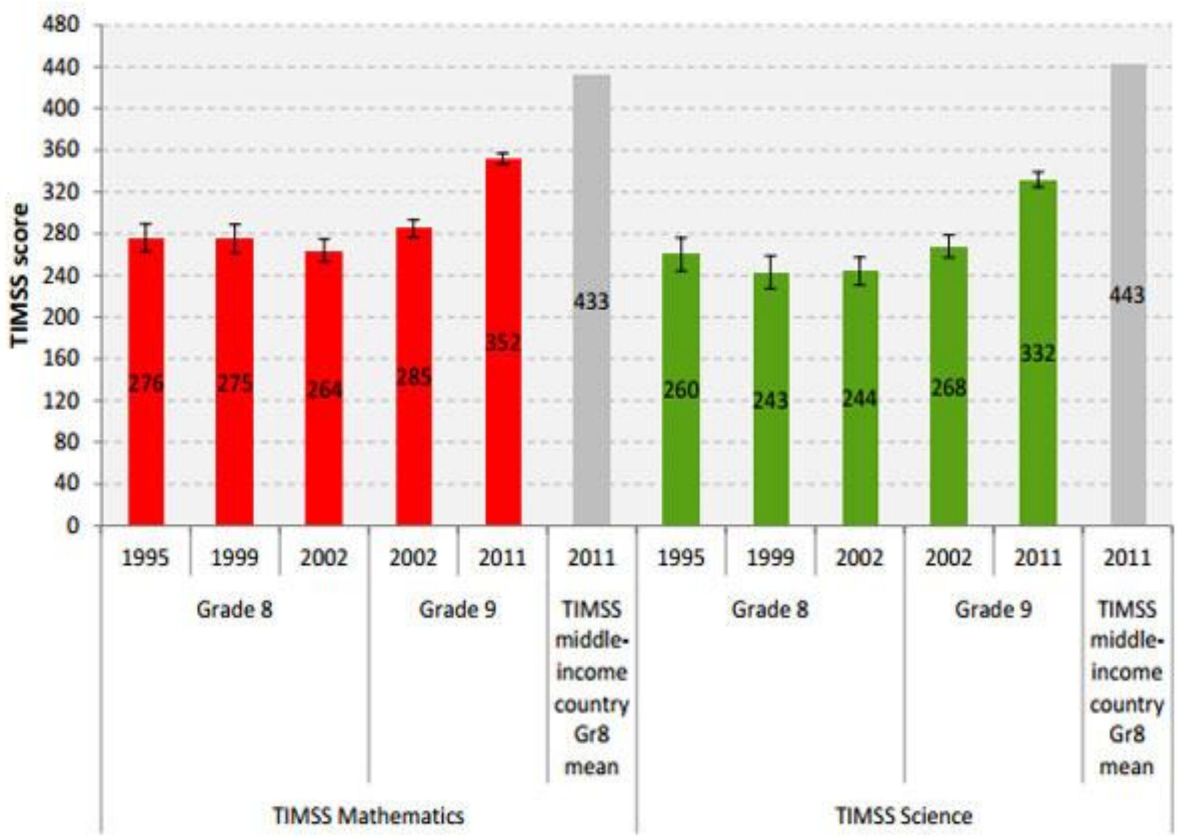
TIMSS results are helping South Africa to monitor its education reform and changes in its government educational policy. When the TIMSS results for 1999 were released, government spending on Mathematics and Science education was increased (Reddy, 2011).

The government also identified the100 best performing secondary schools from disadvantaged communities and equipped them with Mathematics and Science materials to upgrade their teaching of these two domains. The South African Department of Education (DoE) depends on TIMSS results to conceptualise the standard of Mathematics and Science education during their general education and training phase (*Ibid.*).

2.3 Self-efficacy beliefs

Self-efficacy beliefs have to do with learners' impressions about their ability to plan and carry out assigned tasks that enhance performance and achievement. They form the basis for human inspiration, welfare and individual achievement. Learners often display low motivation to engage in a task and are not tolerant of challenging circumstances, especially when they are not certain their involvement will bring about the envisaged outcomes (Bandura cited by Pajares, 2002). Figure 2.1 indicates the trends in South African Mathematics and Science achievement from 1995 to 2011.

Figure 2.1: Trends in South African Mathematics and Science Achievement: 1995 to 2011



Self-efficacy beliefs have to do with the totality of human life and they set up core factors for human development and adaptation. Beliefs and reality are worlds apart when it comes to self-efficacy and Mathematics learning. What learners achieve could be related to their self-efficacy beliefs, prior knowledge or skills in the subject (*Ibid.*).

These beliefs show how learners understand the knowledge and skills that they have acquired. Self-efficacy beliefs are very important elements in human functioning because they develop results and opportunities. Self-efficacy beliefs and result assessments sometimes vary because logical intelligence cannot come from behaviour that is not in line with beliefs *(Ibid.*).

It is possible to produce good results even with low self-efficacy beliefs. For instance, learners may know that they need good arithmetic abilities in order to attain success and admission into a graduate school. This may lead to a relaxed lifestyle and poor performance or confidence in Mathematics ability with learners keeping away from certain courses and not getting to graduate school *(Ibid*).

Self-efficacy is an individual and social construct. There is a need for cooperative efficacy where a group's shared beliefs have the ability to attain set objectives and achieve preferred tasks (*Ibid.*).

2.3.1 How to create self-efficacy beliefs

People develop self-efficacy beliefs when they examine evidence from past results. Self-efficacy is increased through successful performance. Individuals with a low sense of efficacy experience failure without necessarily changing their self-belief. Individual self-efficacy beliefs are developed through joyful experiences of seeing people successfully carry out activities *(Ibid*).

The achievement of some models motivates learners' beliefs concerning their abilities. When learners look at these models' qualities and see that these are differences from theirs, the impact of a joyful experience is reduced. Models that have left an impression can be an inspiration to others as they can modify their self-belief and it may change their way of living (*Ibid*).

People also create and develop self-efficacy beliefs through environmental appeals they get from community members. The appeals expose them to "verbal judgments" from those concerned (Bandura cited by Pajares, 2002, p. 7). Appeals from community members contribute to the growth of people's self-belief and help them reach their set goals. However, negative appeals could contribute to diminished self-efficacy belief.

People with low self-esteem weaken their self-efficacy belief. Individuals live in communities with emotional and physiological states that are created by their own very selves (Bandura, 1997). The gathering and making sense of data have an impact on self-efficacy beliefs.

2.3.2 Factors influencing human functioning

2.3.2.1 Influence of self-efficacy beliefs on human functioning

Self-efficacy beliefs encourage learners to make choices and also enable them to follow up their plans. People normally accept responsibilities and undertakings they are able to carry out. Factors that influence learner behaviour come from the idea that learners have the ability to perform according to certain beliefs (Bandura cited by Pajares, 2002).

Self-efficacy beliefs can influence the level of effort learners need to realise a task, and the time and energy to overcome all difficulties. Learners need much effort, open-mindedness and strength to have a very high sense of efficacy. Self -efficacy beliefs also influence learners' thinking skills and how they can cope with their emotions (*Ibid.*).

High self-efficacy requires level-headedness in individuals to enable them to carry out difficult tasks and assignments. Self-efficacy is a strong force in carrying out tasks and being successful. Self-efficacy beliefs should be assessed from time to time to determine the impact experience has on competence and to keep on improving their effectiveness. It is necessary to understand the importance of knowledge and skills that are needed to develop positive manners to the full (*Ibid.*).

2.3.2.2 Self-efficacy and human attainment

Mathematics is a very important in our day to day lives. Learners regard Mathematics as a difficult subject (Stodolsky, Salk & Glaessner, 1991). Low self-confidence is an essential aspect that causes difficulty in learning Mathematics. This feeling will normally make a learner drop out from learning Mathematics (Brown, Brown & Bibby, 2008).

Self-confidence has an important role to play in learning (Maclellan, 2014) since it determines learners' way of learning (Schunk, 1990). Learners with high self-confidence normally perform better in their tasks (Kleitman, Stankov, Allwood, Young & Mak, 2013) and are more active in carrying out their tasks (Gushue, Scanlan, Pantzer, & Clark, 2006) than learners that have low self-confidence in carrying out a task.

Low self-esteem leads people to see themselves as not capable of attaining success (Bandura cited by Pajares, 2002, p. 7). Learners' self-efficacy beliefs have a positive or negative impact on various tasks and disciplines (Stajkovic & Luthans, 1998). Self-efficacy beliefs can be found in social cognitive theory and involve individual and community services that work together with other social cognitive beliefs to bring about human welfare and success in achieving tasks (Bandura, 1997).

Social cognitive theory examines the nature and origin of self-efficacy beliefs, considers devices that work and the ways through which they can be developed and improved in individuals (*Ibid.*). Studies on self-efficacy have been conducted in various fields, such as health, sports, journalism, business administration, social, economic and political change, psychology, psychiatry and education (*Ibid.*).

Research on self-efficacy in the fields of education abounds and the focus is on "academic excellence, contributing factors to achieving set goals, problem solving, career development, successful teaching techniques, social comparisons and teacher education" (Bandura cited by Pajares, 2002, p. 8).

Studies reveal that self-efficacy beliefs, changes in attitudes and performance output are related and constitute the best way of interpreting human functioning and behaviour. Since their creation self-efficacy beliefs have stood the test of time as an important ingredient that reveals more performance and attitude outcomes than any other inspirational or motivational constructs (Graham & Weiner, 1996). They do not depend on people's ability or potential but on how individual self-beliefs contribute to attaining success.

2.4 Theoretical Framework

This study required a theoretical framework to explore self-efficacy beliefs and Mathematics performance. In order to build the theoretical framework, this study referred to Bandura's social cognitive theory (1986). It adopted Bandura's social cognitive theory in order to explain the relationship between the Mathematics performances of learners' and their self-efficacy beliefs in Mathematics.

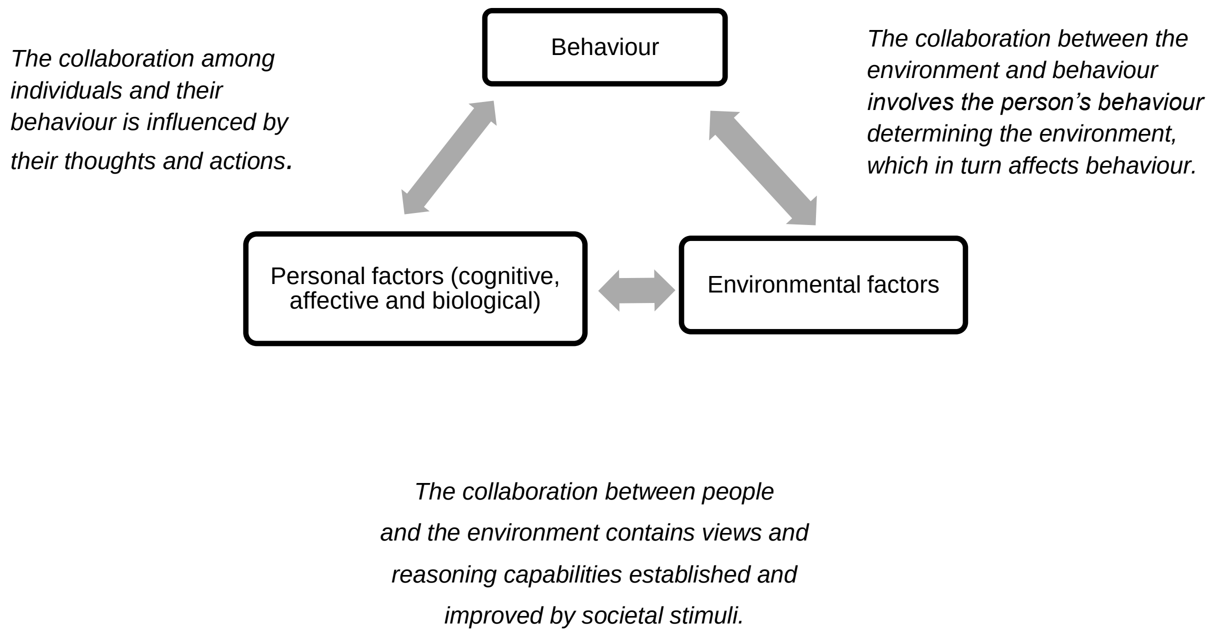
2.4.1 Bandura's social cognitive theory

The social cognitive theory of Bandura (1986) is based on human functioning. Human functioning is seen as the after effect of an individual, after a complete change of behaviour. Human functioning is also a product of a dynamic interplay of personal, behavioural and environmental factors (*Ibid.*). The relationships between the three factors are indicated in Figure 2.2.

Social cognitive theory describes how individuals obtain and preserve certain behavioural patterns, given the foundation for involvement approaches (*Ibid.*). Assessing social change depends on the following factors: environment, people and behaviour. Social cognitive theory provides a framework for designing, applying and assessing programmes (*Ibid.*).

Personality is the result of the relationship between the behaviour, environment and cognitive methodologies. Personal variables can empower learners to enhance their conditions and to remedy faulty feelings of self-belief and tendencies for consideration. Behaviour enhances learners' intellectual abilities and confidence toward their practices. Environmental variables are the institute and the teaching space arrangement that can challenge learners' prosperity *(Ibid*).

Figure 2.2: Factors influencing human functioning



The three variables *behaviour*, *environment* and *person* are continually affecting one another. Behaviour is not just the consequence of nature's field and the individual, pretty much as the earth is not just the after effect of the individual and behaviour (Glanz, Rimer & Lewis, 2002). Behavioural capacity implies that if an individual is to perform behaviour he/she must recognise what the behaviour is and have the skills to perform it (Bandura, 1997).

Human beings are regarded as having the ability to plan, think ahead, do introspection and adjust to new situations (Bandura, 1986). How they function depends on a number of combined factors, such as individual traits, attitudes and societal dynamics. How they relate to their actions and attitudes triggers changes in society. Individual factors, thinking patterns, attitudes, innate or inborn activities and environmental dynamics work together to bring about change in humans (Bandura cited by Pajares, 2002).

Social cognitive theory is necessary and important in academic settings because it is crucial in helping learners acquire the potential to come to terms with what is essential, real and important to adjust, retain data and act out character traits (*Ibid.*).

Ways to develop learners include working on their emotions, thinking or inspirational moods, and changing social working and living conditions of those in the academic environment. It is a difficult task for most teachers to work towards enhancing Mathematics learning and the self-efficacy of learners (*Ibid.*).

Bandura’s social cognitive theory (1986) could assist in enhancing learners’ emotional well-being, improving self-efficacy beliefs, thinking skills, learning ability, attitudes and in changing environmental factors that hinder learners’ academic output and achievement. Bandura’s social cognitive theory (1986) emphasises the fact that thinking without self-reflection is inadequate to explain the various ways in which humans function.

Bussey and Bandura (1999:683) assert that people have the potential to create numerous and varied societal changes, which further develop new selection criteria for the growth of “specialized biological systems for functional consciousness, thought, language and symbolic communication”.

Social cognitive theory enables learners to use symbols, plan ahead, learn through joyful expression, adapt and adjust to changing situations in life. These give them thinking tools through which the future is shaped. Crucial to this is the fact that apart from individual factors, humans have beliefs that give them energy and authority over thoughts, feelings and actions (Bandura, 1986).

Self-efficacy beliefs are critical and crucial ingredients in human development and adaptation. Humans are capable of creating their own worldview and environmental mechanisms that help them cope with changes around them. They constantly work on their self-efficacy beliefs in an effort to bring about a better life and future for all (Bandura cited by Pajares, 2002).

Social cognitive theory can be used to help learners adjust to their learning environment and bring about changes in their individual and communal settings. The theory assumes that economic, social, educational and familiar structures have no influence on human behaviour, but that their effect can be seen through their wishes, self-efficacy beliefs, individual principles, sensitive conditions and other effects (*Ibid.*).

Social cognitive theory has had a significant impact in the field of psychology and educational theories, especially in the last half of the twentieth century down to the new millennium. According to Bandura (1986) symbols carry with them thinking patterns and when learners' experiences are represented using symbols, it gives them shape, fulfilment and a way forward. Data displayed can be stored to serve as reference for future behaviours and with this learners are able to solve cognitive problems, engage in self-reflection and gain new knowledge.

Learners are capable of taking decisions, guide, regulate and accept their actions, set achievable goals and challenges for themselves. Learners gain much not only from their actions, attitudes and behaviours but also through those of others. Self-reflection is an important aspect of social cognitive theory as it enables learners to come to reality with experiences, investigate thoughts and beliefs, evaluate and change thoughts and behaviour *(Ibid.*).

2.5 Evaluation of self-efficacy beliefs and Mathematics performance

2.5.1 Introduction

A systematic literature review was conducted to explore the relationship between Mathematics performance and self-efficacy beliefs. The investigation focused on learners' Mathematics self-efficacy beliefs and their Mathematics performance.

In order to identify articles, searches were conducted on educational databases. The criteria used to search the databases were Mathematics performance and self-efficacy beliefs and only articles that were published between 2009 and 2015 were included.

The results of the searches were then narrowed down using the following exclusion criteria:

- Research that was conducted in a business environment.
- No date of publication, number of participates and author's name.
- Studies focused on principals or administrators.

The rest of the articles were identified using the following inclusion criteria:

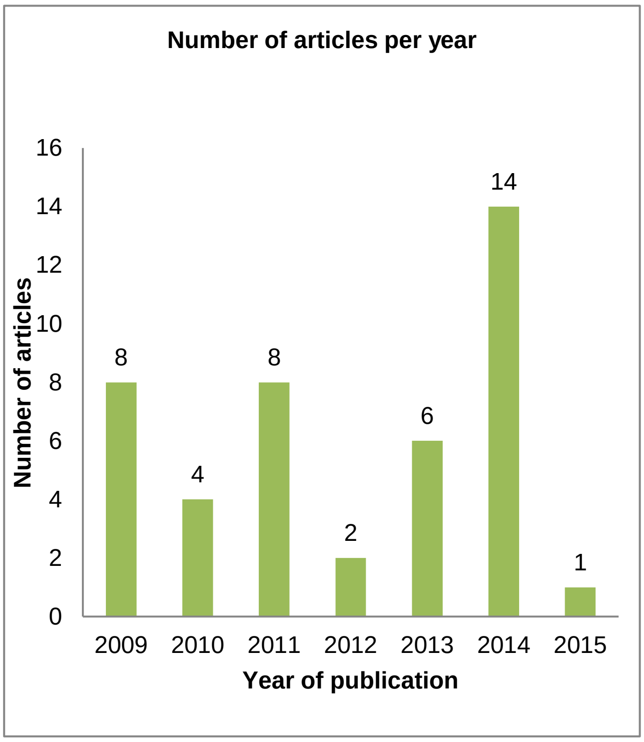
- The study investigated self-efficacy and Mathematics performance.
- The participants were learners or students.
- Date of publication was between 2009 and 2015.
- TIMSS studies from 2003 to 2011.

Different aspect of the studies reviewed were compared and discussed. The analysis focused on the date of publication, the purpose of the study, the number of participates, selection methods, research design and the findings. Following the inclusion criteria, no study was found that evaluated the relationship between Grade 9 learners' Mathematics performance and self-efficacy beliefs for TIMSS 2011 in South African schools. This study aims at exploring the gap identified in secondary education in South Africa as far as TIMSS 2011 studies are concerned.

2.5.2 Publication dates

A total of 43 articles were selected for this study. Table 2.2 indicates the number of articles published from 2009 to 2015.

Figure 2.3: Number of articles per year



2.5.3 Purpose of different articles

The 43 studies selected can be grouped according to their purpose:

- **Influence on Mathematics performance** (Charles-Ogan & Alamina, 2014; Adebule, 2014; Adepoju & Oluchukwa, 2011; Ma & Ma, 2014; Mwamwenda, 2009; Abolmaali, Kh. et al., 2014).
- **Factors or attitudes that affect Mathematics achievement** (Andaya, 2014; Odiembo & Simatwa, 2014; Bayaga & Wadesango, 2014; Aurah, 2013; Hamzeh, 2014; Aldhafri & Alrajhi**,** 2014).
- **Impact of self-efficacy, achievement motivation and learning strategies on academic achievement** (Yusuf, 2011; Kesici et al., 2010; Caprara et al.,

2011; Paraskevi & Gagatsis, 2009; Özgen & Bindak, 2011; Mji & Arigbabu, 2012, Pampaka & Williams, 2010; Stankov et al., 2012).

- **Relationship between self-efficacy and Mathematics achievement** (Ayotola & Adedeji, 2009; Shkullaku, 2013; Liu, X. & Koirala, 2009; Shih-hsien Y. 2012; Tenaw, 2013; William & Tallent-Runnels (2004); Dehghani**,** 2011).
- **Influence of self-efficacy beliefs on Mathematics** (Özgen, 2013; Hodges & Murphy, 2009; Loo & Choy, 2013; Adedeji, 2011; Noble, 2011; Akay, 2010; Owolabi & Olubunmi, 2014).

- **Attainment and self-efficacy beliefs** (Webb-Williams, 2014; Milagros & Eccles, 2011; Isekender, 2009; Maclellan, 2014; Marra et al., 2009; Kleitman et al., 2013).

2.5.4 What was measured?

The instruments applied were mostly self-designed questionnaires and survey items relating to self-efficacy or Mathematics achievement. Learners' study habits and their performance in Mathematics and learners' academic performance in English language and Mathematics questionnaire were also measured.

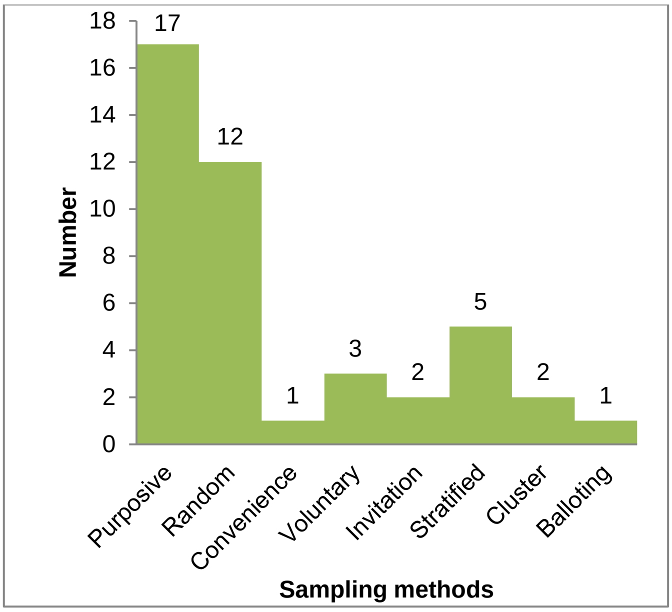
2.5.5 Number of samples and number of participants per sample

The 43 articles reviewed were divided into 3 groups: Group A (n = 29; 67.44%) contained the articles in which the Mathematics performance scores of the learners ranged between 0 and 499. Group B (n = 4; 9.50%) consisted of articles in which the Mathematics performance score ranged between 500 and 1000. Group C (n = 10; 23.26%) consisted of learners with a Mathematics performance score greater than 1000.

2.5.6 Methods for the selection of samples

Different types of sampling methods were utilised for selecting participants. Table 2.3 indicates the sampling methods.

Figure 2.4: Sampling methods



2.5.7 Research design

Qualitative, quantitative and mixed methods designs were used in the articles that were reviewed. A group of 86.04% (n = 37) of the articles reviewed used a quantitative design method; 4.65% (n = 2) used mixed methods and 9.30% (n = 4) used a qualitative design method.

2.5.8 Findings from the articles

Findings from the articles reviewed related to the following:

- Significant differences and influence of study habits on learners' Mathematics performance.
- Significant differences in achievement owing to gender, age and Mathematics anxiety.
- Individual instructional factors affecting achievement.
- Significant differences in self-concept and academic performance.
- Significant differences in English language learners and their Mathematics scores.
- Significant difference in the role of teaching style on learners' Mathematics motivation.

- Significant difference between Mathematics and learner’s beliefs in mathematics.
- Positive influence on learners’ performance.

Chapter 3

Research Design and Methods

3.1 Introduction

This chapter explains the research paradigm, research strategy, research approach, data collection methods and the data preparation used to answer the primary and secondary research questions. Sample selection and the target population are also discussed. It is followed by an explanation of the research procedure and a detailed discussion of the measurement instruments used.

A full explanation of how the secondary data that was extracted from the learners' questionnaire of the TIMSS 2011 study was used to explore the relationship between Mathematics performance and self-efficacy beliefs of Grade 9 Mathematics learners in South African schools is given.

This chapter also describes how the TIMSS 2011 data was accessed, the description of the various types of data, and how it was managed and analysed. The issues of trustworthiness and ethical considerations in this study are also addressed. The chapter ends with a discussion of the methods used for the statistical analysis of the numerical data.

3.2 Research design

Research design is defined as the strategy used to carry out a study and consists of procedures, approaches and tools that are involved in quantitative and qualitative research (O'Leary, 2004:85).

The study purpose and the study problems are the recommended preliminary themes that improve a research design because they offer significant indications about the material that a researcher is targeting to measure (Berry & Otley, 2004; Saunders, Lewis & Thornhill 2009; Yin, 2012).

This secondary data analysis study explores the South Africa data that was collected for TIMSS 2011 by the International Association for Evaluation of Education Achievement (IEA). The study made use of integrated qualitative and quantitative approaches (Srnka & Koeszegi, 2007). The qualitative data was changed into numeric data and analysed using quantitative data analysis methods.

3.2.1 Fundamental assumptions

3.2.1.1 Ontology

The ontological lenses through which a researcher views social factors and their interpretation can be objective or subjective (Neuman, 2011). Schools of thought based on Saunder et al. (2009, p. 119), Guba and Lincoln (2005), and Hallebone and Priest (2009) form the basis of different types of educational research and include positivism, post-positivism, interpretivism and pragmatism.

In order to analyse the Grade 9 learners' Mathematics data collected with a questionnaire in the TIMSS 2011 project, the researcher used the ontological assumptions of positivism since this study involves objective hypothesis testing and careful use of statistical tests (Creswell, 2009).

The analysis was carried out through hypothesis statements that related to the effect an independent variable had over a dependable variable in order to predict and confirm social designs in a scientific and objective manner.

This study explores objective truths that relate to the human behaviour of the participating South Africa Grade 9 learners and their Mathematics performance and self-efficacy beliefs.

3.2.1.2 Epistemology

The researcher followed the epistemological position of a rationalist theorist that advocates the use of a scientific approach by developing numeric measures to discover adequate information (Neuman, 2011).

Rationalism refers to any investigation that depends on academic and inferential purposes in order to apprehend truth. Truth has a coherent organisation that can be understood by means of scientific and coherent principles (Markie, 2013).

In order to explore the data, mathematical principles were needed to measure the relationships between the dependent and independent variables that were identified from the learners' questionnaire on Mathematics for the TIMSS 2011 project.

3.2.1.3 Methodology

Methodology refers to an ideal to conduct research within the framework of a specific model. It is made up of beliefs that guide a researcher to choose one set of research methods over another (Sarantakos, 2005).

This secondary data analysis study analysed the data related to the relevant variables collected by the TIMSS 2011 project and turned into numerical data.

3.2.1.4 Secondary data analysis study

Secondary data analysis is made up of publicly available data that can be re-used by researchers in order to gain new insight into or relevant information on the topic being observed. This method of data collection helped the researcher to collect comprehensive and relevant information in order to develop the strength of the findings (Irwin & Winteron, 2011).

This study re-used data from the TIMSS 2011 for South African Grade 9 Mathematics learner questionnaire. The TIMSS 2011 afforded the researcher the opportunity to gain access to data that was related to Mathematics achievement for 56 participants (42 countries and 14 benchmarking participants) of Grade 8 and 9 learners across the world. A Technical Report User Guide and an international report were published by the IEA and were used to enable accurate research and findings.

3.3 Population of the study

Brynard and Hanekom (2005: 43) argue that in research methodology, 'population' does not refer to the population of a country, but relatively to the items, questions, phenomena, cases, procedures or events specified for the purpose of sampling.

The IEA studies targeted mostly the learners at the end of Grade 4 and Grade 8 and the final year of formal schooling in the participating countries. The TIMSS studies focused on Grades 4 and Grade 8 learners only.

However, countries like England, Malta and New Zealand where children begin primary school at a very early age administered the fourth grade assessment in the fifth year of schooling and their learners were still the youngest in TIMSS 2011 (Mullis, Martin, Foy & Arora, 2012).

Meeting the demands of the assessment, several countries including South Africa saw the option to assess learners at a higher grade and administered the fourth grade assessment in the sixth grade and eighth grade in the ninth grade. TIMSS 2011 had two target populations with each country deciding which grades were to participate in the test (*Ibid*).

The two target populations are defined as follows:

- Population 1: All learners that were enrolled in grades that had the largest proportion of nine to ten year-old learners at the time of testing. This grade level was intended to represent four years of schooling, counting from first year of primary or elementary schooling (*Ibid.*).
- Population 2: All learners that were enrolled in grades that had the largest proportion of 13 to14 year-old learners at the time of testing. This grade level was intended to represent eight years of schooling, counting from the first year of primary or elementary schooling (*Ibid.*).

TIMSS 2011 participants varied, ranging from highly developed countries or regions to developing ones. All participating countries had a main sample and two matching replacement samples that were used in case the main sample school declined to participate (*Ibid.*).This study's focus is on Population 2 of the Mathematics Grade 9 learners for South African schools with a target population of about 9 504 schools and 988 632 learners.

All participating countries were expected to define their national desired councils based on the definition of the worldwide desired councils as mentioned above. Classes of learners of the target age were then randomly sampled within the participating schools (*Ibid.*).

3.4 Sampling procedure

According to O'Leary (2004:103) sampling is a method that is always intentional and sometimes mathematical; it involves using the most applied measures likely for collecting a sample that best represents a larger population.

Quantitative analysis requires the setting of procedures. It consists of a distinctive choice of participants, removing the potential effect of outside variables and guarantees the generalisability of results (Sargeant, 2012).

In order to provide an effective assessment of learner's attainment and features, TIMSS had to select a random sample of schools that represented the full population of learners in the target grades.

A minimum of 150 schools were sampled per grade and a minimum of 4 000 learners per grade were assessed. The response rate target for the schools was 85% for all countries and a minimum participation rate of 50% of schools original samples was required in other to include a country's data in the international database. A 95% response target rate for the classroom and 85% target learner response rate from both the original and substitute schools were required (Mullis, Martin, Foy & Arora, 2012).

Alternative schools that were selected during the sample process by countries were allowed to be used in order to increase the answer rate once the 50% minimum participation rate of the original school sampling had been reached. Following TIMSS guidelines, substitute schools were identified by assigning the two schools near the sampled school in the frame as substitutes to be used in cases where the original sampled school refused to participate and the substitutes schools were required to have similar demographic features as the sampled school (*Ibid.*).

A stratified random sampling method was used and schools were selected on the basis of province, language of instruction and learning in public or private schools (Martin & Mullis, 2012).

3.5 The sample

The Human Science Research Council (HSRC) administered the TIMSS 2011 Mathematics and Science instruments on behalf of the IEA in South African schools. TIMSS 2011 sampled 285 schools in South Africa, using a stratified random sampling technique. A total of 11 969 learners were considered for this study.

3.6 Instruments for collecting data

For this secondary data analysis research process, learner questionnaires (Question 14) for Mathematics were used to gather data relevant to the topic. The categories of the questions for inferential statistics are indicated in Table 3.1.

Table 3.1: Question 14 (see Addendum A)

How much do you agree on these statements about learning Mathematics? Please mark only one choice in each row.		
	Agree	**Disagree**
I enjoy learning Mathematics BSBM14A	☐	☐
I wish I did not have to study Mathematics BSBM14B	☐	☐
Mathematics is boring BSBM144C	☐	☐
I learn many interesting things in Mathematics BSBM14D	☐	☐
I like Mathematics BSBM14E	☐	☐
It is important to do well in Mathematics BSBM14F	☐	☐

The Mathematics proficiency scores (BSMMAT01) of learner achievement were also used.

For the descriptive statistics the following questions were used: (1) Gender; (3) Language of test; (4) Books at home and (5) things at home. (see Addendum A)

3.7 Data collection

The data collection for TIMSS 2011 was carried out at the end of the school year for countries in the northern hemisphere where the school year ends in June. The examination was applied between April, May and June 2010. In the southern hemisphere, including South Africa, where the school year ends in November or December, and the examination was carried out in October or November (Martin & Mullis, 2012).

Every country that took part in TIMSS was in control of its data collection, using the consistent procedures designed for the study, and it was structured in the training guides that were designed for school directors and testing directors (*Ibid.*).

International Quality Control Monitors (IQCMs) carried out checks "at a sample of 15 schools per grade in each country during the TIMSS test administration" (*Ibid.*). The IQCMs successfully "completed the TIMSS 2011 Classroom Observation Record" (*Ibid.*). The records were arranged in the four components listed below to guarantee valid recording of key tasks in each participating country:

- Section A – Documentation of the TIMSS Testing Session.
- Section B – Summary Observations of the TIMSS Testing Session.
- Section C – Student Questionnaire Administering.
- Section D – Interview with the School Coordinator (Ibid.).

Overall, the TIMSS 2011 IQCMs observed 776 fourth-grade investigation activities and 692 eighth-grade investigation sessions in all the participating countries (Leva, 2011).

South Africa conducted the learners' test and the Administering of Mathematics questionnaires under the umbrella of the Assessment Technology and Education Evaluation Research Programme at the Human Science Research Council (HSRC). Learners used one booklet containing both Mathematics and Science items. The learners took a break between the assessment and the completion of the questionnaire. The TIMSS 2011 data was accessed from the IEA website, a public domain (Martin & Mullis, 2012).

The South African TIMSS 2011 data set was retrieved from the IEA study data repository in SPSS format. The online data interface provides the option to select the year of study, the type of file, the country and the format from where the data could be retrieved. This study used the South African Grade 9 Mathematics learners' data (*Ibid.*).

3.8 Data preparation

The researcher carefully studied the codebook relating to the South African data. The codebook provides a full description of all the variables used in the database. In the codebook one finds some of these important elements: variable name, variable description and variable format that enabled the researcher to choose the appropriate variables for the research. Hence the researcher selected learners' Mathematics datasets and had to choose the variables that applied to the research problem.

3.9 Operational definition of research variables

The variables that were used in this study are identified in this section. A detailed description of the variables is given in terms of variable type, number of categories, information coming from the database where the variables were removed and the numerical procedures used to analyse the data.

Two categories of statistical analysis were used for this study, namely descriptive statistics and inferential statistics. A one-way chi-square analysis was used to determine if there was a statistical significant difference in the frequencies of participants. The Mann-Whitney U test was conducted with the p-value of either 0.01 or 0.05 to determine if there were statistical significant differences between the median scores and self-efficacy beliefs (Maree, 2008). The variable types and their data analysis instruments are shown in Table 3.2.

Table 3.2: Variable types and the data analysis instruments

Variables		Type of Variable	Data analysis
Gender	BSBGO1	Nominal	One-way chi-square
Language	BSBGO3	Nominal	One-way chi-square
Books at home	BSBGO4	Ordinal	One-way chi-square
Do you have any of these things at home?	Computer BSBGO5A	Nominal	One-way chi-square
	Study desk BSBGO5B	Nominal	One-way chi-square
	Own room BSBGO5C	Nominal	One-way chi-square
	Internet BSBGO5D	Nominal	One-way chi-square
	Own cellular phone BSBGO5E	Nominal	One-way chi-square
	Dictionaries BSBGO5F	Nominal	One-way chi-square
	Electricity BSBGO5G	Nominal	One-way chi-square
	Running tap water BSBGO5H	Nominal	One-way chi-square
	Television BSBGO5I	Nominal	One-way chi-square
How much do you agree on these Statements about learning Mathematics?	Video player BSBGO5J	Nominal	One-way chi-square
	Enjoy learning Mathematics BSBM14A	Ordinal	One-way chi-square
	Wish you did not have to study Mathematics BSBM14B	Ordinal	One-way chi-square
	Mathematics is boring BSBM14C	Ordinal	One-way chi-square
	I learn interesting things in Mathematics BSBM14D	Ordinal	One-way chi-square
	I like Mathematics BSBM14E	Ordinal	One-way chi-square
	It is important to do well in Mathematics BSBM14F	Ordinal	One-way chi-square
	BSMMAT01	Numerical Ordinal	Mean-Whitney difference between the median score and self-efficacy beliefs
Mathematics achievement self-efficacy scores			

3.10 Procedure for testing hypotheses or answering research questions

Table 3.3 illustrates the dependent and independent variables for learners' Mathematics efficacy statements.

Table 3.3: Dependent and independent variables

Hypotheses	Variables	Statistical analysis
H_0: P < .05 H_1: P = > .05	**Dependent**: Mathematics scores **Independent**: I enjoy Mathematics	Mann-Whitney U test
H_0: P < .05 H_1: P = > .05	**Dependent**: Mathematics scores **Independent**: I wish I did not have to study Mathematics	Mann-Whitney U test
H_0: P < .05 H_1: P = > .05	**Dependent**: Mathematics scores **Independent**: Mathematics is boring	Mann-Whitney U test
H_0: P < .05 H_1: P = > .05	**Dependent**: Mathematics scores **Independent**: I learn many interesting things in Mathematics	Mann-Whitney U test
H_0: P < .05 H_1: P = > .05	**Dependent**: Mathematics scores **Independent**: I like Mathematics	Mann-Whitney U test
H_0: P < .05 H_1: P = > .05	**Dependent**: Mathematics scores **Independent**: It is important to do well in Mathematics	Mann-Whitney U test

In order to analyse the qualitative data, descriptive and inferential statistical analysis were applied by utilising the SPSS V22 statistical software package.

Inferential statistics were used to determine whether the medians between two or more groups in the various individual characteristics of the participating learners were equal (null hypothesis) or different (alternative hypothesis) by using a one-way chi-square technique. To determine if there was a statistical significant difference between the medians, the p-value should be equal to 0.5 (Pallant, 2013). In addition, frequencies and percentages were illustrated by using tables.

Inferential statistics were calculated by means of two variables to verify statistically significant differences using the Mann-Whitney U test as well as the strength of relations.

3.11 Ethical consideration

Secondary data introduced inside documents provided by participants to the researchers and widely available data significant to the topic being observed. This method of collecting data from multiple sources helped the researcher not only to collect more comprehensive relevant information but also to validate its consistency in order to improve the strength of the findings (Patton, 2002).

One of the advantages of carrying out secondary data analysis was that the researcher had access to the data without retrieving individual information that could expose individual confidentiality (Coyer & Gallo, 2005). Before this study was carried out, the researcher applied for ethical clearance to the Ethics Committee of the Faculty of Education at the University of Pretoria.

The data was rendered anonymous for secondary data analysis since the original research participants could not be identified. The results of the study have been documented as precisely as possible; there was no personal bias or opinion that influenced the decisions drawn from the study.

Chapter 4

Data Gathering and Analysis

4.1 Introduction

This chapter is a summary of the results of the descriptive and inferential analysis of the TIMSS 2011 data set applicable to the research reported in this chapter. The South African Grade 9 Mathematics learners who participated in TIMSS 2011 study were selected as participants.

4.2 Data capturing

In order to explore the data sets, the descriptions of the variables were compared with the contents of the items from the TIMSS questionnaires. The items that related to the definition were selected and verified to suit the present study. Once the data had been recoded, the file was converted to SPSS for further analysis.

Using the SPSS program, the descriptive analysis of the items was undertaken in order to describe and organise the data. The descriptive analysis involved the calculation of a one-way chi-square statistic for each of the related selected variables. Frequencies relating to the selected variables as well as the percentages were determined for the respondents who selected each option.

4.3 Descriptive statistics

The data for the variables in Figure 4.3.1 was calculated in order to describe and organise the data.

Figure 4.3.1: Variables about biographical details

Biographical details

- ❖ Gender
- ❖ Speaking English
- ❖ Books at home
- Things at home
    - ❖ Computer
    - ❖ Study desk
    - ❖ Your own books
    - ❖ Your own room
    - ❖ Internet connection
    - ❖ Your own cell phone
    - ❖ Availability of a dictionary
    - ❖ Access to electricity
    - ❖ Running tap water
    - ❖ Television at home
    - ❖ Access to a video player

One-way Chi^2

4.3.1 Gender distribution

Table 4.3.1 indicates the gender distribution of the Grade 9 learners that participated in the Mathematics survey conducted by TIMSS in 2011.

Table 4.3.1: Gender distribution

	Frequency	Percentage
Girl	5 875	49.3
Boy	6 040	50.7
Total	11 915	100.0

A one-way Chi-square analysis (see Appendix A in the CD) revealed that there was no significant difference between the number of males and females that participated ($X^2(1) = 2,285$, $p = .131$).

4.3.2 Speaking English at home

Table 4.3.2 indicates how frequently the Grade 9 learners that participated in TIMSS in 2011 spoke English at home.

Table 4.3.2: Speaking English at home

	Frequency	Percentage
Always	2 364	20.0
Almost always	1 622	13.7
Sometimes	7 042	59.6
Never	794	6.7
Total	11 822	100.0

A one-way Chi-square analysis (see Appendix A in the CD) revealed that there is a significant difference between the frequencies relating to each of the options in Table 4.3.2 ($X^2(3) = 7951.1$, $p < .05$).

4.3.3 Books at home

Table 4.3.3 indicates the number of books owned by individual Grade 9 learners that participated in the Mathematics survey conducted by TIMSS in 2011.

Table 4.3.3: Books at home

	Frequency	Percentage
0 - 10 books	4 582	39.1
11 - 25 books	4 124	35.2
26 - 100 books	1 842	15.7
101 - 200 books	582	5.0
More than 200 books	576	4.9
Total	11 706	100.0

A one-way Chi-square analysis (see Appendix A in the CD) showed that there is a significant difference between the frequencies relating to each of the options in Table 4.3.3 ($X^2(4) = 62661.5$, $p < .05$).

4.3.4 Things at home

4.3.4.1 Computer

Table 4.3.4.1 indicates the number of Grade 9 learners that participated in the Mathematics survey conducted by TIMSS in 2011 and the availability of a computer at home.

Table 4.3.4.1: Computers

	Frequency	Percentage
Yes	4 890	41.8
No	6 809	58.2
Total	11 699	100.0

A one-way Chi-square analysis (see Appendix A in the CD) revealed that there is a significant difference between the frequencies of learners relating to each of the options in Table 4.3.4.1 ($X^2(1) = 314.8$, $p < .05$).

4.3.4.2 Study desk

Table 4.3.4.2 specifies the number of Grade 9 learners who participated in the Mathematics study conducted by TIMSS in 2011 and the availability of desks at home.

Table 4.3.4.2: Study Desk

	Frequency	Percentage
Yes	6 885	59.6
No	4 669	40.4
Total	11 554	100.0

A one-way Chi-square analysis (see Appendix A in the CD) indicated that there is a significant difference between the frequencies relating to each of the options in Table 4.3.4.2 ($X^2(1) = 425.0$, $p < .05$).

4.3.4.3 Your own books

Table 4.3.4.3 indicates the number of Grade 9 learners who participated in the Mathematics study conducted by TIMSS in 2011 that owned books.

Table 4.3.4.3: Your own books

	Frequency	Percentage
Yes	7 877	68.3
No	3 663	31.7
Total	11 540	100.0

A one-way Chi-square analysis (see Appendix A in the CD) indicated that there is a significant difference between the frequencies relating to each of the options in Table 4.3.4.3 ($X^2(1) = 1538.8$, $p < .05$).

4.3.4.4 Your own room

Table 4.3.4.4 indicates the frequencies of the Grade 9 learners who participated in the Mathematics study conducted by TIMSS in 2011 and the availability of a room at home.

Table 4.3.4.4: Your own room

	Frequency	Percentage
Yes	8 047	68.9
No	3 636	31.1
Total	11 683	100.0

A one-way Chi-square analysis (see Appendix A in the CD) disclosed that there is a significant difference between the frequencies relating to each of the options in Table 4.3.4.4 ($X^2(1) = 1665.4$, $p < .05$).

4.3.4.5 Internet connection

Table 4.3.4.5 shows the frequency of the Grade 9 learners who participated in the study in TIMSS 2011 and the accessibility of an Internet connection at home.

Table 4.3.4.5: Internet connection

	Frequency	Percentage
Yes	4 154	36.2
No	7 312	63.8
Total	11 466	100.0

A one-way Chi-square analysis (see Appendix A in the CD) revealed that there is a significant difference between the number of learner frequencies relating to each of the options in Table 4.3.4.5 ($X^2(1) = 869.8$, $p < .05$).

4.3.4.6 Your own cell phone

Table 4.3.4.6 indicates the number of Grade 9 learners who participated in the Mathematics study conducted by TIMSS in 2011 and the accessibility of a cell phone.

Table 4.3.4.6: Your own cell phone

	Frequency	Percentage
Yes	9 464	81.0
No	2 224	19.0
Total	11 688	100.0

A one-way Chi-square analysis (see Appendix A in the CD) revealed that there is a significant difference between the frequencies relating to each of the options in Table 4.3.4.6 ($X^2(1) = 869.7$, $p < .05$).

4.3.4.7 Availability of a dictionary

Table 4.3.4.7 indicates the number of Grade 9 learners who participated in TIMSS in 2011 and the availability of a dictionary.

Table 4.3.4.7: Dictionary

	Frequency	Percentage
Yes	8 941	76.9
No	2 684	23.1
Total	11 625	100.0

A one-way Chi-square analysis (see Appendix A in the CD) disclosed that there is a significant difference between the frequencies relating to each of the options in Table 4.3.4.7 ($X^2(1) = 3367.8$, $p < .05$).

4.3.4.8 Access to electricity

Table 4.3.4.8 indicates the frequencies of the Grade 9 learners who participated in TIMSS in 2011 and the availability of electricity at home.

Table 4.3.4.8: Electricity

	Frequency	Percentage
Yes	10 543	90.2
No	1 141	9.8
Total	11 684	100.0

A one-way Chi-square analysis (see Appendix A in the CD) indicated that there is a significant difference between the learners' frequencies relating to each of the options in Table 4.3.4.8 ($X^2(1) = 7565.6$, $p < .05$).

4.3.4.9 Running tap water

Table 4.3.4.9 indicates the number of the Grade 9 learners who participated in TIMSS in 2011 and the availability of running tap water at home.

Table 4.3.4.9: Running tap water

	Frequency	Percentage
Yes	8 940	76.9
No	2 681	23.1
Total	11 621	100.0

A one-way Chi-square analysis (see Appendix A in the CD) revealed that there is a significant difference between the learner frequencies relating to access to running tap water at home ($X^2(1) = 3371.0$, $p < .05$).

4.3.4.10 Television at home

Table 4.3.4.10 indicates the number of the Grade 9 learners who participated in TIMSS in 2011 and the availability of television at home.

Table 4.3.4.10: Television

	Frequency	Percentage
Yes	10 648	91.1
No	1 043	8.9
Total	11 691	100.0

A one-way Chi-square analysis (see Appendix A in the CD) revealed that there is a significant difference between the frequencies relating to each of the options in Table 4.3.4.10 ($X^2(1) = 7891.2$, $p < .05$).

4.3.4.11 Access to a video player

Table 4.3.4.11 indicates the number of the Grade 9 learners who participated in TIMSS in 2011 and the availability of a video player at home.

Table 4.3.4.11: Video player

	Frequency	Percentage
Yes	8 116	69.6
No	3 538	30.4
Total	11 654	100.0

A one-way Chi-square analysis (see Appendix A in the CD) revealed that there is a significant difference between the learner frequencies relating to each of the options in Table 4.3.4.11 ($X^2(1) = 1798.4$, $p < .05$).

4.3.5 Data on efficacy statements

The data relating to the efficacy statements is listed in Figure 4.3.5

Figure 4.3.5: Efficacy statements

Efficacy statements	
I enjoy learning Mathematics I wish I did not have to study Mathematics Mathematics is boring I learn many interesting things in Mathematics I like Mathematics It is important to do well in Mathematics	**One-way Chi²**

4.3.5.1 Enjoy learning Mathematics

Table 4.3.5.1 indicates the number of the Grade 9 learners that took part in TIMSS in 2011 and enjoyed learning Mathematics.

Table 4.3.5.1: Enjoy learning Mathematics

	Frequency	Percentage
Agree a lot	6 471	56.8
Agree a little	3 432	30.1
Disagree a little	889	7.8
Disagree a lot	607	5.3
Total	11 399	100.0

A one-way Chi-square analysis (see Appendix A in the CD) revealed that there is a significant difference between the number of learner frequencies relating to each of the options in Table 4.3.5.1 ($X^2(3) = 7834.7$, $p < .05$).

4.3.5.2 Wish I did not have to study Mathematics

Table 4.3.5.2 shows the number of the Grade 9 learners that were part of TIMSS in 2011 and wished they did not have to study Mathematics.

Table 4.3.5.2: Wish I did not have to study Mathematics

	Frequency	Percentage
Agree a lot	1 753	15.9
Agree a little	2 456	22.3
Disagree a little	1 887	17.1
Disagree a lot	4 936	44.7
Total	11 032	100.0

A one-way Chi-square analysis (see Appendix A in the CD) revealed that there is a significant difference between the number of learners relating to each of the options in table 4.3.5.2 ($X^2(3) = 2394.3$, $p < .05$).

4.3.5.3 Mathematics is boring

Table 4.3.5.3 shows the frequencies of the Grade 9 learners who participated in TIMSS in 2011 and their boredom relating to studying Mathematics.

Table 4.3.5.3: Mathematics is boring

	Frequency	Percentage
Agree a lot	1 252	11.6
Agree a little	2 107	19.5
Disagree a little	2 170	20.1
Disagree a lot	5 282	48.9
Total	10 811	100.0

A one-way Chi-square analysis (see Appendix A in the CD) disclosed that there is a significant difference between the number of learners relating to each of the options of boredom ($X^2(3) = 3476.4$, $p < .05$).

4.3.5.4 I learn many interesting things in Mathematics

Table 4.3.5.4 indicates the total number of the Grade 9 learners who participated in TIMSS in 2011 and learnt many interesting things in Mathematics.

Table 4.3.5.4: I learn many interesting things in Mathematics

	Frequency	Percentage
Agree a lot	6 449	58.7
Agree a little	2 881	26.2
Disagree a little	1 069	9.7
Disagree a lot	580	5.3
Total	10 979	100.0

A one-way Chi-square analysis (see Appendix A in the CD) showed that there is a significant difference between the number of learners relating to each of the options in Table 4.3.5.4 ($X^2(3) = 7736.3$, $p < .05$).

4.3.5.5 I like Mathematics

Table 4.3.5.5 displays the aggregate of the Grade 9 learners who took part in TIMSS in 2011 and liked Mathematics.

Table 4.3.5.5: Like Mathematics

	Frequency	Percentage
Agree a lot	6 137	55.5
Agree a little	3 032	27.4
Disagree a little	1 032	9.3
Disagree a lot	860	7.8
Total	11 061	100.0

A one-way Chi-square analysis (see Appendix A in the CD) indicated that there is a significant difference between the number of learners relating to each of the options in Table 4.3.5.5 ($X^2(3) = 6536.1$, $p < .05$).

4.3.5.6 Important to do well in Mathematics

Table 4.3.5.6 indicates the total number of the Grade 9 learners involved in TIMSS in 2011 expressing their views on the importance of doing well in Mathematics.

Table 4.3.5.6: Important to do well in Mathematics

	Frequency	Percentage
Agree a lot	9 695	86.1
Agree a little	940	8.3
Disagree a little	334	3.0
Disagree a lot	296	2.6
Total	11 265	100.0

A one-way Chi-square analysis (see Appendix A in the CD) showed that there is a significant difference between the number of learner frequencies relating to each of the options in Table 4.3.4.6 ($X^2(3) = 22494.7$, $p < .05$).

4.3.5.7 Summary of frequencies of efficacy statements

The summary of the mean and median of the efficacy statements is indicated in Table 4.3.5.7

Table: 4.3.5.7: Mean and median of the efficacy statements (see Appendix B in the CD)

Efficacy statement		Mean	Median	N	Total
I enjoy learning Mathematics	Yes	369.9	358.7	9903	11309
	No	372.7	362.2	1496	
I Wish I did not have to study Mathematics	Yes	350.9	337.4	4209	11032
	No	385.7	373.8	6823	
Mathematics is boring	Yes	358.8	342.6	3359	10811
	No	379.3	368.0	7452	
I learn many interesting things in Mathematics	Yes	374.0	363.3	9330	10979
	No	363.9	349.1	1649	
I like Mathematics	Yes	372.4	360.8	9169	11061
	No	368.6	359.7	1892	
It is important to do well in Mathematics	Yes	375.6	363.9	10635	11265
	No	300.2	291.0	630	

4.4 Mann-Whitney U results relating to the efficacy statements related to gender

The efficacy statements related to gender are shown in Figure 4.4.

Figure 4.4: Efficacy statements by gender

Efficacy statements (Gender)
I enjoy learning Mathematics
I wish I did not have to study Mathematics
Mathematics is boring
I learn many interesting things in Mathematics
I like Mathematics
It is important to do well in Mathematics

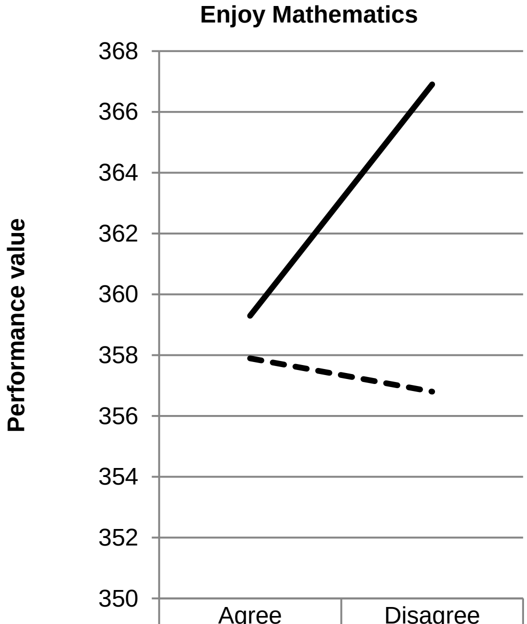
Mann-Whitney U

The Mann-Whitney U results relating to each efficacy statement is described in paragraph 4.4.1 – 4.4.6. (See Appendix C in the CD)

4.4.1 I enjoy learning Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they enjoyed Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.4.1.

Table 4.4.1: Mathematics performance of learners relating to the enjoyment of learning Mathematics



	Agree	Disagree
- - - - - -	359.3	366.9
———	357.9	356.8

The solid line represents the females and the broken line the males.

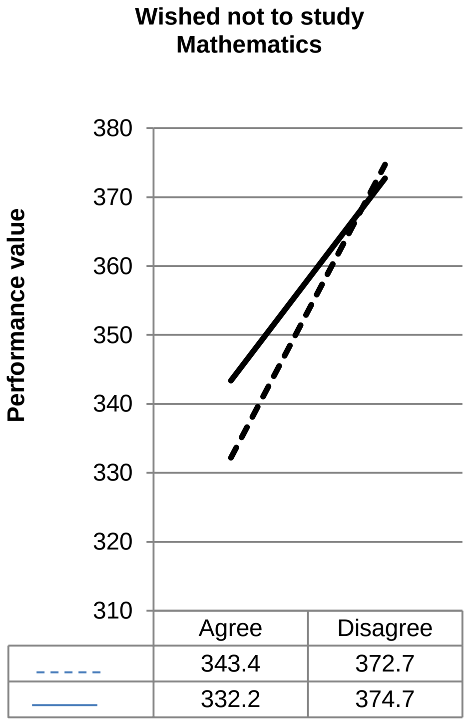
The achievement levels of the female learners that enjoyed learning Mathematics (n = 4821) (Mdn = 359.3) differ significantly from the female learners that did not enjoy learning Mathematics (n = 818) (Mdn = 366.9), Z = - 2.0, P < .05.

The achievement levels of the male learners that enjoyed learning Mathematics (n = 5081) (Mdn= 357.9) did not differ significantly from the male learners that did not enjoy learning Mathematics (n = 678) (Mdn = 356.8), Z= - .53, P < .06.

4.4.2 I wish I did not have to study Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they wished not to study Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.4.2.

Table 4.4.2: Mathematics performance of learners relating to wishing not to study Mathematics



The solid line represents the females and the broken line the males.

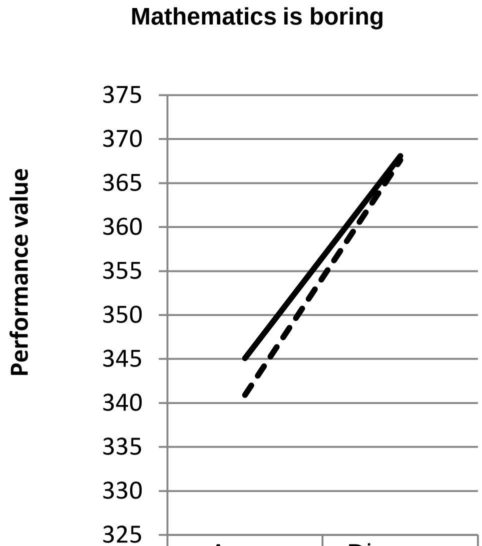
The achievement levels of the female learners that wished they did not have to study Mathematics (n = 2118) (Mdn = 343.4) differ significantly from the female learners that wished to study Mathematics (n = 3348) (Mdn = 372.7), Z = - 12.9, P < .000.

The achievement levels of the male learners that wished they did not have to study Mathematics (n = 2091) (Mdn = 332.2) differ significantly from the male learners that wanted to study Mathematics (n = 3474) (Mdn = 374.7), Z= -17.0, P < .000.

4.4.3 Mathematics is boring

A graph indicating the trend in the Mathematics performance of the learners that agreed that Mathematics is boring as well as the Mathematics performance of learners that disagreed is provided in Table 4.4.3.

Table 4.4.3: Mathematics performance of learners relating to Mathematics being boring



	Agree	Disagree
-------	345.1	368.1
———	340.9	367.6

The solid line represents the females and the broken line the males.

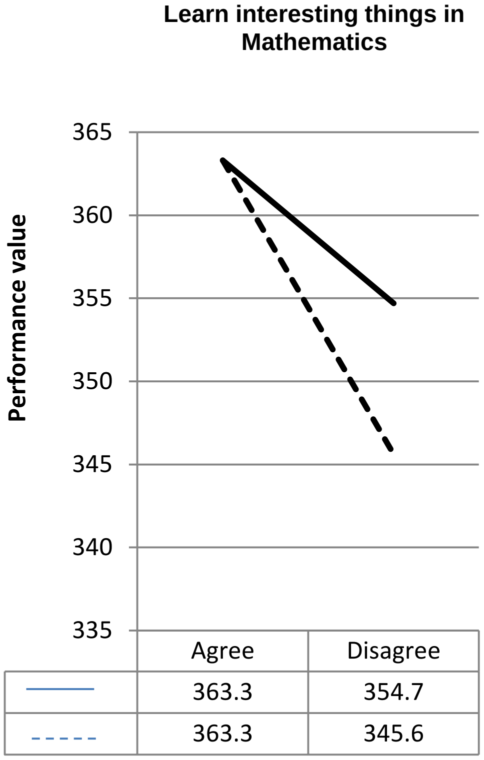
The achievement levels of the female learners that experienced that Mathematics as boring (n = 1682) (Mdn = 345.1) differ significantly from the female learners that experienced Mathematics as not boring (n = 3685) (Mdn = 368.1), Z = - 8.9, P < .000.

The achievement levels of the male learners that experienced Mathematics as boring (n =1677) (Mdn = 340.9) differ significantly from the male learners that did not experience Mathematics as boring (n = 3766) (Mdn = 367.6), Z = - 10.0, P < .000.

4.4.4 I learn many interesting things in Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they learnt many interesting things in Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.4.4.

Table 4.4.4: Mathematics performance of learners relating to learning interesting things in Mathematics



The solid line represents the females and the broken line the males.

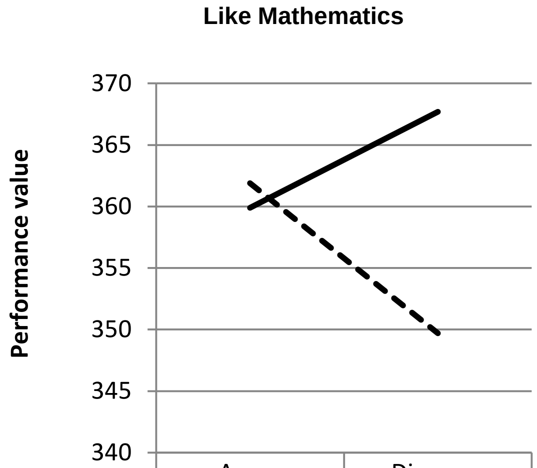
The achievement levels of the female learners that learnt many interesting things in Mathematics (n = 4628) (Mdn = 363.3) differ significantly from the female learners that did not learn many interesting things in Mathematics (n = 810) (Mdn = 354.7), Z = - 2.42, P < .02.

The achievement levels of the male learners that learnt many interesting things in Mathematics (n = 4701) (Mdn = 363.3) differ significantly from the male learners that did not learn many interesting things in Mathematics (n = 839) (Mdn = 345.6), Z = - 4.83, P < .000.

4.4.5 I like Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they liked Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.4.5.

Table 4.4.5: Mathematics performance of learners relating to liking Mathematics



	Agree	Disagree
——— (solid line)	359.9	367.7
- - - - - - (broken line)	361.9	349.7

The solid line represents the females and the broken line the males.

The achievement levels of the female learners that liked Mathematics (n = 4510) (Mdn = 359.9) differ significantly from the female learners that did not like Mathematics (n = 993) (Mdn = 367.7), Z = - 2.0, P < .12.

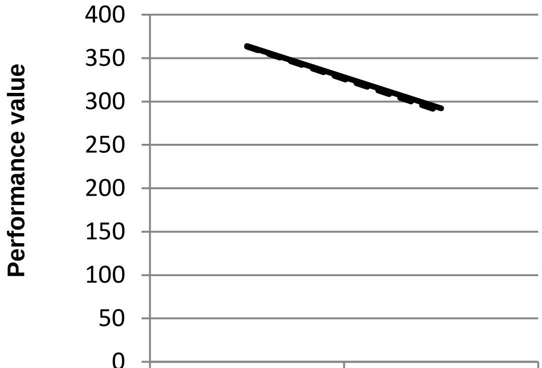
The achievement levels of the male learners that liked Mathematics (n = 4658) (Mdn = 361.9) differ significantly from the male learners that did not like Mathematics (n = 899) (Mdn = 349.7), Z = - 3.63, P < .000.

4.4.6 It is important to do well in Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that it was important to do well in Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.4.6.

Table 4.4.6: Mathematics performance of learners relating to the importance of doing well in Mathematics

Important to do well in Mathematics



	Agree	Disagree
(solid line)	364.2	292.2
(broken line)	363.3	288.6

The solid line represents the females and the broken line the males.

The achievement levels of the female learners that realised the importance of doing well in Mathematics (n = 5329) (Mdn = 364.2) differ significantly from the female learners that did not realise the importance of doing well in Mathematics (n = 280) (Mdn = 292.2), Z = -14.34, P < .000.

The achievement levels of the male learners that realised the importance of doing well in Mathematics (n = 5305) (Mdn = 363.6) differ significantly from the male learners that did not realise the importance of doing well in Mathematics (n = 350) (Mdn = 288.6), Z = -17.0, P < .000.

4.5 Mann-Whitney U results relating to the efficacy statements related to language

The efficacy statements relating to language are shown in Figure 4.5.

Figure 4.5: Efficacy statements relating to language

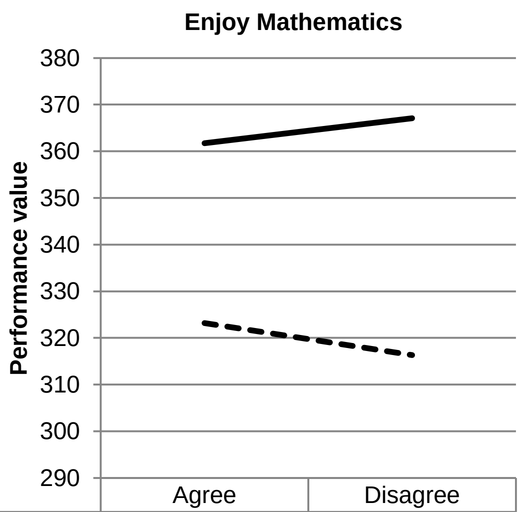
Efficacy statements (Language)	
I enjoy learning Mathematics	Mann-Whitney U
I wish I did not have to study Mathematics	
Mathematics is boring	
I learn many interesting things in Mathematics	
I like Mathematics	
It is important to do well in Mathematics	

The Mann-Whitney U results relating to each efficacy statement are described in paragraph 4.5.1 – 4.5.6. (see Appendix D in the CD)

4.5.1 I enjoy learning Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they enjoyed Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.5.1.

Table 4.5.1: Mathematics performance of learners relating to the enjoyment of learning Mathematics



	Agree	Disagree
———— (solid)	361.7	367.1
- - - - - - (broken)	323.2	316.3

The solid line represents learners that often used English and the broken line those that never used English at home.

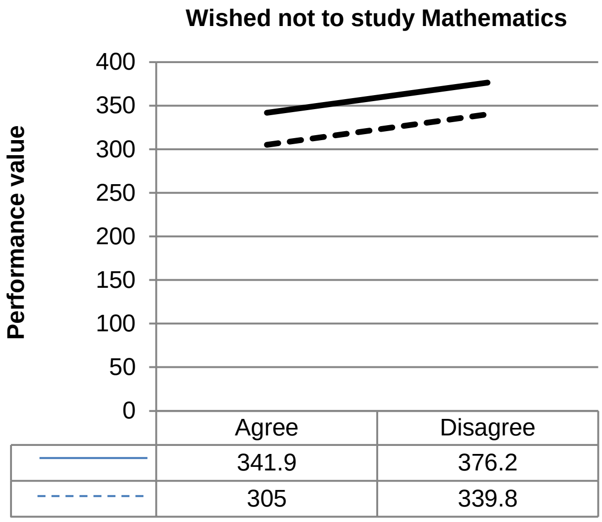
The achievement levels of the learners that often speak English at home and enjoyed learning Mathematics (n = 9219) (Mdn = 361.7) do not differ significantly from the learners that often speak English at home and do not enjoy learning Mathematics (n = 1369) (Mdn = 367.1), Z = -1.72, P < .09.

The achievement levels of the learners that never speak English at home and enjoyed learning Mathematics (n = 624) (Mdn = 323.2) do not differ significantly from the learners that never speak English at home and did not enjoy learning Mathematics (n = 118) (Mdn = 316.3), Z = - .9, P < .4.

4.5.2 I wish I did not have to study Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they wished not having to have study Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.5.2.

Table 4.5.2: Mathematics performance of learners relating to wishing not to have to study Mathematics



The solid line represents learners that often used English and the broken line those that never used English at home.

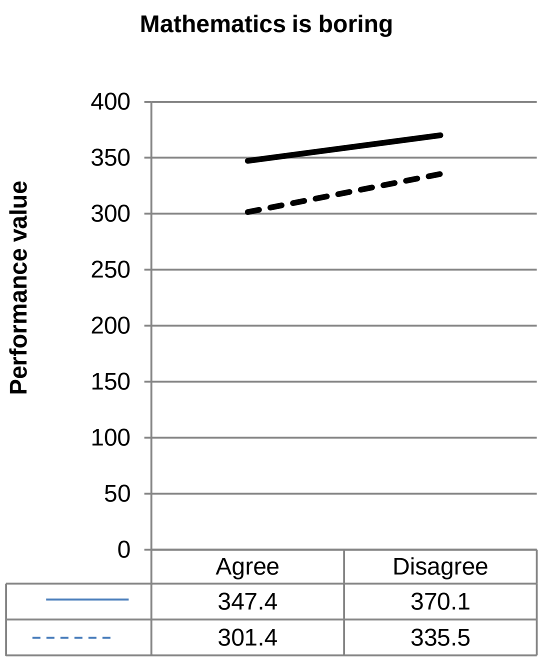
The achievement levels of the learners that often spoke English at home and wished not to study Mathematics (n = 3844) (Mdn = 341.9) differ significantly from the learners that often spoke English at home and wished to study Mathematics (n = 6428) (Mdn = 376.2), Z = -19.3, P < .000.

The achievement levels of the learners that never spoke English at home and wished not to study Mathematics (n = 334) (Mdn = 305.0) differ significantly from the learners that never spoke English at home and wished to study Mathematics (n = 448) (Mdn = 339.8), Z = - 6.12, P < .000.

4.5.3 Mathematics is boring

A graph indicating the trend in the Mathematics performance of the learners that agreed that Mathematics is boring as well as the Mathematics performance of learners that disagreed is provided in Table 4.5.3.

Table 4.5.3: Mathematics performance of learners relating to Mathematics being boring



The solid line represents learners that often used English and the broken line those that never used English at home.

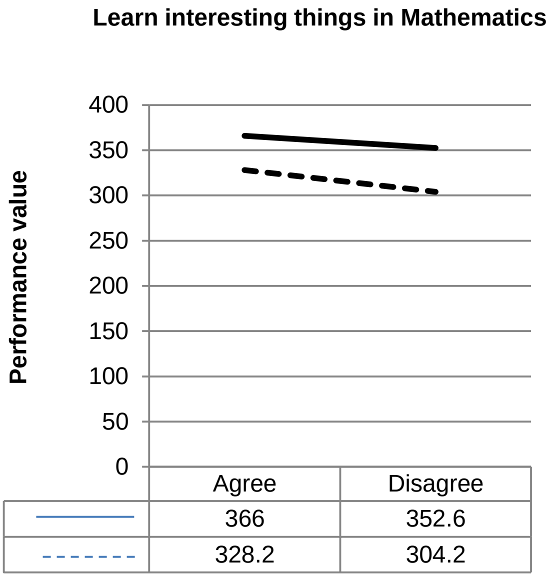
The achievement levels of the learners that often spoke English at home and experienced Mathematics as boring (n = 3095) (Mdn = 347.4) differ significantly from the learners that often spoke English at home and did not experience Mathematics as boring (n = 6970) (Mdn = 370.1), Z = -11.71, P < .000.

The achievement levels of the learners that never spoke English at home and experienced Mathematics as boring (n = 239) (Mdn = 301.4) differ significantly from the learners that never spoke English at home and did not experience Mathematics as boring (n= 448) (Mdn = 335.5), Z = - 5.4, P < .000.

4.5.4 I learn many interesting things in Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they learnt many interesting things in Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.5.4.

Table 4.5.4: Mathematics performance of learners relating to learning many interesting things in Mathematics



The solid line represents learners that often used English and the broken line those that never used English at home.

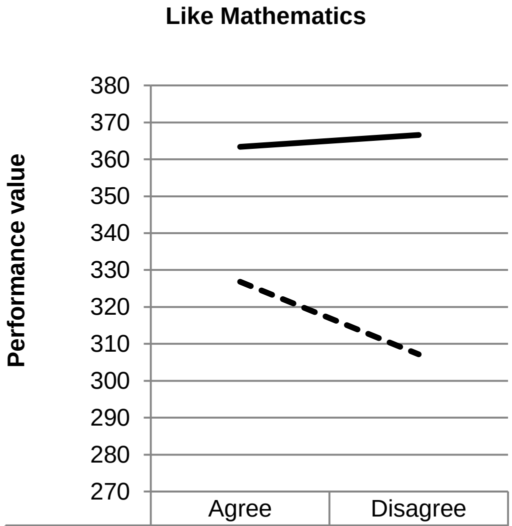
The achievement levels of the learners that often spoke English at home and learnt many interesting things in Mathematics (n = 8734) (Mdn = 366.0) differ significantly from the learners that often spoke English at home and did not learn many interesting things in Mathematics (n = 1497) (Mdn = 352.6), Z = - 4.0, P < .000.

The achievement levels of the learners that never spoke English at home and learnt many interesting things in Mathematics (n = 550) (Mdn = 328.2) differ significantly from the learners that never spoke English at home and did not learn many interesting things in Mathematics (n = 139) (Mdn = 304.2), Z = - 3.0, P < .004.

4.5.5 I like Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they liked Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.5.5.

Table 4.5.5: Mathematics performance of learners relating to liking Mathematics



	Agree	Disagree
- - - - - -	363.4	366.6
———	326.8	307.2

The solid line represents learners that often used English and the broken line those that never used English at home.

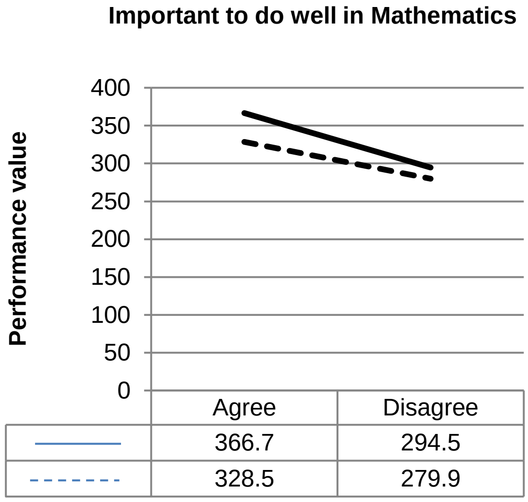
The achievement levels of the learners that often spoke English at home and liked Mathematics (n = 8579) (Mdn = 363.4) do not differ significantly from the learners that often spoke English at home and did not like Mathematics (n = 1711) (Mdn = 366.6), Z = - .3, P < .767.

The achievement levels of the learners that never spoke English at home and liked Mathematics (n = 548) (Mdn = 326.8) differ significantly from the learners that never spoke English at home and did not like Mathematics (n = 160) (Mdn = 307.2), Z = - 2.90, P < .004.

4.5.6 It is important to do well in Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that it is important to do well in Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.5.6.

Table 4.5.6: Mathematics performance of learners relating to the importance of doing well in Mathematics



The solid line represents learners that often used English and the broken line those that never used English at home.

The achievement levels of the learners that often spoke English at home and realised the importance of doing well in Mathematics (n = 9955) (Mdn = 366.7) differ significantly from the learners that often spoke English at home and did not realise the importance of doing well in Mathematics (n = 521) (Mdn = 294.9), Z = -20.0, P < .000.

The achievement levels of the learners that never spoke English at home and realised the importance of doing well in Mathematics (n = 631) (Mdn = 328.5) differ significantly from the learners that never spoke English at home and did not realise the importance of doing well in Mathematics (n = 95) (Mdn = 279.9), Z = - 5.91, P < .000.

4.6 Mann-Whitney U results relating to the efficacy statements related to books

The efficacy statements regarding owning books are shown in Figure 4.6.

Figure 4.6: Efficacy statements of owning books

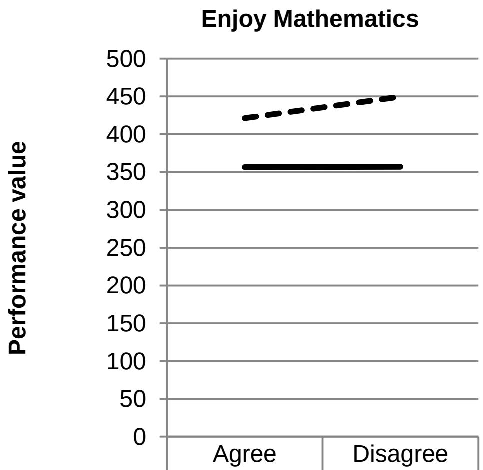
Efficacy statements (own books)	
I enjoy learning Mathematics I wish I did not have to study Mathematics Mathematics is boring I learn many interesting things in Mathematics I like Mathematics It is important to do well in Mathematics	**Mann-Whitney U**

The Mann-Whitney U results relating to each efficacy statement are described in paragraph 4.6.1 – 4.6.6. (see Appendix E in the CD)

4.6.1 I enjoy learning Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they enjoyed learning Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.6.1.

Table 4.6.1: Mathematics performance of learners relating to the enjoyment of learning Mathematics



	Agree	Disagree
————	356.6	356.8
- - - - - - -	421.1	449.5

The solid line represents learners that owned books and the broken line those that did not own books at home.

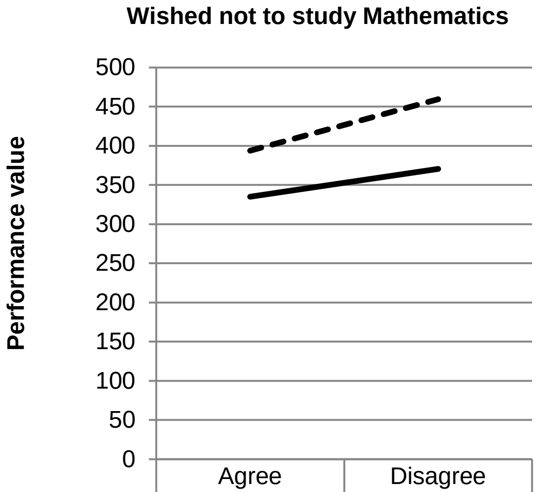
The achievement levels of the learners that had fewer than 100 books and enjoyed learning Mathematics (n = 8813) (Mdn = 356.6) do not differ significantly from the learners that had fewer than 100 books and did not enjoy learning Mathematics (n = 1285) (Mdn = 356.6), Z = - .461, P < .645.

The achievement levels of the learners that had more than 100 books and enjoyed learning Mathematics (n = 938) (Mdn = 421.1) did not differ significantly from the learners that had more than 100 books and did not enjoy learning Mathematics (n = 188) (Mdn = 449.5), Z = - .471, P < .64.

4.6.2 I wish I did not have to study Mathematics

A graph indicating the trend in Mathematics performance of the learners that agreed that they wished not to have study Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.6.2.

Table 4.6.2: Mathematics performance of learners relating to wishing not to have to study Mathematics



	Agree	Disagree
————	335.1	370.4
- - - - - - -	393.9	459.5

The solid line represents learners that owned books and the broken line those that did not own books at home.

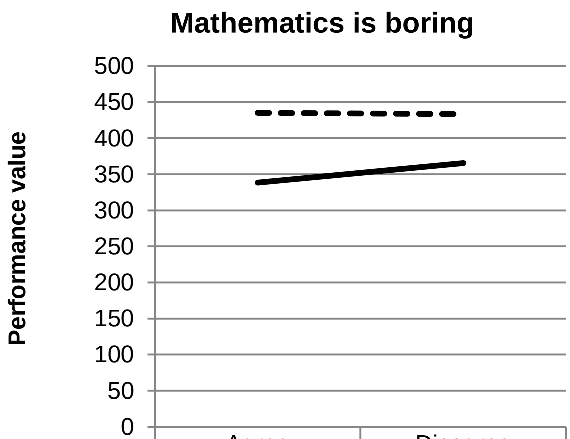
The achievement levels of the learners that had fewer than 100 books and wished they did not have to study Mathematics (n = 3708) (Mdn = 335.1) differ significantly from the learners that had fewer than 100 books and wanted to study Mathematics (n = 6069) (Mdn = 370.4), Z = - .20.0, P < .000.

The achievement levels of the learners that had more than 100 books and wished they did not have to study Mathematics (n = 417) (Mdn = 393.9) differ significantly from the learners that had more than 100 books and wanted to study Mathematics (n = 680) (Mdn = 459.5), Z = - 8.0, P < .000.

4.6.3 Mathematics is boring

A graph indicating the trend in the Mathematics performance of the learners that agreed that Mathematics is boring as well as the Mathematics performance of learners that disagreed is provided in Table 4.6.3.

Table 4.6.3: Mathematics performance of learners relating to Mathematics being boring



	Agree	Disagree
————	338.6	365.5
- - - - - - -	435.2	433.3

The solid line represents learners that owned books and the broken line those that did not own books at home.

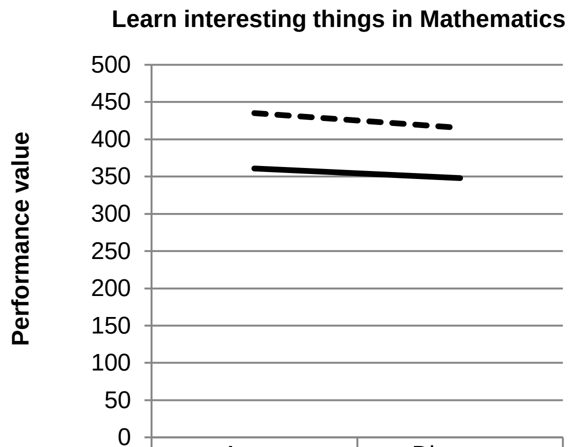
The achievement levels of the learners that had fewer than 100 books and experienced Mathematics as boring (n = 2913) (Mdn = 338.6) differ significantly from the learners that had fewer than 100 books and did not experience Mathematics as boring (n = 6666) (Mdn = 365.5), Z = - 13.64, P < .000.

The achievement levels of the learners that had more than 100 books and experienced Mathematics as boring (n = 379) (Mdn = 435.2) do not differ significantly from the learners that had more than 100 books and did not experience Mathematics as boring (n = 706) (Mdn = 433.3), Z = - 1.5, P < .141.

4.6.4 I learn many interesting things in Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they learnt many interesting things in Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.6.4.

Table 4.6.4: Mathematics performance of learners relating to learning interesting things in Mathematics



	Agree	Disagree
———	360.6	347.8
------	434.9	415.2

The solid line represents learners that owned books and the broken line those that did not own books.at home.

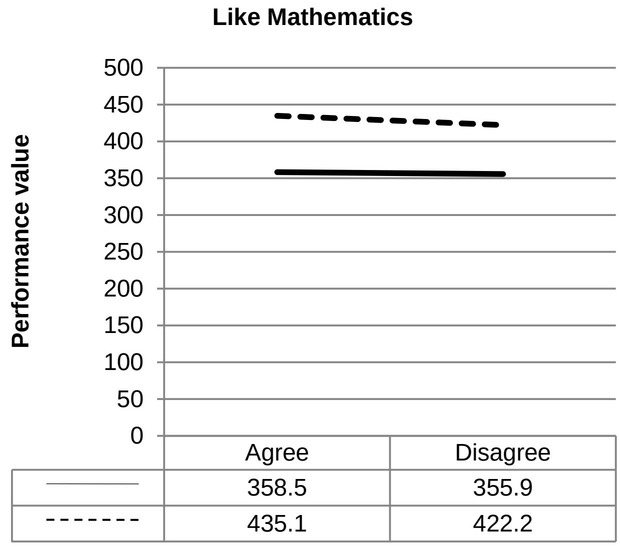
The achievement levels of the learners that had fewer than 100 books and learnt many interesting things in Mathematics (n = 8293) (Mdn = 360.6) differ significantly from the learners that had fewer than 100 books and did not learn many interesting things in Mathematics (n = 1428) (Mdn = 347.8), Z = - 4.51, P < .000.

The achievement levels of the learners that had more than 100 books and learnt many interesting things in Mathematics (n = 911) (Mdn = 434.9) differ significantly from the learners that had more than 100 books and did not learn many interesting things in Mathematics (n = 185) (Mdn = 415.2), Z = - 2.94, P < .003.

4.6.5 I like Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they liked Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.6.5.

Table 4.6.5: Mathematics performance of learners relating to liking Mathematics



The solid line represents learners that owned books and the broken line those that did not own books at home.

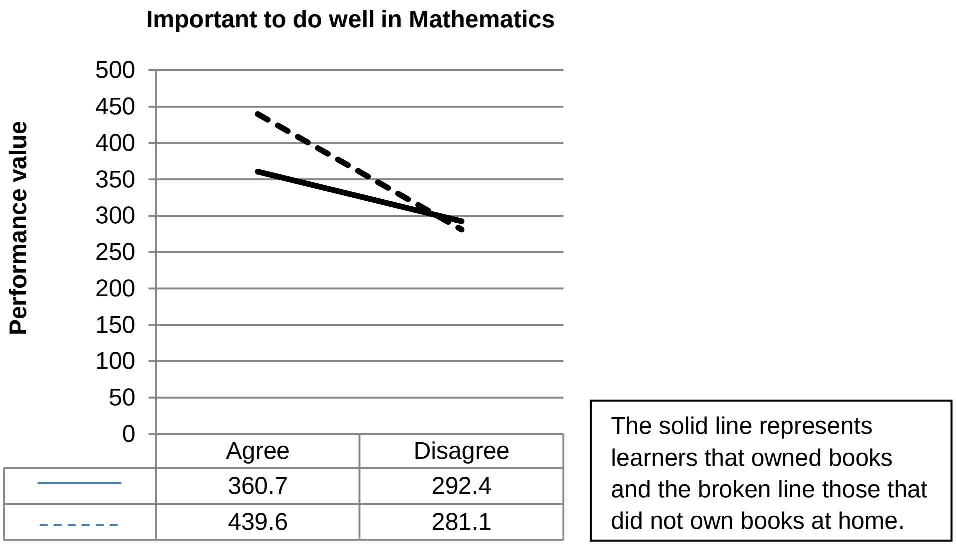
The achievement levels of the learners that had fewer than 100 books and liked Mathematics (n= 8166) (Mdn = 358.5) do not differ significantly from the learners that had fewer than 100 books and did not like Mathematics (n = 1637) (Mdn = 355.9), Z = -1.20, P < .227.

The achievement levels of the learners that had more than 100 books and liked Mathematics (n = 873) (Mdn = 435.1) differ significantly from the learners that had more than 100 books and did not like Mathematics (n = 224) (Mdn = 422.2), Z = - 2.34, P < .019.

4.6.6 It is important to do well in Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that it is important to do well in Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.6.6.

Table 4.6.6: Mathematics performance of learners relating to the importance of doing well in Mathematics



The achievement levels of the learners that had fewer than 100 books and realised the importance of doing well in Mathematics (n = 9448) (Mdn = 360.7) differ significantly from the learners that had fewer than 100 books and did not realise the importance of doing well in Mathematics (n = 534) (Mdn = 292.4), Z = - 19.5, P < .000.

The achievement levels of the learners that had more than 100 books and realised the importance of doing well in Mathematics (n = 1054) (Mdn = 439.6) differ significantly from the learners that had more than 100 books and did not realise the importance of doing well in Mathematics (n = 61) (Mdn = 281.1), Z = - 9.0, P < .000.

4.7 Mann-Whitney U results relating to the efficacy statements related to things

The efficacy statements on owning a computer are shown in Figure 4.7.1

Figure 4.7.1: Efficacy statements related to owning a computer

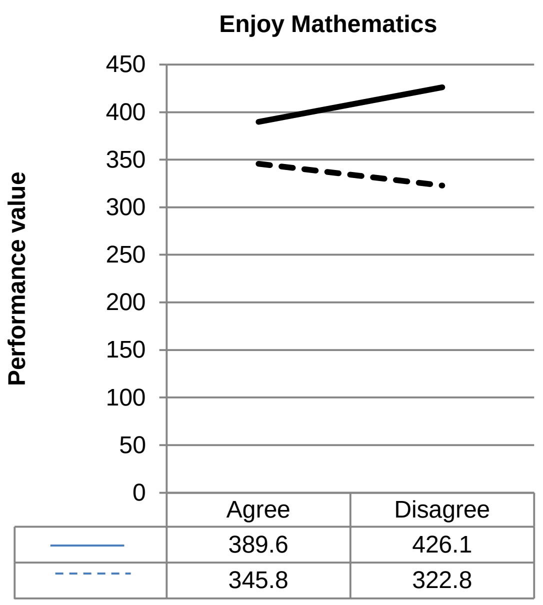
Efficacy statements (Computer)	
I enjoy learning Mathematics	Mann-Whitney U
I wish I did not have to study Mathematics	
Mathematics is boring	
I learn many interesting things in Mathematics	
I like Mathematics	
It is important to do well in Mathematics	

The Mann-Whitney U results relating to each efficacy statement are described in paragraph 4.7.1.1 – 4.7.1.6. (see Appendix F in the CD)

4.7.1.1 I enjoy learning Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they enjoyed learning Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.1.1.

Table 4.7.1.1: Mathematics performance of learners relating to the enjoyment of learning Mathematics



The solid line represents learners that had a computer and the broken line those that did not have a computer at home.

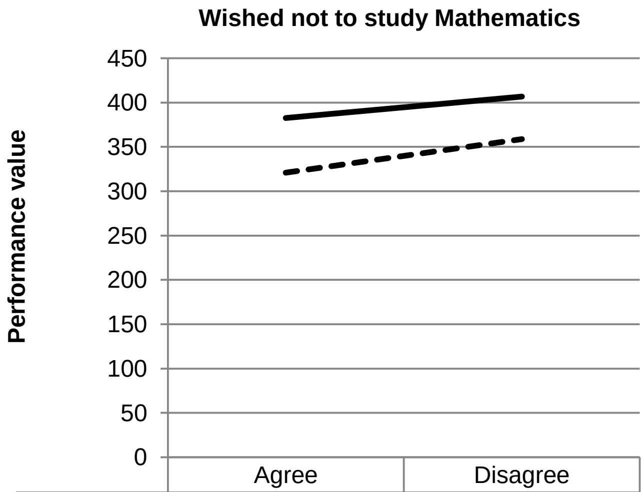
The achievement levels of the learners that had a computer at home and enjoyed learning Mathematics (n = 4011) (Mdn = 389.6) differ significantly from the learners that had a computer at home and did not enjoy learning Mathematics (n = 755) (Mdn = 426.1), Z = - .3.90, P < .000.

The achievement levels of the learners that did not have a computer at home and enjoyed learning Mathematics (n = 5734) (Mdn = 345.8) differ significantly from the learners that did not have a computer at home and did not enjoy learning Mathematics (n = 718) (Mdn = 322.8), Z = - 6.92, P < .000.

4.7.1.2 I wish I did not have to study Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they wished they did not have to study Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.1.2.

Table 4.7.1.2: Mathematics performance of learners relating to wishing they did not have to study Mathematics



	Agree	Disagree
———	382.7	406.7
-------	321.1	358.8

The solid line represents learners that had a computer and the broken line those that did not have computer at home.

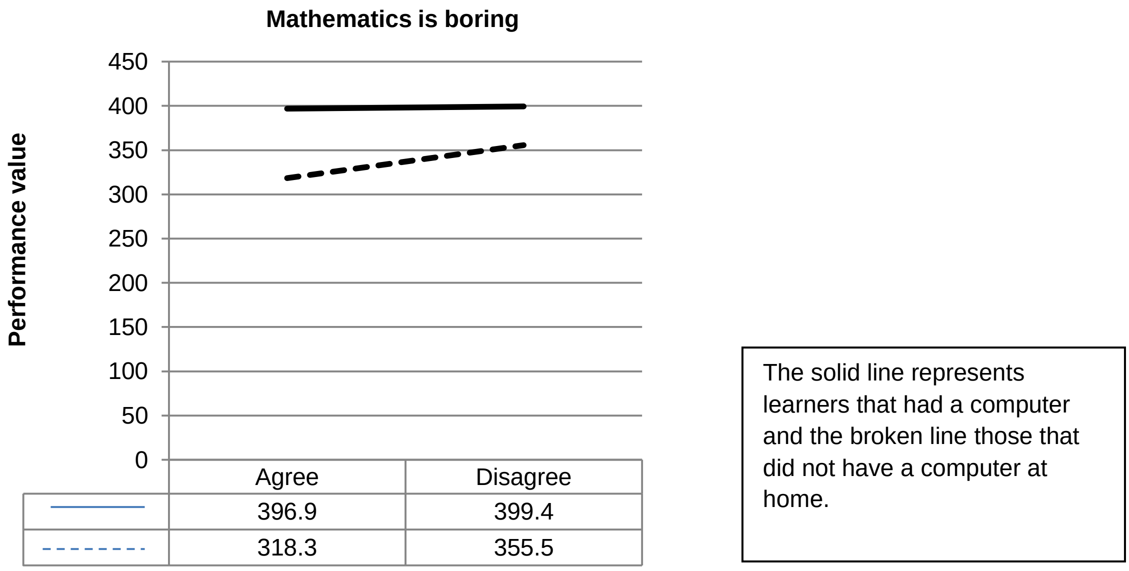
The achievement levels of the learners that had a computer at home and wished they did not have to study Mathematics (n = 1784) (Mdn = 382.7) differ significantly from the learners that had a computer at home and wished to study Mathematics (n = 2877) (Mdn =406.7), Z = - 21, P < .000.

The achievement levels of the learners that did not have a computer at home and wished they did not have to study Mathematics (n = 2347) (Mdn = 321.1) differ significantly from the learners that did not have a computer at home and did not enjoy learning Mathematics (n = 3867) (Mdn = 358.8), Z = - 14.5, P < .000.

4.7.1.3 Mathematics is boring

A graph indicating the trend in the Mathematics performance of the learners that agreed that Mathematics is boring as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.1.3.

Table 4.7.1.3: Mathematics performance of learners relating to Mathematics being boring



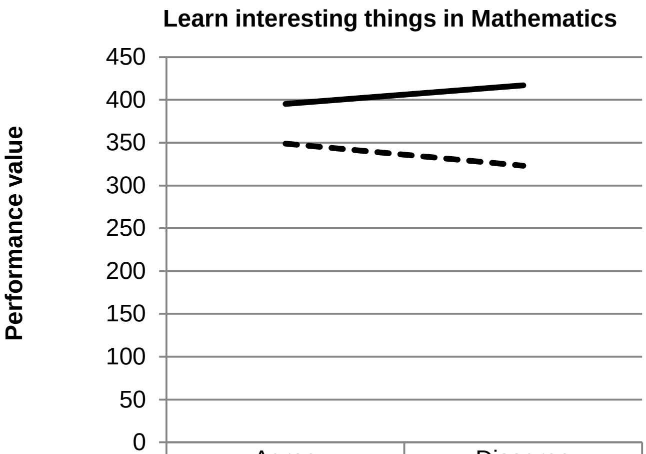
The achievement levels of the learners that had a computer at home and experienced Mathematics as boring (n = 1549) (Mdn = 396.9) differ significantly from the learners that had a computer at home and did not experience Mathematics as boring (n = 3017) (Mdn = 399.4), Z = - 3.2, P < .001.

The achievement levels of the learners that did not have a computer at home and experienced Mathematics as boring (n = 1741) (Mdn = 318.3) differ significantly from the learners that did not have a computer at home and did not experience Mathematics as boring (n = 4346) (Mdn = 355.5), Z = - 18.3, P < .000.

4.7.1.4 I learn many interesting things in Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they learnt many interesting things in Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.1.4.

Table 4.7.1.4: Mathematics performance of learners relating to learning many interesting things in Mathematics



	Agree	Disagree
———	395.3	417
- - - - - - - -	348.8	323

The solid line represents to learners that had a computer and the broken line those that did not have a computer at home.

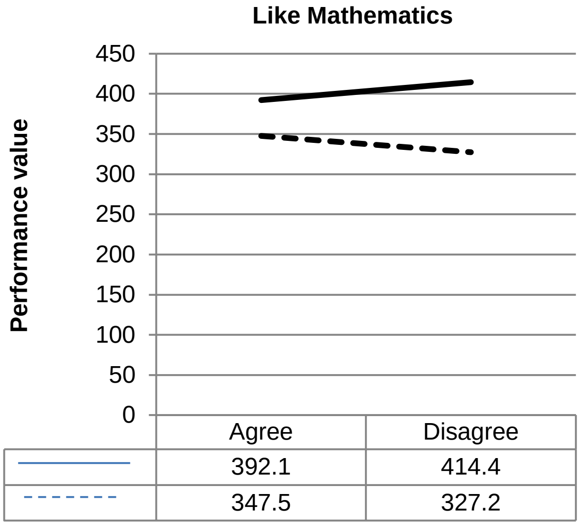
The achievement levels of the learners that had a computer at home and learnt many interesting things in Mathematics (n = 3892) (Mdn = 395.3) do no differ significantly from the learners that had a computer at home and did not learn many interesting things in Mathematics (n = 735) (Mdn = 417.0), Z = - 1.4, P < .165.

The achievement levels of the learners that did not have a computer but learnt many interesting things in Mathematics (n = 5308) (Mdn = 348.8) differ significantly from the learners that did not have a computer and did not learn many interesting things in Mathematics (n = 890) (Mdn = 323.0), Z = - 10, P < .000.

4.7.1.5 I like Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they liked Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.1.5.

Table 4.7.1.5: Mathematics performance of learners relating to liking Mathematics



The solid line represents learners that had a computer and the broken line those that did not have a computer at home.

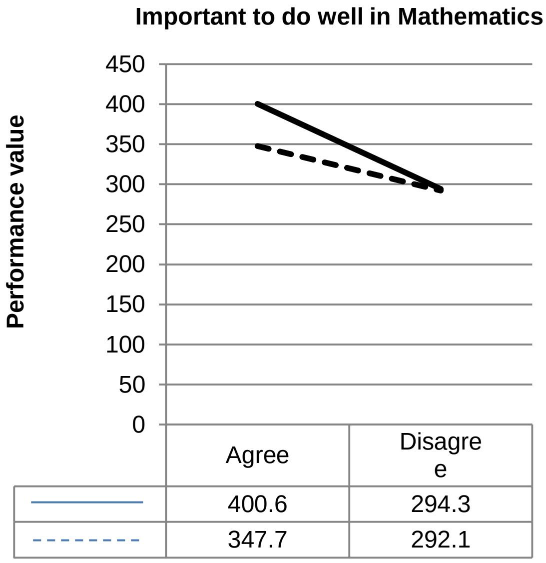
The achievement levels of the learners that had a computer and liked Mathematics (n = 3697) (Mdn = 392.1) do not differ significantly from the learners that had a computer and did not like Mathematics (n = 934) (Mdn = 414.4), Z = - .10, P < .340.

The achievement levels of the learners that did not have a computer but liked Mathematics (n = 5338) (Mdn = 347.5) differ significantly from the learners that did not have a computer and did not like Mathematics (n = 929) (Mdn = 327.2), Z = - 7.5, P < .000.

4.7.1.6 It is important to do well in Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that it is important to do well in Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.1.6.

Table 4.7.1.6: Mathematics performance of learners relating to the importance of doing well in Mathematics



The solid line represents learners that had a computer and the broken line those that did not have computer at home.

The achievement levels of the learners that had a computer and realised the importance of doing well in Mathematics (n = 4510) (Mdn = 400.1) differ significantly from the learners that had a computer and did not realise the importance of doing well in Mathematics (n = 198) (Mdn = 294.3), Z = - 13, P < .000.

The achievement levels of the learners that did not have a computer and realised the importance of doing well in Mathematics (n = 5986) (Mdn = 347.7) differ significantly from the learners that did not have a computer and did not realise the importance of doing well in Mathematics (n = 407) (Mdn = 292.1), Z = - 16.0, P < .000.

4.7.2 Mann-Whitney U results relating to the efficacy statements related to a study desk

The efficacy statements related to owning a study desk are shown in Figure 4.7.2.

Figure 4.7.2: Efficacy statements related to owning study desk

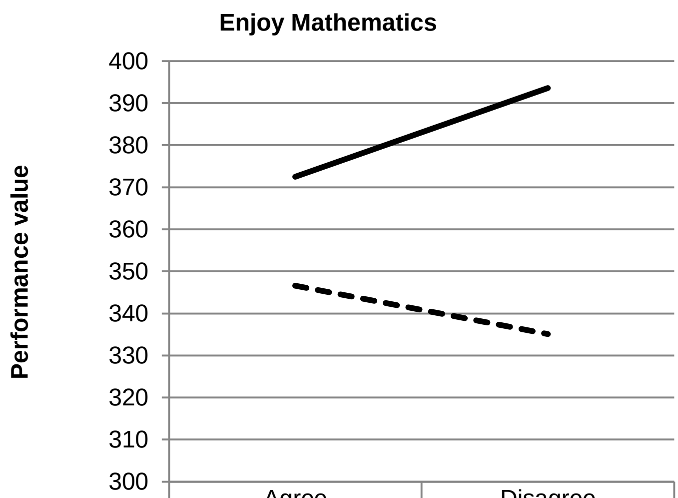
Efficacy statements (study desk)	
I enjoy learning Mathematics	Mann-Whitney U
I wish I did not have to study Mathematics	
Mathematics is boring	
I learn many interesting things in Mathematics	
I like Mathematics	
It is important to do well in Mathematics	

The Mann-Whitney U results relating to each efficacy statement are described in paragraph 4.7.2.1 – 4.7.2.6. (see Appendix F in the CD)

4.7.2.1 I enjoy learning Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they enjoyed learning Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.2.1.

Table 4.7.2.1: Mathematics performance of learners relating to enjoying learning Mathematics



	Agree	Disagree
——— (solid)	372.5	393.6
- - - - (broken)	346.6	335.1

The solid line represents learners that had a study desk and the broken line those that did not have a study desk at home.

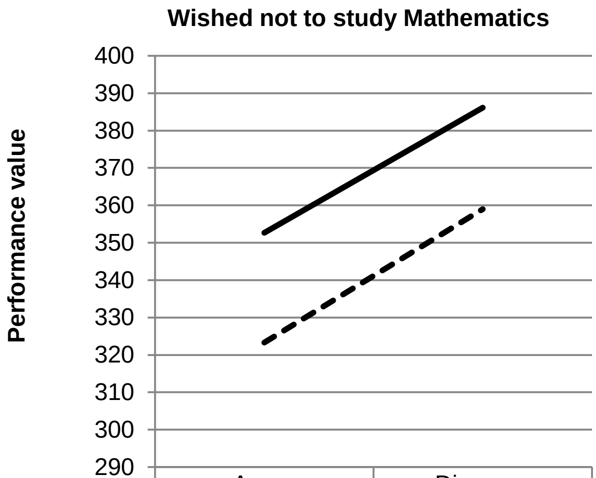
The achievement levels of the learners that had a study desk at home and enjoyed learning Mathematics (n = 5795) (Mdn = 372.5) differ significantly from the learners that had a study desk and did not enjoy learning Mathematics (n = 897) (Mdn = 393.6), Z = - 3.1, P < .002.

The achievement levels of the learners that did not have a study desk and enjoyed learning Mathematics (n = 3853) (Mdn = 346.6) differ significantly from the learners that did not have a study desk and did not enjoy learning Mathematics (n = 554) (Mdn = 335.1), Z = - 3, P < .010.

4.7.2.2 I wish I did not have to study Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they wished they did not have to study Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.2.2.

Table 4.7.2.2: Mathematics performance of learners relating to wishing not to study Mathematics



	Agree	Disagree
—— (solid line)	352.7	386.1
- - - - (broken line)	323.3	359

The solid line represents that had a study desk and the broken line those that did not have a study desk at home.

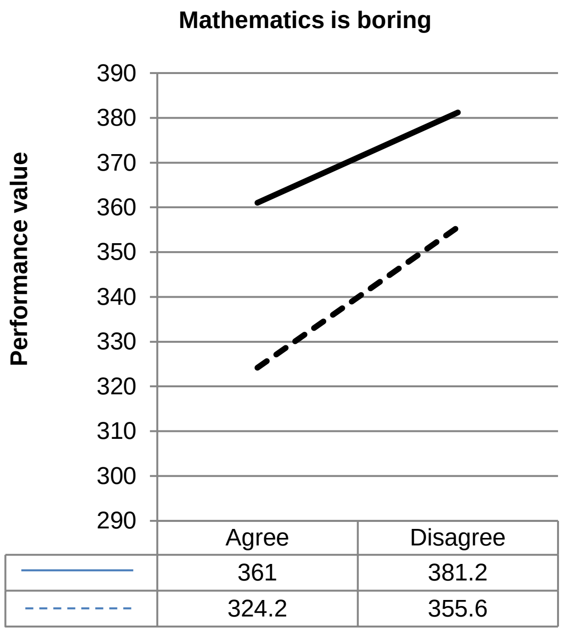
The achievement levels of the learners that had a study desk and wished they did not have to study Mathematics (n = 2487) (Mdn = 352.7) differ significantly from the learners that had a study desk and wished to study Mathematics (n = 4055) (Mdn = 386.1), Z = - 21, P < .000.

The achievement levels of the learners that did not have a study desk and wished to study Mathematics (n = 1599) (Mdn = 323.3) differ significantly from the learners that did not have a study desk and wished to study Mathematics (n = 2636) (Mdn = 359.0), Z = - 14.54, P < .000.

4.7.2.3 Mathematics is boring

A graph indicating the trend in the Mathematics performance of the learners that agreed that Mathematics is boring as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.2.3.

Table 4.7.2.3: Mathematics performance of learners relating to Mathematics being boring



The solid line represents learners that had a study desk and the broken line to those that did not have study desk at home.

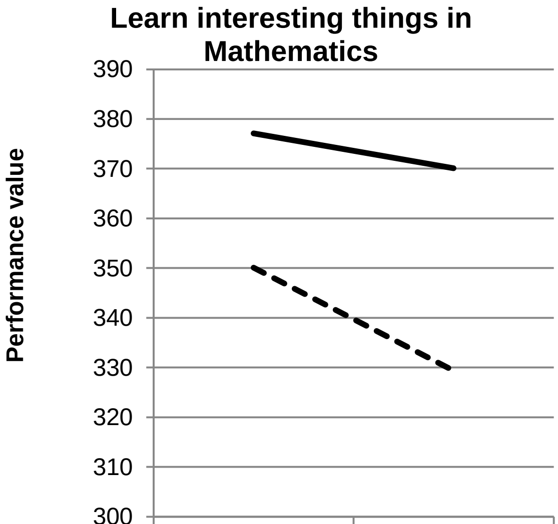
The achievement levels of the learners that had a study desk and experienced Mathematics as boring (n = 2073) (Mdn = 361.0) differ significantly from the learners that had study desk and did not experience Mathematics as boring (n = 4363) (Mdn = 381.2), Z = - 8, P < .000.

The achievement levels of the learners that did not have a study desk and experienced Mathematics as boring (n = 1186) (Mdn = 324.2) differ significantly from the learners that did not have a study desk and did not experience Mathematics as boring (n = 2944) (Mdn = 355.6), Z = - 11.81, P < .000.

4.7.2.4 I learn many interesting things in Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they learnt many interesting things in Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.2.4.

Table 4.7.2.4: Mathematics performance of learners relating to learning many interesting things in Mathematics



	Agree	Disagree
————	377.1	370.1
- - - - - - -	350.1	329.4

The solid line represents learners that had a study desk and the broken line those that did not have a study desk at home.

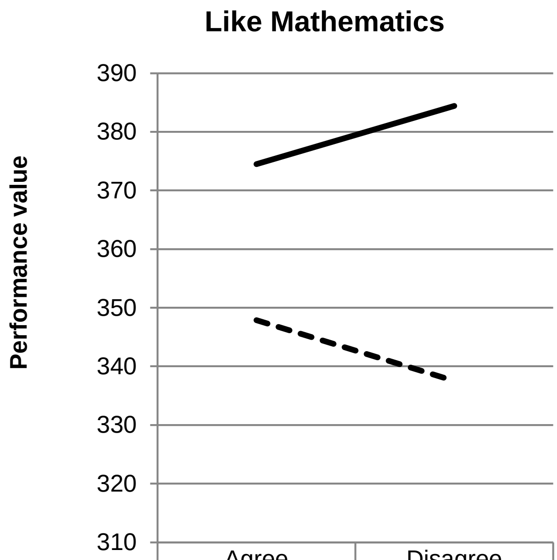
The achievement levels of the learners that had a study desk and that learnt many interesting things in Mathematics (n = 5524) (Mdn = 377.1) differ significantly from the learners that had a study desk and did not learn many interesting things in Mathematics (n = 993) (Mdn = 370.1), Z = - .2.2, P < .030.

The achievement levels of the learners that did not have a study desk and learnt many interesting things in Mathematics (n = 3586) (Mdn = 350.1) differ significantly from the learners that did not have a study desk and did not learn many interesting things in Mathematics (n = 616) (Mdn = 329.4), Z = - 5.83, P < .000.

4.7.2.5 I like Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they liked Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.2.4.

Table 4.7.2.5: Mathematics performance of learners relating to liking Mathematics



	Agree	Disagree
——— (solid)	374.5	384.4
- - - - (broken)	347.9	337.5

The solid line represents learners that had a study desk and the broken line those that did not have a study desk at home.

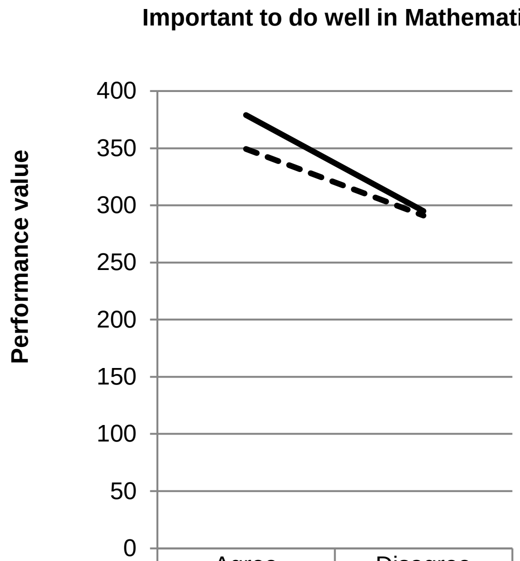
The achievement levels of the learners that had a study desk and liked Mathematics (n = 5417) (Mdn = 374.5) do not differ significantly from the learners that had a study desk and did not like Mathematics (n = 1112) (Mdn = 384.4), Z = - .471, P < .638.

The achievement levels of the learners that had a study desk and liked Mathematics (n = 3543) (Mdn = 347.9) differ significantly from the learners that had a study desk and did not like Mathematics (n = 718) (Mdn = 337.54), Z = - 2.44, P < .014.

4.7.2.6 It is important to do well in Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that it is important to do well in Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.2.6.

Table 4.7.2.6: Mathematics performance of learners relating to the importance of doing well in Mathematics



	Agree	Disagree
————	378.9	295
- - - - - - -	349.4	291.1

The solid line represents learners that had a study desk and the broken line those that did not have a study desk at home.

The achievement levels of the learners that had a study desk and realised the importance of doing well in Mathematics (n = 6339) (Mdn = 378.9) differ significantly from the learners that had a study desk and did not realise the importance of doing well in Mathematics (n = 305) (Mdn = 295.0), Z = - 16, P < .000.

The achievement levels of the learners that had a study desk and realised the importance of doing well in Mathematics (n = 4068) (Mdn = 349.4) differ significantly from the learners that had a study desk and did not realise the importance of doing well in Mathematics (n = 285) (Mdn = 291.1), Z = - 13.4, P < .000.

4.7.3 Mann-Whitney U results relating to the efficacy statements related to owning books

The efficacy statements relating to owning books are shown in Figure 4.7.3.

Figure 4.7.3: Efficacy statements relating to owning books

Efficacy statements (own books)
I enjoy learning Mathematics
I wish I did not have to study Mathematics
Mathematics is boring
I learn many interesting things in Mathematics
I like Mathematics
It is important to do well in Mathematics

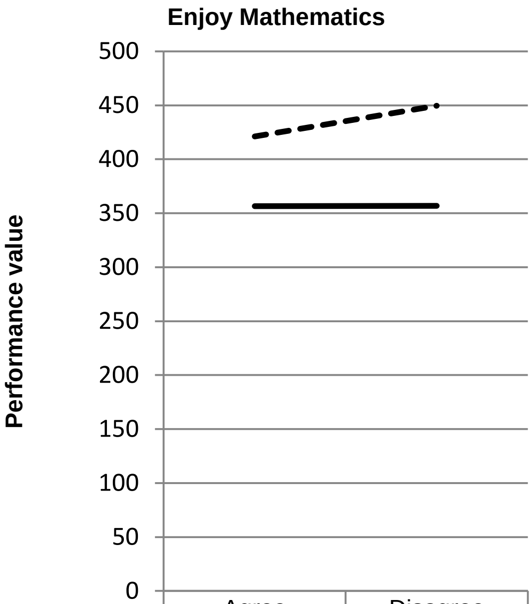
Mann-Whitney U

The Mann-Whitney U results relating to each efficacy statement are described in paragraph 4.7.3.1 to 4.7.3.6. (see Appendix F in the CD)

4.7.3.1 I enjoy learning Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they enjoyed learning Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.3.1.

Table 4.7.3.1: Mathematics performance of learners relating to enjoying learning Mathematics



	Agree	Disagree
———— (solid line)	356.6	356.8
- - - - - - - (broken line)	421.1	449.5

The solid line represents learners that owned books and the broken line those that did not own books at home.

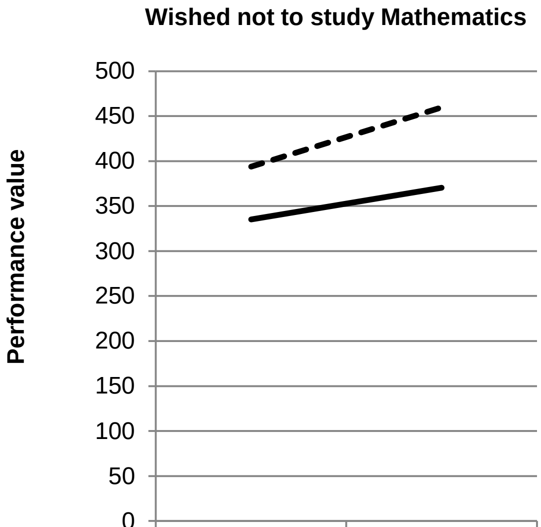
The achievement levels of the learners that owned books and enjoyed learning Mathematics (n = 6636) (Mdn = 368.7) differ significantly from the learners that owned books and did not enjoy learning Mathematics (n = 997) (Mdn = 382.3), Z = - 2.53, P < .011.

The achievement levels of the learners that did not own books and enjoyed learning Mathematics (n = 2993) (Mdn = 344.3) do not differ significantly from the learners that did not own books and did not enjoy learning Mathematics (n = 461) (Mdn = 340.8), Z = - .931, P < .352.

4.7.3.2 I wish I did not have to study Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they wished they did not have to study Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.3.2.

Table 4.7.3.2: Mathematics performance of learners relating to wishing they did not have to study Mathematics



	Agree	Disagree
——— (solid)	335.1	370.4
- - - - (broken)	393.9	459.5

The solid line represents learners that owned books and the broken line those that did not own books at home.

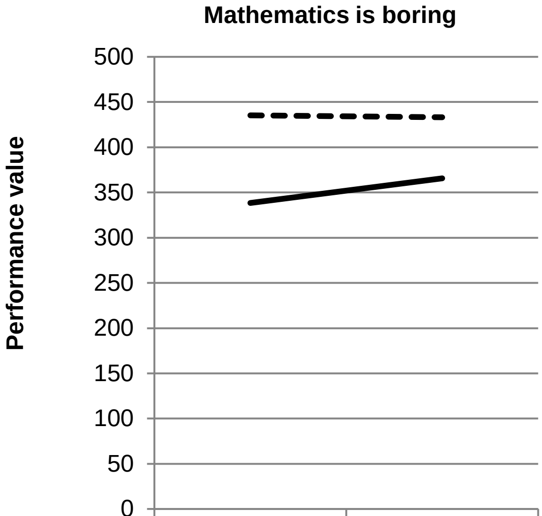
The achievement levels of the learners that owned books and wished they did not have to study Mathematics (n = 2758) (Mdn = 347.5) differ significantly from the learners that owned books and wanted to study Mathematics (n = 4713) (Mdn = 382.4), Z = -16.32, P < .000.

The achievement levels of the learners that did not own books and wished they did not have to study Mathematics (n = 1331) (Mdn = 325.1) differ significantly from the learners that did not own books and wanted to study Mathematics (n = 1964) (Mdn = 359.0), Z = - 11.71, P < .000.

4.7.3.3 Mathematics is boring

A graph indicating the trend in the Mathematics performance of the learners that agreed that Mathematics is boring as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.3.3.

Table 4.7.3.3: Mathematics performance of learners relating to Mathematics being boring



	Agree	Disagree
——— (solid line)	338.6	365.5
- - - - (broken line)	435.2	433.3

The solid line represents learners that owned books and the broken line those that did not own books at home.

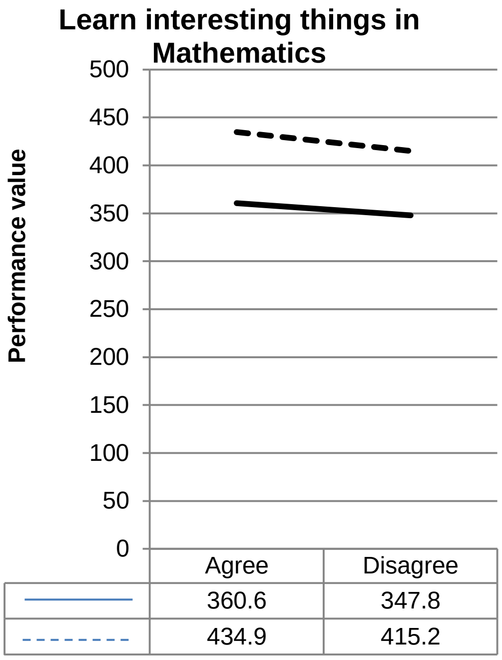
The achievement levels of the learners that owned books and experienced Mathematics as boring ($n = 2241$) ($Mdn = 354.0$) differ significantly from the learners that owned books and did not experience Mathematics as boring ($n = 5089$) ($Mdn = 377.7$), $Z = -9.50$, $P < .000$.

The achievement levels of the learners that did not own books and experienced Mathematics as boring ($n = 1020$) ($Mdn = 329.2$) differ significantly from the learners that did not own books and did not experience Mathematics as boring ($n = 2198$) ($Mdn = 359.1$), $Z = -7.53$, $P < .000$.

4.7.3.4 I learn many interesting things in Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they learnt many interesting things in Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.3.4.

Table 4.7.3.4: Mathematics performance of learners relating to learning many interesting things in Mathematics



The solid line represents learners that owned books and the broken line those that did not own books at home.

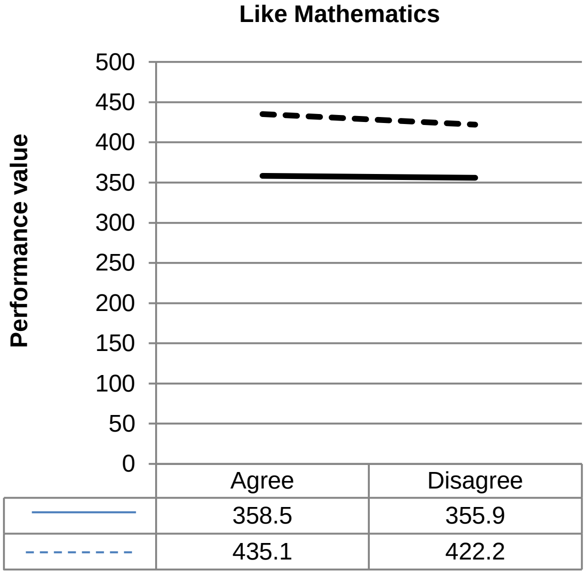
The achievement levels of the learners that owned books and learnt many interesting things in Mathematics (n = 6378) (Mdn = 372.9) differ significantly from the learners that owned books and did not learn many interesting things in Mathematics (n = 1058) (Mdn = 360.5), Z = - 3, P < .003.

The achievement levels of the learners that did not own books and learnt many interesting things in Mathematics (n = 2740) (Mdn = 347.7) differ significantly from the learners that did not own books and did not learn many interesting things in Mathematics (n = 540) (Mdn = 359.1), Z = - 3.91, P < .004.

4.7.3.5 I like Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they liked Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.3.5.

Table 4.7.3.5: Mathematics performance of learners relating to liking Mathematics



The solid line represents learners that owned books and the broken line those that did not own books at home.

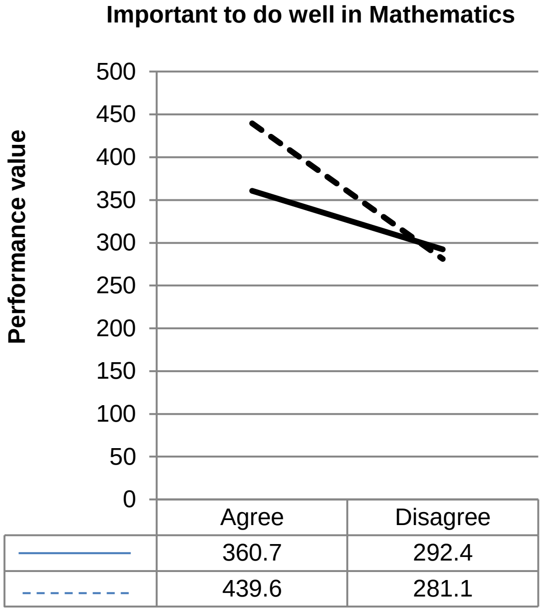
The achievement levels of the learners that owned books and liked Mathematics (n = 6232) (Mdn = 370.2) do not differ significantly from the learners that owned books and did not like Mathematics (n = 1242) (Mdn = 374.7), Z = - .175, P < .861.

The achievement levels of the learners that did not own books and liked Mathematics (n = 2706) (Mdn = 346.1) do not differ significantly from the learners that did not own books and did not like Mathematics (n = 608) (Mdn = 342.0), Z = - 2.0, P < .096.

4.7.3.6 It is important to do well in Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that it is important to do well in Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.3.6.

Table 4.7.3.6: Mathematics performance of learners relating to the importance of doing well in Mathematics



The solid line represents learners that owned books and the broken line those that did not own books at home.

The achievement levels of the learners that owned books and realised the importance of doing well in Mathematics (n = 7236) (Mdn = 374.0) differ significantly from the learners that owned books and did not realise the importance of doing well in Mathematics (n = 369) (Mdn = 290.7), Z = - 17.4, P < .000.

The achievement levels of the learners that did not own books and realised the importance of doing well in Mathematics (n = 3153) (Mdn = 348.6) differ significantly from the learners that did not own books and did not realise the importance of doing well in Mathematics (n = 230) (Mdn = 296.8), Z = - 11.62, P < .000.

4.7.4 Mann-Whitney U results relating to the efficacy statements related to having one’s own room

The efficacy statements relating to having one’s own room are shown in Figure 4.7.4.

Figure 4.7.4: Efficacy statements relating to having one's own room

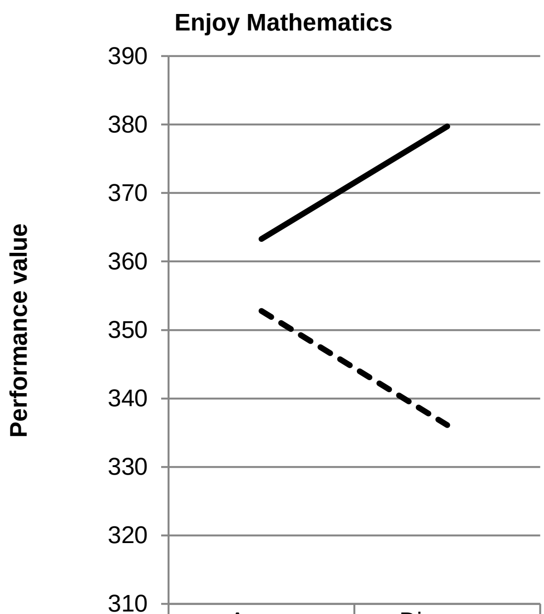
Efficacy statements (own room)	
I enjoy learning Mathematics	Mann-Whitney U
I wish I did not have to study Mathematics	
Mathematics is boring	
I learn many interesting things in Mathematics	
I like Mathematics	
It is important to do well in Mathematics	

The Mann-Whitney U results relating to each efficacy statement are described in paragraph 4.7.4.1 – 4.7.4.6. (see Appendix F in the CD)

4.7.4.1 I enjoy learning Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they enjoyed learning Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.4.1.

Table 4.7.4.1: Mathematics performance of learners relating to the enjoyment of learning Mathematics



	Agree	Disagree
————	363.3	379.7
- - - - - - - -	352.8	336.1

The solid line represents learners that had an own room and the broken line those that did not have an own room at home.

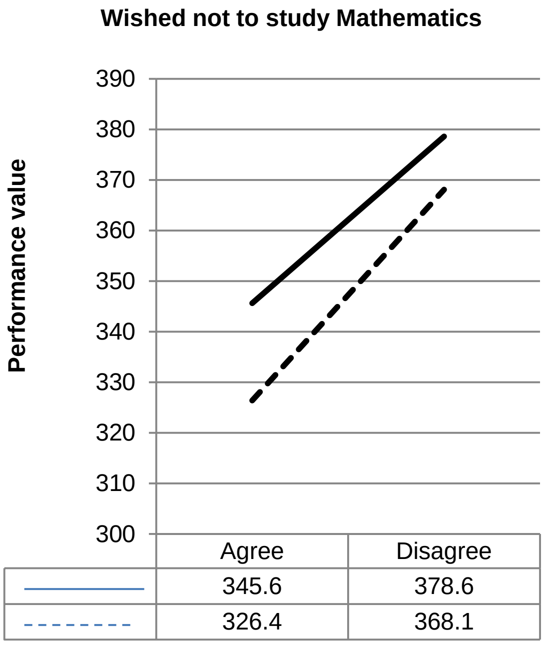
The achievement levels of the learners that had their own room at home and enjoyed learning Mathematics (n = 6750) (Mdn = 363.3) differ significantly from the learners that had their own room at home and did not enjoy learning Mathematics (n = 1033) (Mdn = 379.7), Z = - 3.53, P < .000.

The achievement levels of the learners that did not have their own room at home and enjoyed learning Mathematics (n = 3001) (Mdn = 352.8) differ significantly from the learners that did not have their own room at home and did not enjoy learning Mathematics (n = 438) (Mdn = 336.1), Z = - 3.62, P < .000.

4.7.4.2 I wish I did not have to study Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they wished they did not have to study Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.4.2.

Table 4.7.4.2: Mathematics performance of learners relating to wishing they did not have to study Mathematics



The solid line represents learners that had a room and the broken line those that did not own room at home.

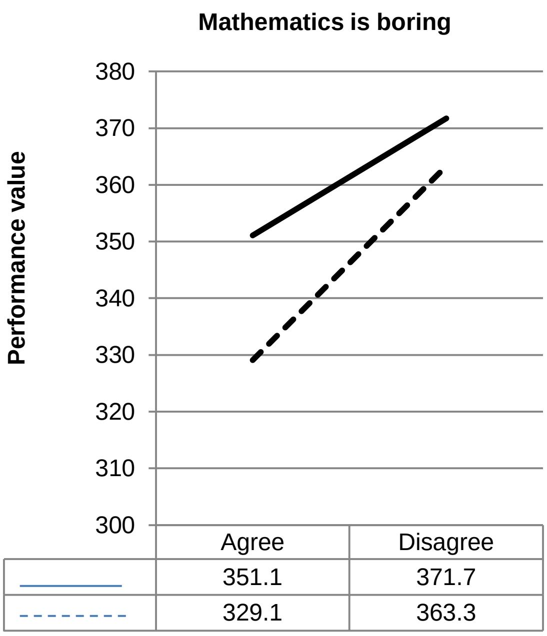
The achievement levels of the learners that had their own room at home and wished they did not have to study Mathematics (n = 2898) (Mdn = 345.6) differ significantly from the learners that had their own room at home and wished to study Mathematics (n = 4697) (Mdn = 378.1), Z = - 15.2, P < .000.

The achievement levels of the learners that did not have their own room at home and wished they did not have to study Mathematics (n = 1244) (Mdn = 326.4) differ significantly from the learners that did not have their own room at home and wished to study Mathematics (n = 2045) (Mdn = 368.1), Z = - 15.53, P < .000.

4.7.4.3 Mathematics is boring

A graph indicating the trend in the Mathematics performance of the learners that agreed is boring is provided in Table 4.7.4.3.

Table 4.7.4.3: Mathematics performance of learners relating to Mathematics being boring



The solid line represents learners with an own room and the broken line those that did not have own room at home.

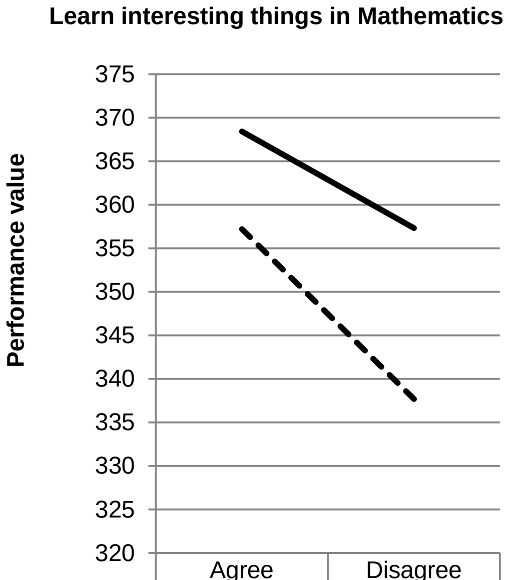
The achievement levels of the learners that had their own room at home and experienced Mathematics as boring (n = 2338) (Mdn = 351.1) differ significantly from the learners that had their own room at home and did not experience Mathematics as boring (n = 5098) (Mdn = 371.7), Z = - 8.3, P < .000.

The achievement levels of the learners that did not have their own room at home and experienced Mathematics as boring (n = 957) (Mdn = 329.1) differ significantly from the learners that did not have their own room at home and did not experience Mathematics as boring (n = 2267) (Mdn = 363.3), Z = - 11.3, P < .000.

4.7.4.4 I learn many interesting things in Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they learnt many interesting things in Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.4.4.

Table 4.7.4.4: Mathematics performance of learners relating to learning many interesting things in Mathematics



	Agree	Disagree
———	368.4	357.3
- - - - - - - -	357.2	337.7

The solid line represents learners having an own room and the broken line those without an own room at home.

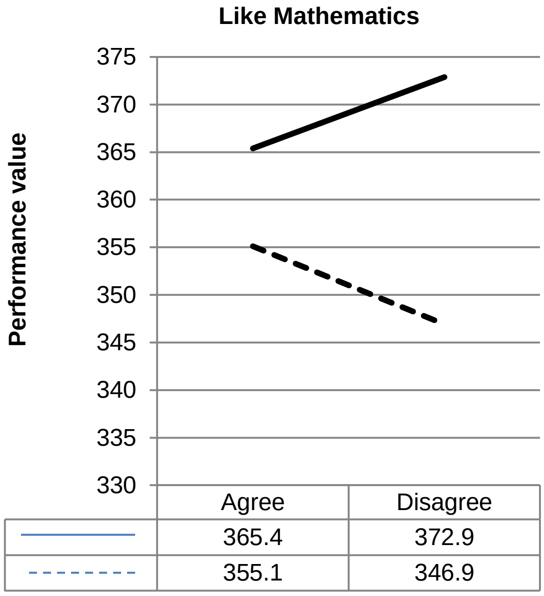
The achievement levels of the learners that had their own room at home and learnt many interesting things in Mathematics (n = 6412) (Mdn = 368.4) do not differ significantly from the learners that had their own room at home and did not learn many interesting things in Mathematics (n = 1142) (Mdn = 357.3), Z = - 2.70, P < .007.

The achievement levels of the learners that did not have their own room at home and learnt many interesting things in Mathematics (n = 2805) (Mdn = 357.2) differ significantly from the learners that did not have their own room at home and did not learn many interesting things in Mathematics (n = 469) (Mdn = 337.7), Z = - 4.82, P < .000.

4.7.4.5 I like Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they liked Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.4.5.

Table 4.7.4.5: Mathematics performance of learners relating to liking Mathematics



The solid line represents learners with an own room and the broken line those that did not have an own room at home.

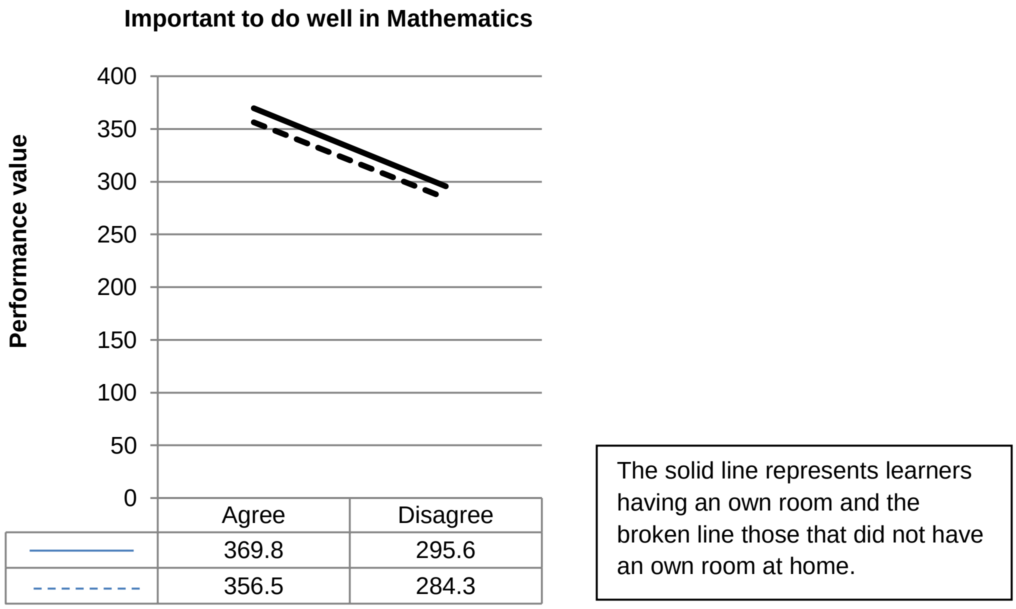
The achievement levels of the learners that had their own room at home and liked Mathematics (n = 6269) (Mdn = 365.4) do not differ significantly from the learners that had their own room at home and did not like Mathematics (n = 1326) (Mdn = 372.9), Z = - .331, P < .741.

The achievement levels of the learners that did not have their own room at home and liked Mathematics (n = 2784) (Mdn = 355.1) differ significantly from the learners that did not have their own room at home and did not like Mathematics (n = 529) (Mdn = 346.9), Z = - 3.1, P < .002.

4.7.4.6 It is important to do well in Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that it is important to do well in Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.4.6.

Table 4.7.4.6: Mathematics performance of learners relating to the importance of doing well in Mathematics



The achievement levels of the learners that had their own room at home and realised the importance of doing well in Mathematics (n = 7319) (Mdn = 369.8) differ significantly from the learners that had their own room at home and did not realise the importance of doing well in Mathematics (n = 400) (Mdn = 295.6), Z = - 17.02, P < .000.

The achievement levels of the learners that did not have their own room at home and realised the importance of doing well in Mathematics (n = 3186) (Mdn = 356.5) differ significantly from the learners that did not have their own room at home and did not realise the importance of doing well in Mathematics (n = 205) (Mdn = 284.3), Z = -13.0, P < .000.

4.7.5 Mann-Whitney U results relating to the efficacy statements related to Internet access

The efficacy statements regarding Internet access are shown in Figure 4.7.5.

Figure 4.7.5: Efficacy statements regarding Internet access

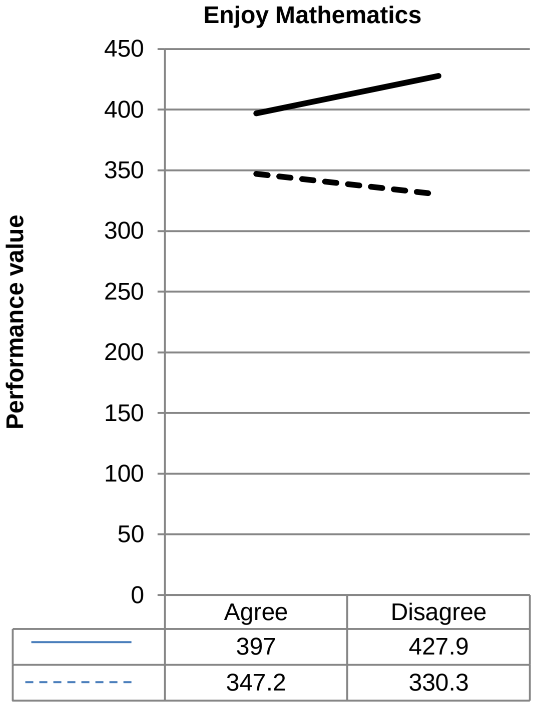
Efficacy statements (internet access)	
I enjoy learning Mathematics	**Mann-Whitney U**
I wish I did not have to study Mathematics	
Mathematics is boring	
I learn many interesting things in Mathematics	
I like Mathematics	
It is important to do well in Mathematics	

The Mann-Whitney U results relating to each efficacy statement are described in paragraph 4.7.5.1 – 4.7.5.6. (see Appendix F in the CD)

4.7.5.1 I enjoy learning Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they enjoyed learning Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.5.1.

Table 4.7.5.1: Mathematics performance of learners relating to enjoying learning Mathematics



The solid line represents learners that had Internet access and the broken line those that did not have Internet access at home.

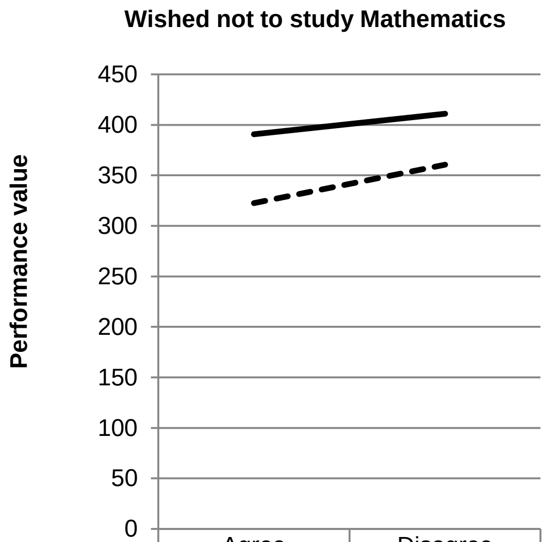
The achievement levels of the learners that had Internet access at home and enjoyed learning Mathematics (n = 3383) (Mdn = 397.0) differ significantly from the learners that had Internet access at home and did not enjoy learning Mathematics (n = 659) (Mdn = 427.9), Z = - 3.01, P < .003.

The achievement levels of the learners that did not have Internet access at home and enjoyed learning Mathematics (n = 6195) (Mdn = 347.2) differ significantly from the learners that did not have Internet access at home and did not enjoy learning Mathematics (n = 783) (Mdn = 330.3), Z = - 5.0, P < .000.

4.7.5.2 I wish I did not have to study Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that wished they did not have to study Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.5.2.

Table 4.7.5.2: Mathematics performance of learners relating to wishing not to have to study Mathematics



	Agree	Disagree
——— (solid line)	390.9	411.2
- - - - (broken line)	322.5	360.5

The solid line represents learners that had Internet access and the broken line those that did not have Internet access at home.

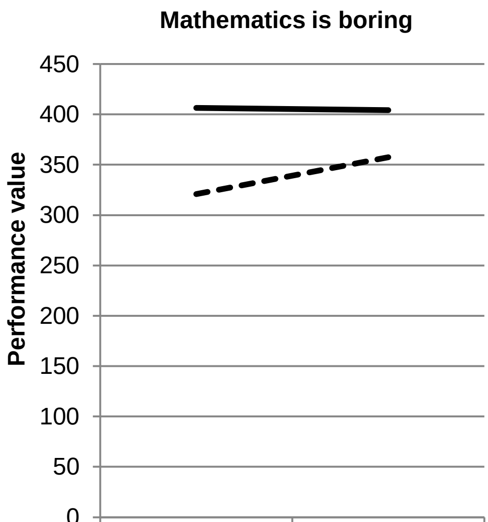
The achievement levels of the learners that had Internet access at home and wished they did not have to study Mathematics (n = 1476) (Mdn = 390.9) differ significantly from the learners that had Internet access at home and wished to study Mathematics (n = 2493) (Mdn = 411.2), Z = - 8.63, P < .000.

The achievement levels of the learners that did not have Internet access at home and wished they did not have to study Mathematics (n = 2574) (Mdn = 322.5) differ significantly from the learners that did not have Internet access at home and wished to study Mathematics (n = 4159) (Mdn = 360.5), Z = - 21.0, P < .000.

4.7.5.3 Mathematics is boring

A graph indicating the trend in the Mathematics performance of the learners that agreed that Mathematics is boring as well as the Mathematics performance of learners that disagreed that is provided in Table 4.7.5.3.

Table 4.7.5.3: Mathematics performance of learners relating to Mathematics being boring



	Agree	Disagree
(solid line)	406.4	404.1
(broken line)	320.8	357.3

The solid line represents learners that had Internet access and the broken line those that did not have Internet access at home.

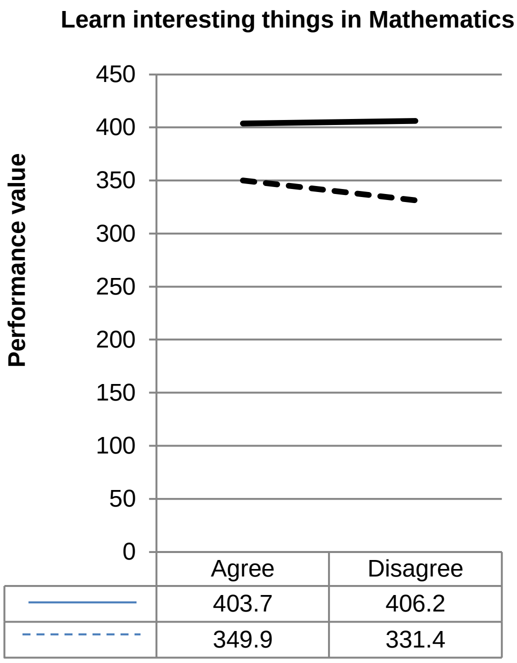
The achievement levels of the learners that had Internet access at home and experienced Mathematics as boring (n = 1268) (Mdn = 406.4) do not differ significantly from the learners that had Internet access at home and did not experience Mathematics as boring (n = 2636) (Mdn = 404.1), Z = - .723, P < .470

The achievement levels of the learners that did not have internet access at home and experienced Mathematics as boring (n = 1959) (Mdn = 320.8) differ significantly from the learners that did not have Internet access at home and did not experience Mathematics as boring (n = 4622) (Mdn = 357.2), Z = - 17.5, P < .000.

4.7.5.4 I learn many interesting things in Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they learnt many interesting things in Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.5.4.

Table 4.7.5.4: Mathematics performance of learners relating to learning many interesting things in Mathematics



The solid line represents learners that had Internet access and the broken line those that did not have Internet access at home.

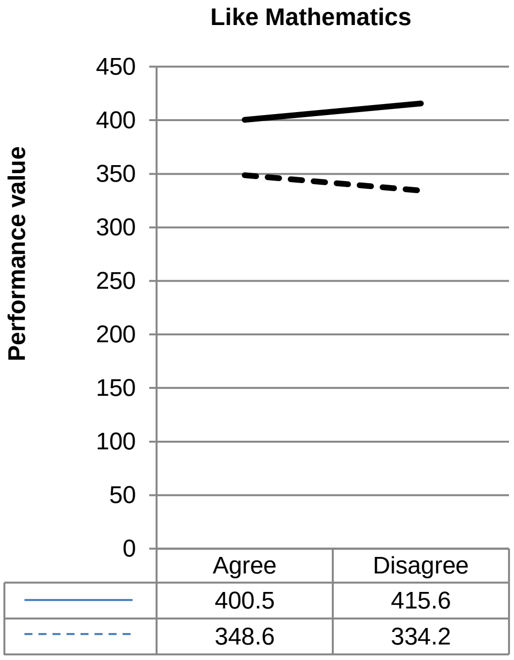
The achievement levels of the learners that had Internet access at home and learnt many interesting things in Mathematics (n = 3316) (Mdn = 403.7) do not differ significantly from the learners that had Internet access at home and did not learn many interesting things in Mathematics (n = 632) (Mdn = 357.3), Z = -.223, P < .823

The achievement levels of the learners that did not have Internet access at home and learnt many interesting things in Mathematics (n = 5747) (Mdn = 349.9) differ significantly from the learners that did not have Internet access at home and did not learn many interesting things in Mathematics (n = 951) (Mdn = 331.4), Z = - 7.1, P < .000.

4.7.5.5 I like Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they liked Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.5.5.

Table 4.7.5.5: Mathematics performance of learners relating to liking Mathematics



The solid line represents learners that had Internet access and the broken line those that did not have Internet access at home.

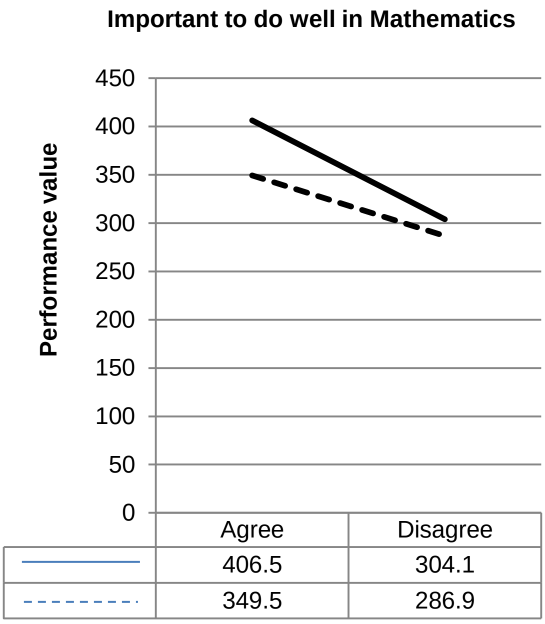
The achievement levels of the learners that had Internet access at home and liked Mathematics (n = 3138) (Mdn = 400.5) do not differ significantly from the learners that had Internet access at home and did not like Mathematics (n = 818) (Mdn = 415.6), Z = - .192, P < .848.

The achievement levels of the learners that did not have Internet access at home and liked Mathematics (n = 5754) (Mdn = 348.6) differ significantly from the learners that did not have Internet access at home and did not like Mathematics (n = 1010) (Mdn = 334.2), Z = - 5.72, P < .002.

4.7.5.6 It is important to do well in Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that it is important to do well in Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.5.6.

Table 4.7.5.6: Mathematics performance of learners relating to the importance of doing well in Mathematics



The solid line represents learners that had Internet access and the broken line those that did not have Internet access at home.

The achievement levels of the learners that had Internet access at home and realised the importance of doing well in Mathematics (n = 3841) (Mdn = 406.5) differ significantly from the learners that had Internet access at home and did not realise the importance of doing well in Mathematics (n = 173) (Mdn = 304.1), Z = - 11.94, P < .000.

The achievement levels of the learners that did not have Internet access at home and realised the importance of doing well in Mathematics (n = 6490) (Mdn = 349.5) differ significantly from the learners that did not have Internet access at home and did not realise the importance of doing well in Mathematics (n = 411) (Mdn = 286.9), Z = - 17.0, P < .000, r = - 0.204.

4.7.6 Mann-Whitney U results relating to the efficacy statements regarding owning a cell phone

The efficacy statements relating to owning a cell phone are shown in Figure 4.7.6

Figure 4.7.6: Efficacy statements regarding owning a cell phone

Efficacy statements (own cell phone)
I enjoy learning Mathematics
I wish I did not have to study Mathematics
Mathematics is boring
I learn many interesting things in Mathematics
I like Mathematics
It is important to do well in Mathematics

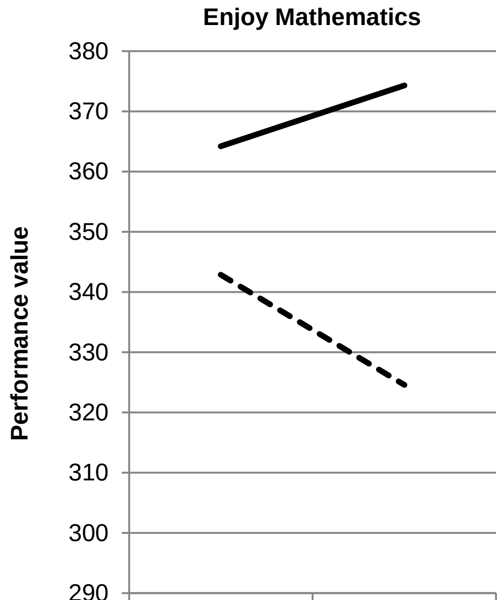
Mann-Whitney U

The Mann-Whitney U results relating to each efficacy statement are described in paragraph 4.7.6.1 – 4.7.6.6. (see Appendix F in the CD)

4.7.6.1 I enjoy learning Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they enjoyed learning Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.6.1.

Table 4.7.6.1: Mathematics performance of learners relating to enjoying learning Mathematics



	Agree	Disagree
——— (solid)	364.2	374.3
- - - - - - - - (broken)	342.9	324.6

The solid line represents learners owning a cell phone and the broken line those that did not own cell phone.

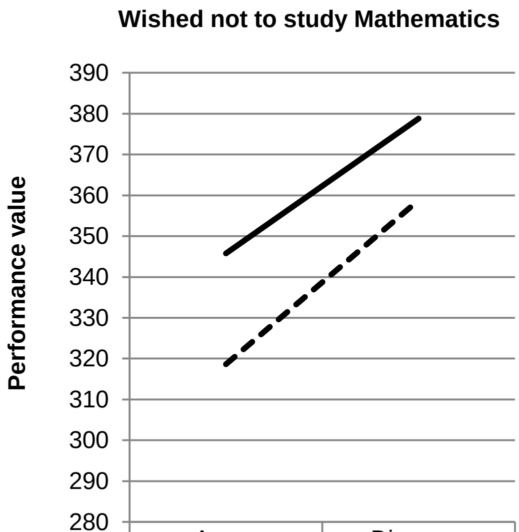
The achievement levels of the learners that owned a cell phone and enjoyed learning Mathematics (n = 7903) (Mdn = 364.2) differ significantly from the learners that owned a cell phone and did not enjoy learning Mathematics (n = 1240) (Mdn = 374.3), Z = - 2.3, P < .022.

The achievement levels of the learners that did not own a cell phone and enjoyed learning Mathematics (n = 1856) (Mdn = 342.9) differ significantly from the learners that did not own a cell phone and did not enjoy learning Mathematics (n = 229) (Mdn = 324.6), Z = - 3.2, P < .001.

4.7.6. I wish I did not have to study Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that wished they did not have to study Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.6.2.

Table 4.7.6.2: Mathematics performance of learners relating to wishing they did not have to study Mathematics



	Agree	Disagree
——— (solid line)	345.8	378.8
- - - - - (broken line)	318.6	358.8

The solid line represents learners that owned a cell phone and the broken line those that did not own a cell phone.

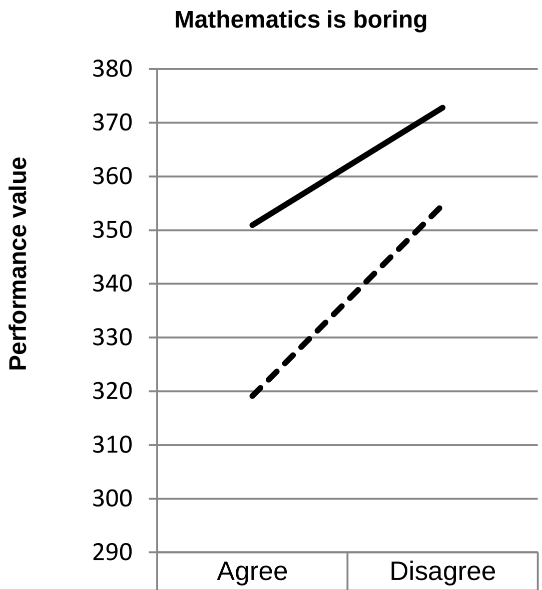
The achievement levels of the learners that owned a cell phone and wished they did not have to study Mathematics (n = 3360) (Mdn = 345.8) differ significantly from the learners that owned a cell phone and wished to study Mathematics (n = 5556) (Mdn = 378.8), Z = - 17.0, P < .000.

The achievement levels of the learners that did not own a cell phone and wished they did not have to study Mathematics (n = 773) (Mdn = 318.6) differ significantly from the learners that did not own a cell phone and wished to study Mathematics (n = 1200) (Mdn = 358.8), Z = - 13.04, P < .000.

4.7.6.3 Mathematics is boring

A graph indicating the trend in the Mathematics performance of the learners that agreed that Mathematics is boring as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.6.3.

Table 4.7.6.3: Mathematics performance of learners relating to Mathematics being boring



	Agree	Disagree
———— (solid line)	350.9	372.8
- - - - - - - - (broken line)	319.1	354.7

The solid line represents learners that owned a cell phone and the broken line those that did not own cell phone.

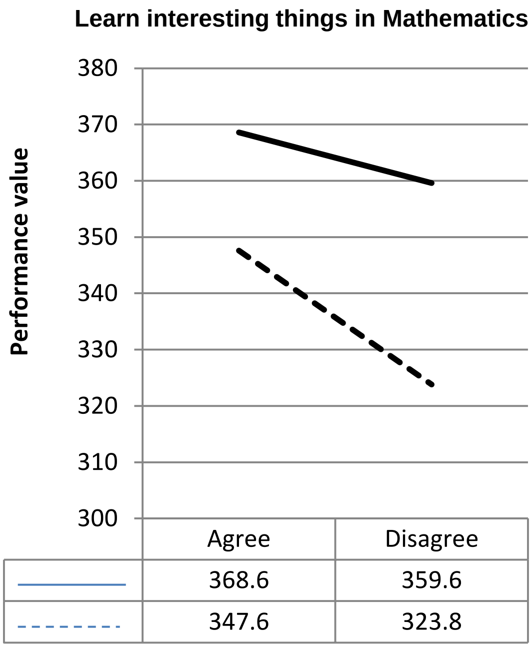
The achievement levels of the learners that owned a cell phone and experienced Mathematics as boring (n = 2720) (Mdn = 350.9) differ significantly from the learners that owned a cell phone and did not experience Mathematics as boring (n = 6008) (Mdn = 372.8), Z = - 9.5, P < .000.

The achievement levels of the learners that did not own a cell phone and experienced Mathematics as boring (n = 579) (Mdn = 319.1) differ significantly from the learners that did not own a cell phone and did not experience Mathematics as boring: (n = 1358) (Mdn = 354.7), Z = - 10.5, P < .000.

4.7.6.4 I learn many interesting things in Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they learnt many interesting things in Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.6.4.

Table 4.7.6.4: Mathematics performance of learners relating to learning many interesting things in Mathematics



The solid line represents learners that owned a cell phone and the broken line those that did not own a cell phone.

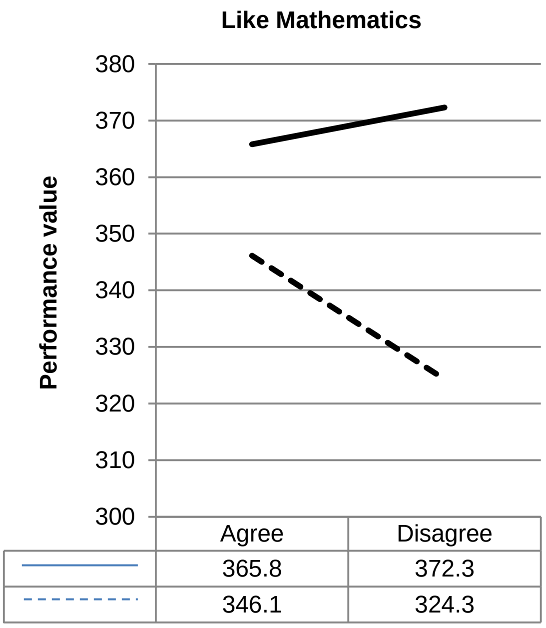
The achievement levels of the learners that owned cell phones and learnt many interesting things in Mathematics (n = 7549) (Mdn = 368.6) differ significantly from the learners that owned a cell phone and did not learn many interesting things in Mathematics (n = 1313) (Mdn = 359.6), Z = - 2.61, P < .000.

The achievement levels of the learners that did not own a cell phone and learnt many interesting things in Mathematics (n = 1675) (Mdn = 347.6) differ significantly from the learners that did not own a cell phone and claimed that they did not learn many interesting things in Mathematics (n = 301) (Mdn = 323.8), Z = - 5.54, P < .000.

4.7.6.5 I like Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they liked Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.6.5.

Table 4.7.6.5: Mathematics performance of learners relating to liking Mathematics



The solid line represents learners that owned a cell phone and the broken line those that did not own cell phone.

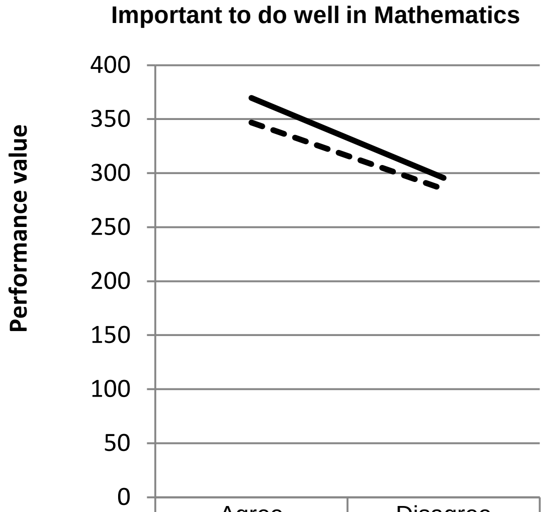
The achievement levels of the learners that owned a cell phone and liked Mathematics (n = 7361) (Mdn = 365.8) do not differ significantly from the learners that owned a cell phone and did not like Mathematics (n = 1556) (Mdn = 372.3), Z = -.600, P < .548.

The achievement levels of the learners that did not own a cell phone and liked Mathematics (n = 1697) (Mdn = 346.1) differ significantly from the learners that did not own a cell phone and did not like Mathematics (n = 301) (Mdn = 324.3), Z = -5.31, P < .000.

4.7.6.6 It is important to do well in Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that it is important to do well in Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.6.6.

Table 4.7.6.6: Mathematics performance of learners relating to the importance of doing well in Mathematics



	Agree	Disagree
——— (solid line)	369.8	295.6
- - - - (broken line)	347	285.1

The solid line represents learners that owned a cell phone and the broken line those that did not own a cell phone.

The achievement levels of the learners that owned a cell phone and realised the importance of doing well in Mathematics (n = 8629) (Mdn = 369.8) differ significantly from the learners that owned a cell phone and did not realise the importance of doing well in Mathematics (n = 441) (Mdn = 295.6), Z = - 18.03, P < .000.

The achievement levels of the learners that did not own a cell phone and realised the importance of doing well in Mathematics (n = 1886) (Mdn = 347.0) differ significantly from the learners that did not own a cell phone and did not realise the importance of doing well in Mathematics (n = 160) (Mdn = 285.1), Z = - 10.4, P < .000.

4.7.7 Mann-Whitney U results relating to the efficacy statements related to owning a dictionary

The efficacy statements related to owning a dictionary are shown in Figure 4.7.7.

Figure 4.7.7: Efficacy statements related to owning a dictionary

Efficacy statements (own cell phone)
I enjoy learning Mathematics
I wish I did not have to study Mathematics
Mathematics is boring
I learn many interesting things in Mathematics
I like Mathematics
It is important to do well in Mathematics

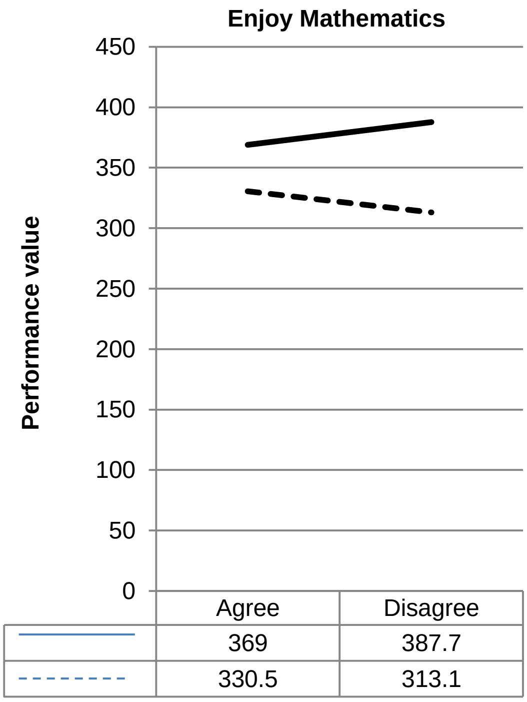
Mann-Whitney U

The Mann-Whitney U results relating to each efficacy statement are described in paragraph 4.7.7.1 – 4.7.7.6. (see Appendix F in the CD)

4.7.7.1 I enjoy learning Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they enjoyed learning Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.7.1.

Table 4.7.7.1: Mathematics performance of learners relating to enjoying learning Mathematics



The solid line represents learners that owned a dictionary and the broken line those that did not own dictionary at home.

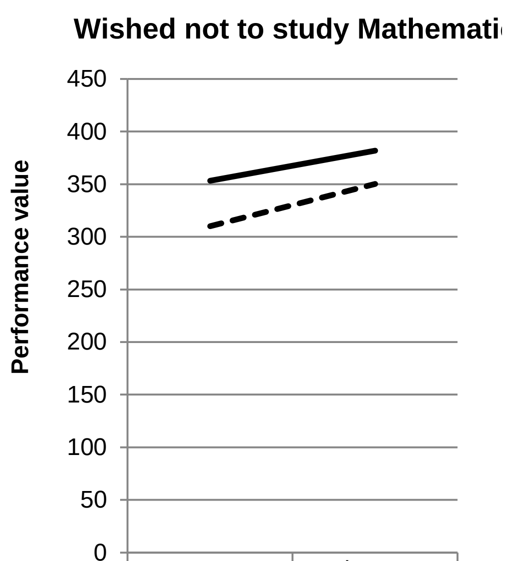
The achievement levels of the learners that owned a dictionary at home and enjoyed learning Mathematics (n = 7553) (Mdn = 369.0) differ significantly from the learners that had a dictionary and did not enjoy learning Mathematics (n = 1111) (Mdn = 387.7), Z = - 4.1, P < .000.

The achievement levels of the learners that did not own dictionary at home and enjoyed learning Mathematics (n = 2156) (Mdn = 330.5) differ significantly from the learners that did not own a dictionary at home and did not enjoy learning Mathematics (n = 351) (Mdn = 313.1), Z = - 4.0, P < .000.

4.7.7.2 I wish I did not have to study Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they wished they did not have to study Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.7.2.

Table 4.7.7.2: Mathematics performance of learners relating to wishing they did not have to study Mathematics



	Agree	Disagree
——— (solid)	353.3	382
- - - - (broken)	310.2	350.1

The solid line represents learners that owned a dictionary and the broken line those who did not own dictionary at home.

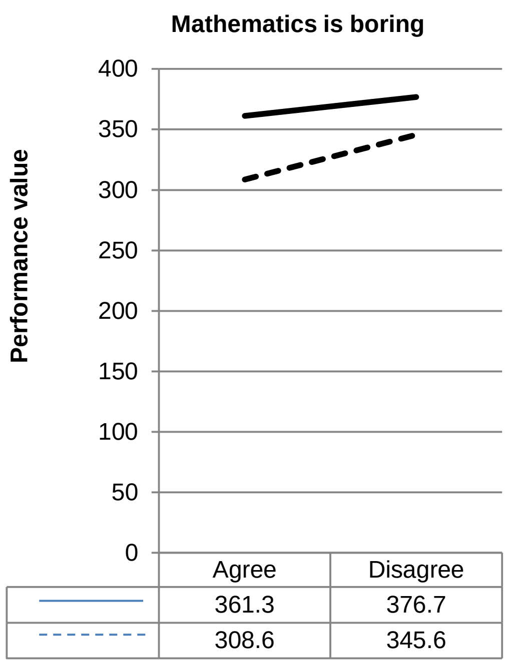
The achievement levels of the learners that owned dictionary at home and wished they did not have to study Mathematics (n = 3070) (Mdn = 353.3) differ significantly from the learners that owned dictionary at home and wished to study Mathematics (n = 5396) (Mdn = 382.0), Z = - 15.0, P < .000.

The achievement levels of the learners that did not own dictionary at home and wished they did not have to study Mathematics (n = 1042) (Mdn = 310.2) differ significantly from the learners that did not own a dictionary at home and wished to study Mathematics (n = 1333) (Mdn = 350.1), Z = - 13.3, P < .000.

4.7.7.3 Mathematics is boring

A graph indicating the trend in the Mathematics performance of the learners that agreed that Mathematics is boring as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.7.3.

Table 4.7.7.3: Mathematics performance of learners relating to Mathematics being boring



The solid line represents learners that owned a dictionary and the broken line those that did not own dictionary at home.

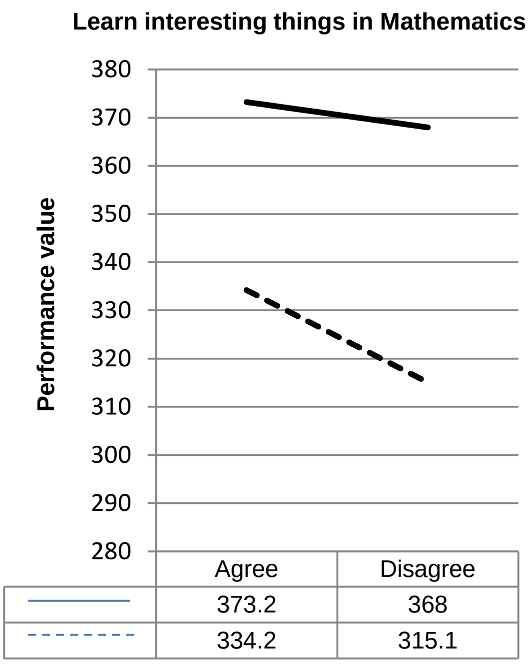
The achievement levels of the learners that owned dictionary at home and experienced Mathematics as boring (n = 2476) (Mdn = 361.3) differ significantly from the learners that owned dictionary at home and did not experience Mathematics as boring (n = 5848) (Mdn = 376.7), Z = - 7.3, P < .000.

The achievement levels of the learners that did not own dictionary at home and experienced Mathematics as boring (n = 803) (Mdn = 308.6) differ significantly from the learners that did not own dictionary at home and did not experience Mathematics as boring (n = 1496) (Mdn = 345.6), Z = - 11.2, P < .000.

4.7.7.4 I learn many interesting things in Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they learnt many interesting things in Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.67.4.

Table 4.7.7.4: Mathematics performance of learners relating to learning many interesting things in Mathematics



The solid line represents learners that owned a dictionary and the broken line those that did not own dictionary at home.

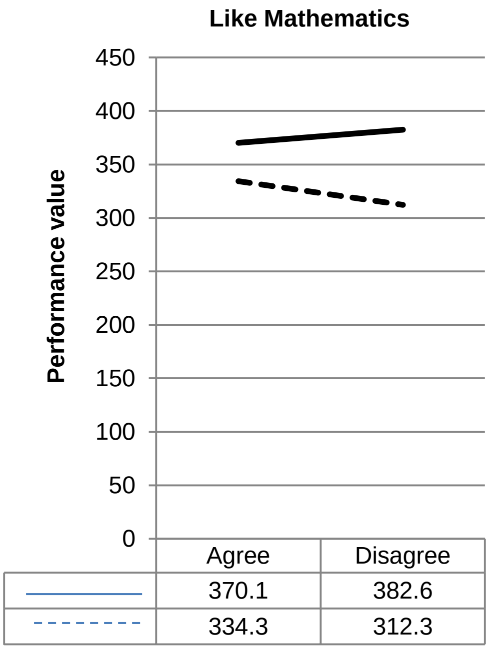
The achievement levels of the learners that owned a dictionary at home and learnt many interesting things in Mathematics (n = 7248) (Mdn = 373.2) do not differ significantly from the learners that owned dictionary at home and did not learn many interesting things in Mathematics (n = 1193) (Mdn = 368.0), Z = - 1.72, P < .085.

The achievement levels of the learners that did not own dictionary at home and learnt many interesting things in Mathematics (n = 1934) (Mdn = 334.2) differ significantly from the learners that did not own dictionary at home and did not learn many interesting things in Mathematics (n = 416) (Mdn = 315.1), Z = - 5.13, P < .000.

4.7.7.5 I like Mathematics

A graph indicating the trend in Mathematics performance of the learners that agreed that they liked Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.7.5.

Table 4.7.7.5: Mathematics performance of learners relating to liking Mathematics



The solid line represents learners that owned a dictionary and the broken line those that did not own a dictionary at home.

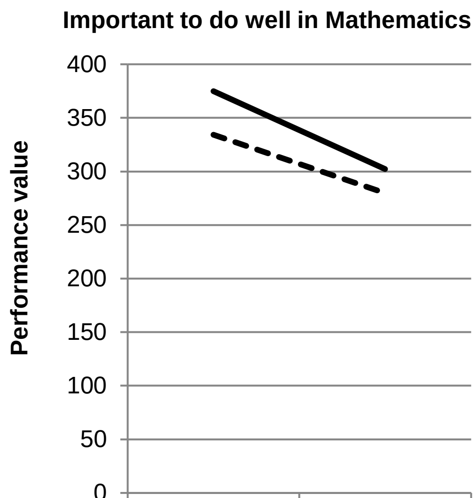
The achievement levels of the learners that owned a dictionary at home and liked Mathematics (n = 7060) (Mdn = 370.1) differ significantly from the learners that owned a dictionary at home and did not like Mathematics (n = 1402) (Mdn = 382.6), Z = - 2.42, P < .015.

The achievement levels of the learners that did not own a dictionary at home and liked Mathematics (n = 1954) (Mdn = 334.3), differ significantly from the learners that did not own a dictionary at home and did not like Mathematics (n = 441) (Mdn = 312.3), Z = - 6.02, P < .000.

4.7.7.6 It is important to do well in Mathematics

A graph indicating the trend in Mathematics performance of the learners that agreed that it is important to do well in Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.7.6.

Table 4.7.7.6: Mathematics performance of learners relating to the importance of doing well in Mathematics



	Agree	Disagree
———	374.8	302.1
- - - - -	334.2	279.7

The solid line represents learners that owned a dictionary and the broken line those that did not own a dictionary at home.

The achievement levels of the learners that owned a dictionary at home and realised the importance of doing well in Mathematics (n = 8244) (Mdn = 374.8) differ significantly from the learners that owned a dictionary at home and did not realise the importance of doing well in Mathematics (n = 361) (Mdn = 302.1), Z = - 16.1, P < .000.

The achievement levels of the learners that did not own a dictionary at home and realised the importance of doing well in Mathematics (n = 2228) (Mdn = 334.2) differ significantly from the learners that did not own a dictionary at home and did not realise the importance of doing well in Mathematics (n = 232) (Mdn = 279.7), Z = - 11.4, P < .000.

4.7.8 Mann-Whitney U results relating to the efficacy statements related to access to electricity

The efficacy statements related to access to electricity are shown in Figure 4.7.8

Figure 4.7.8: Efficacy statements relating to access to electricity

Efficacy statements (access to electricity)
I enjoy learning Mathematics
I wish I did not have to study Mathematics
Mathematics is boring
I learn many interesting things in Mathematics
I like Mathematics
It is important to do well in Mathematics

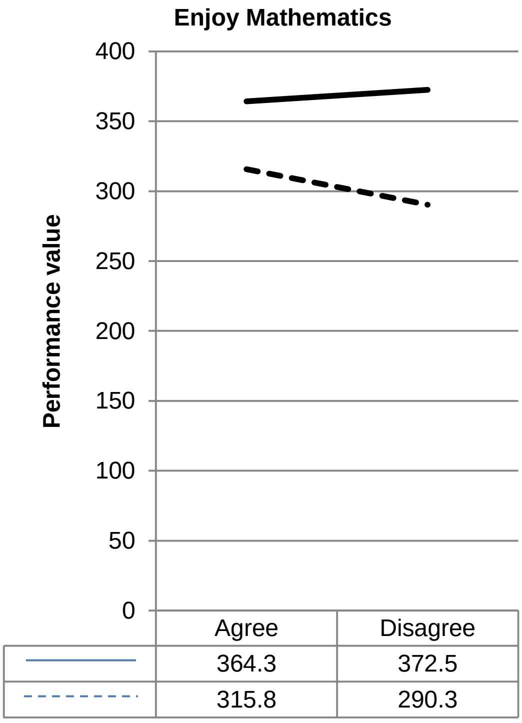
Mann-Whitney U

The Mann-Whitney U results relating to each efficacy statements are described in paragraph 4.7.8.1 – 4.7.8.6. (see Appendix F in the CD)

4.7.8.1 I enjoy learning Mathematics

A graph indicating the trend in Mathematics performance of the learners that agreed that they enjoyed learning Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.8.1.

Table 4.7.8.1: Mathematics performance of learners relating to enjoying learning Mathematics



The solid line represents learners that had access to electricity and the broken line those that did not have access to electricity at home.

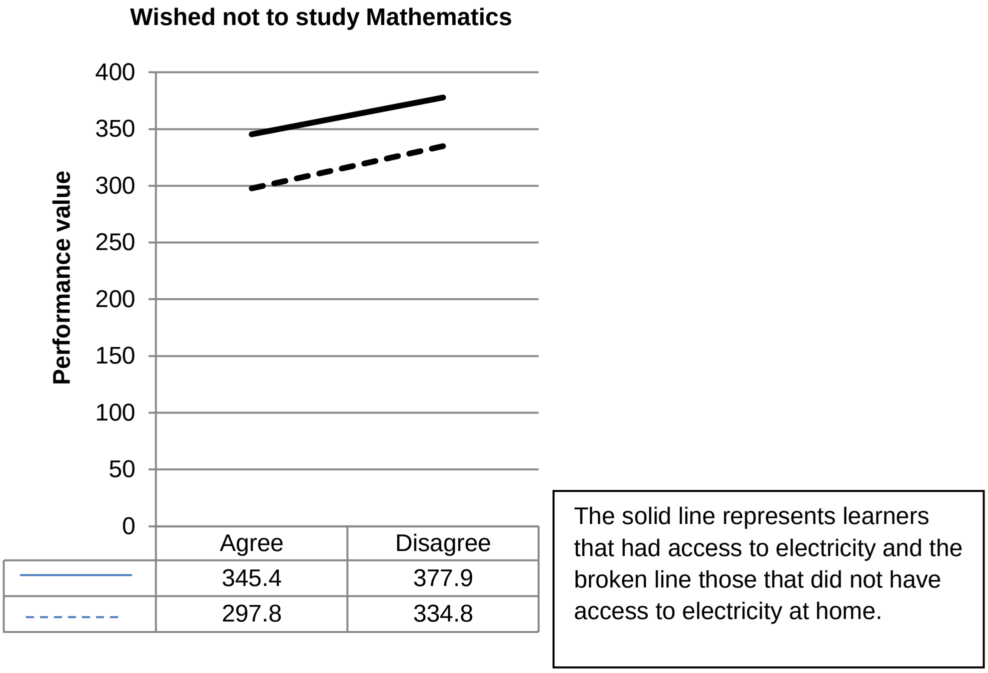
The achievement levels of the learners that had access to electricity at home and enjoyed learning Mathematics (n = 8870) (Mdn = 364.3) do not differ significantly from the learners that had access to electricity at home and did not enjoy learning Mathematics (n = 1342) (Mdn = 372.5), Z = - 3.0, P < .008.

The achievement levels of the learners that did not have access to electricity at home and enjoyed learning Mathematics (n = 876) (Mdn = 315.8) differ significantly from the learners that did not have access to electricity at home and did not enjoy learning Mathematics (n = 130) (Mdn = 290.3 Z = - 4.4, P < .000.

4.7.8.1 I wish I did not have to study Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they wished they did not have to study Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.8.1.

Table 4.7.8.1: Mathematics performance of learners relating to wishing they did not have to study Mathematics



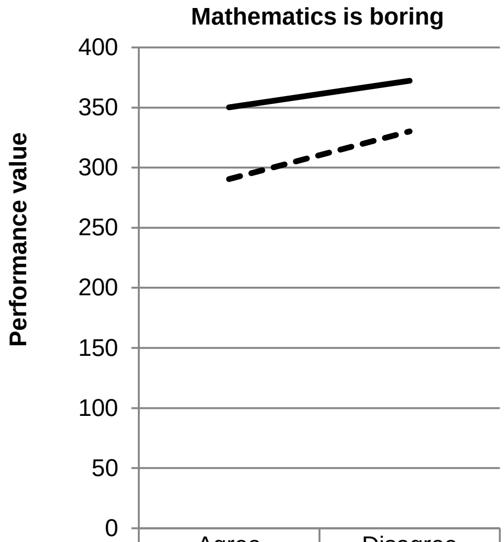
The achievement levels of the learners that had access to electricity at home and wished they did not have to study Mathematics (n = 3687) (Mdn = 345.4) differ significantly from the learners that had access to electricity at home and wished to study Mathematics (n = 6272) (Mdn = 377.9), Z = - 18.13, P < .000.

The achievement levels of the learners that did not have access to electricity at home and wished they did not have to study Mathematics (n = 455) (Mdn = 297.8) differ significantly from the learners that did not have access to electricity at home and wished to study Mathematics (n = 477) (Mdn = 334.8), Z = - 7.61, P < .000.

4.7.8.3 Mathematics is boring

A graph indicating the trend in the Mathematics performance of the learners that agreed that Mathematics is boring as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.8.3.

Table 4.7.8.3: Mathematics performance of learners relating to Mathematics being boring



	Agree	Disagree
——— (solid line)	350.3	372.3
- - - - (broken line)	290.4	330.1

The solid line represents learners that had access to electricity and the broken line those that did not have access to electricity at home.

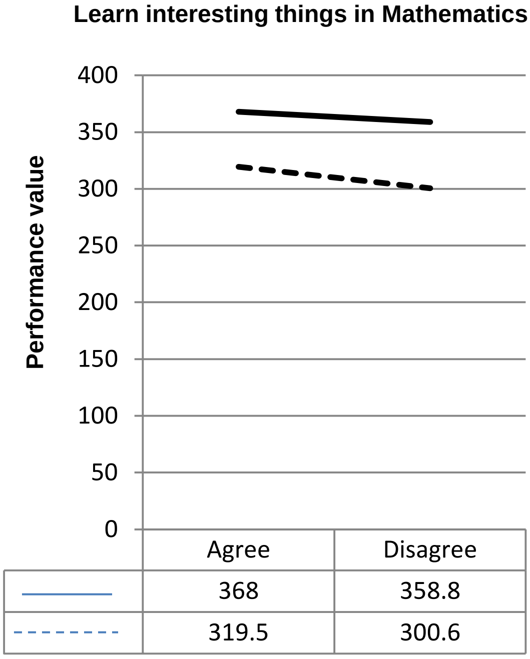
The achievement levels of the learners that had access to electricity at home and experienced Mathematics as boring (n = 2990) (Mdn = 350.3) differ significantly from the learners that had access to electricity at home and did not experience Mathematics as boring (n = 6777) (Mdn = 372.3), Z = - 10.4, P < .000.

The achievement levels of the learners that did not have access to electricity at home and experienced Mathematics as boring (n = 302) (Mdn = 290.4) differ significantly from the learners that did not have access to electricity at home and did not experience Mathematics as boring (n = 590) (Mdn = 330.1), Z = - 8.5, P < .000.

4.7.8.4 I learn many interesting things in Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they learnt many interesting things in Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.8.4.

Table 4.7.8.4: Mathematics performance of learners relating to learning many interesting things in Mathematics



The solid line represents learners that had access to electricity and the broken line those that did not have access to electricity at home.

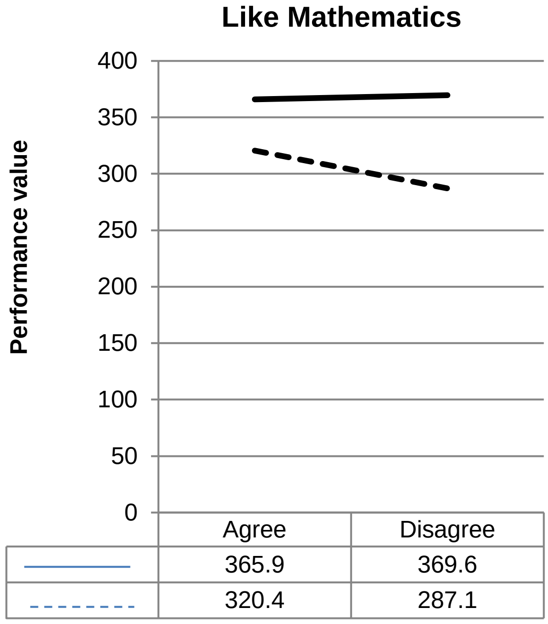
The achievement levels of the learners that had access to electricity at home and learnt many interesting things in Mathematics (n = 8493) (Mdn = 368.0) differ significantly from the learners that had access to electricity at home and did not learn many interesting things in Mathematics (n = 1440) (Mdn = 358.8), Z = -3.12, P < .002.

The achievement levels of the learners that did not have access to electricity at home and learnt many interesting things in Mathematics (n = 724) (Mdn = 319.5) differ significantly from the learners that did not have access to electricity at home and did not learn many interesting things in Mathematics (n = 179) (Mdn = 300.6), Z = - 4.0, P < .000.

4.7.8.5 I like Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they liked Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.8.5.

Table 4.7.8.5: Mathematics performance of learners relating to liking Mathematics



The solid line represents learners that had access to electricity and the broken line those that did not have access to electricity at home.

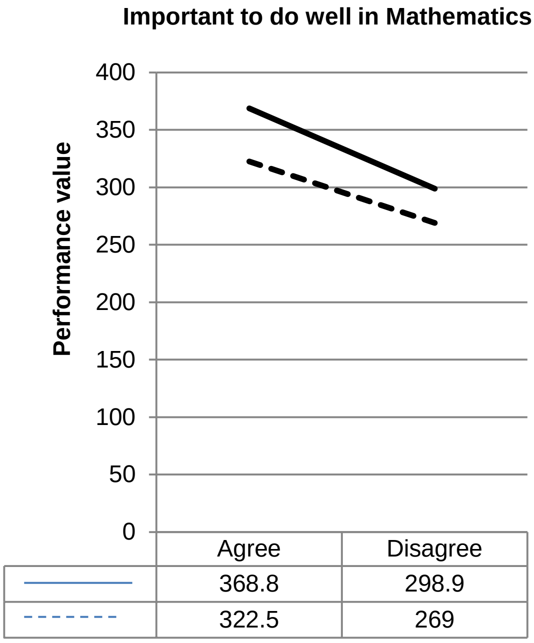
The achievement levels of the learners that had access to electricity at home and liked Mathematics (n = 8271) (Mdn = 365.9) do not differ significantly from the learners that had access to electricity at home and did not like Mathematics (n = 1700) (Mdn = 369.6), Z = - .280, P < .779.

The achievement levels of the learners that did not have access to electricity at home and liked Mathematics (n = 782) (Mdn = 320.4) differ significantly from the learners that did not have access to electricity at home and did not like Mathematics (n = 157) (Mdn = 287.1), Z = - 5.22, P < .000.

4.7.8.6 It is important to do well in Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that it is important to do well in Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.8.6.

Table 4.7.8.6: Mathematics performance of learners relating to the importance of doing well in Mathematics



The solid line represents learners that had access to electricity and the broken line those that did not have access to electricity at home.

The achievement levels of the learners that had access to electricity at home and realised the importance of doing well in Mathematics (n = 9668) (Mdn = 368.8) differ significantly from the learners that had access to electricity at home and did not realise the importance of doing well in Mathematics (n = 469) (Mdn = 298.9), Z = - 17.83, P < .000.

The achievement levels of the learners that did not have access to electricity at home and realised the importance of doing well in Mathematics (n = 837) (Mdn = 322.5) differ significantly from the learners that did not have access to electricity at home and did not realise the importance of doing well in Mathematics (n = 139) (Mdn = 269.0), Z = - 9.0, P < .000.

4.7.9 Mann-Whitney U results relating to the efficacy statements related to having access to running tap water

The efficacy statements related to having access to running tap water are shown in Figure 4.7.9.

Figure 4.7.9: Efficacy statements related to having access to running tap water

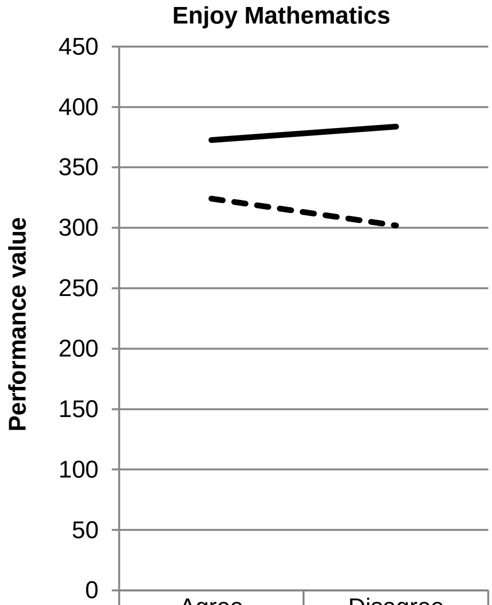
Efficacy statements (access to running tap water)	
I enjoy learning Mathematics	**Mann-Whitney U**
I wish I did not have to study Mathematics	
Mathematics is boring	
I learn many interesting things in Mathematics	
I like Mathematics	
It is important to do well in Mathematics	

The Mann-Whitney U results relating to each efficacy statement are described in paragraph 4.7.9.1 – 4.7.9.6. (see Appendix F in the CD)

4.7.9.1 I enjoy learning Mathematics

A graph indicating the trend in Mathematics performance of the learners that agreed that they enjoyed learning Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.9.1.

Table 4.7.9.1: Mathematics performance of learners relating to enjoying learning Mathematics



	Agree	Disagree
—— (solid)	372.5	383.7
- - - - (broken)	324.2	302

The solid line represents learners that had access to running tap water and the broken line those that did not have access to running tap water at home.

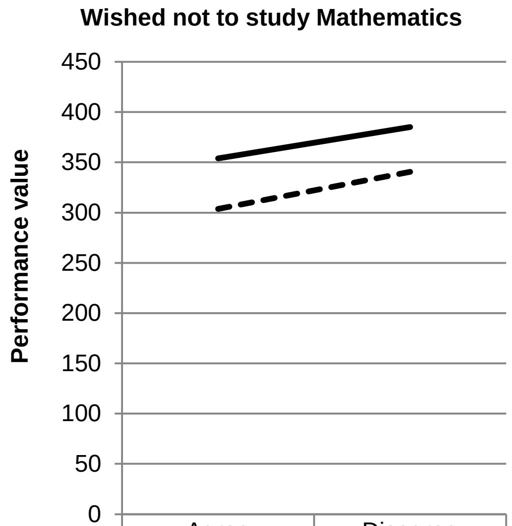
The achievement levels of the learners that had access to running tap water at home and enjoyed learning Mathematics (n = 7476) (Mdn = 372.5) differ significantly from the learners that had access to running tap water at home and did not enjoy learning Mathematics (n = 1206) (Mdn = 383.7), Z = - 2.52, P < .011.

The achievement levels of the learners that did not have access to running tap water at home and enjoyed learning Mathematics (n = 2228) (Mdn = 324.2) differ significantly from the learners that did not have access to running tap water at home and did not enjoy learning Mathematics (n = 255) (Mdn = 302.0), Z = - 5.20, P < .000.

4.7.9.2 I wish I did not have to study Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they wished they did not have to study Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.9.2.

Table 4.7.9.2: Mathematics performance of learners relating to wishing they did not have to study Mathematics



	Agree	Disagree
——— (solid)	353.9	385
- - - - (broken)	303.7	340.7

The solid line represents learners that had access to running tap water and the broken line those that did not have access to running tap water at home.

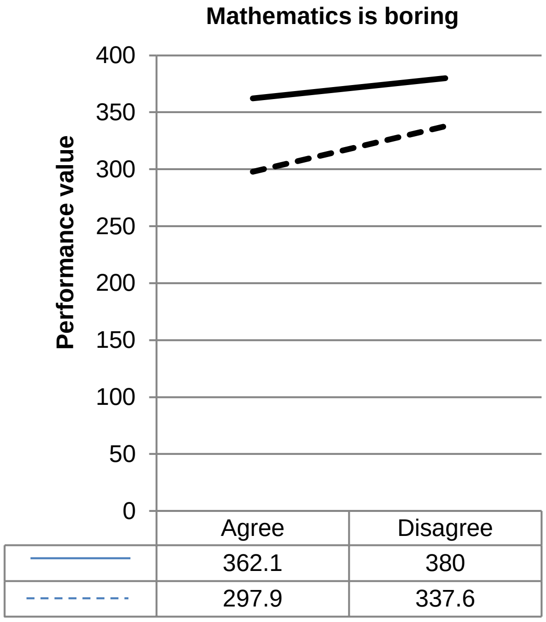
The achievement levels of the learners that had access to running tap water at home and wished they did not have to study Mathematics (n = 3133) (Mdn = 353.9) differ significantly from the learners that had access to running tap water at home and wished to study Mathematics (n = 5374) (Mdn = 385.0), Z = - 15.8, P < .000.

The achievement levels of the learners that did not have access to running tap water at home and wished they did not have to study Mathematics (n = 980) (Mdn = 303.7) differ significantly from the learners that did not have access to running tap water at home and wished to study Mathematics 1357) (Mdn = 340.7), Z = - 13.3, P < .000.

4.7.9.3 Mathematics is boring

A graph indicating the trend in the Mathematics performance of the learners that agreed that Mathematics is boring as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.3.

Table 4.7.9.3: Mathematics performance of learners relating to Mathematics being boring



The solid line represents learners that had access to running tap water and the broken line those that did not have access to running tap water at home.

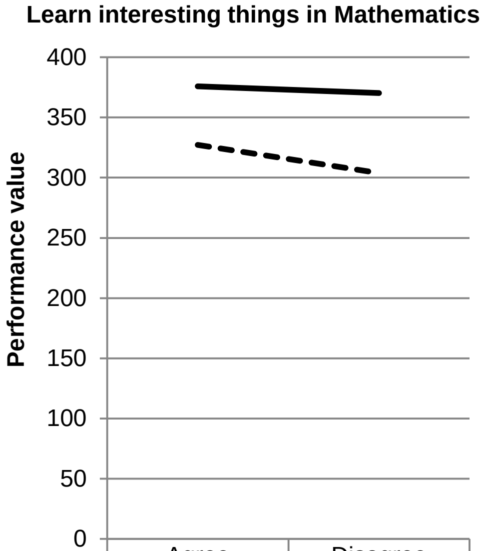
The achievement levels of the learners that had access to running tap water at home and experienced Mathematics as boring (n = 2582) (Mdn = 362.1) differ significantly from the learners that had access to running tap water at home and did not experience Mathematics as boring (n = 5756) (Mdn = 380.0), Z = - 8.31, P < .000.

The achievement levels of the learners that did not have access to running tap water at home and experienced Mathematics as boring (n = 699) (Mdn = 297.9) differ significantly from the learners that did not have access to running tap water at home and did not experience Mathematics as boring (n = 1584) (Mdn = 337.6), Z = - 12.63, P < .000.

4.7.9.4 I learn many interesting things in Mathematics

A graph indicating the trend in Mathematics performance of the learners that agreed that they learnt many interesting things in Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.9.4.

Table 4.7.9.4: Mathematics performance of learners relating to learning many interesting things in Mathematics



	Agree	Disagree
——— (solid)	375.9	370.4
- - - - (broken)	327.3	303.9

The solid line represents learners that had access to running tap water and the broken line those that did not have access to running tap water at home.

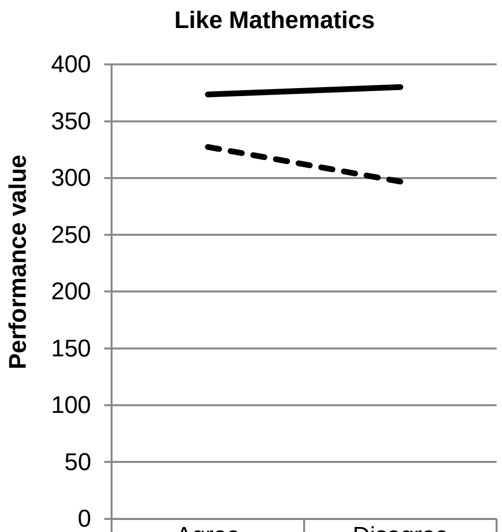
The achievement levels of the learners that had access to running tap water at home and learnt many interesting things in Mathematics (n = 7223) (Mdn = 375.9) do not differ significantly from the learners that had access to running tap water at home and did not learn many interesting things in Mathematics (n = 1243) (Mdn = 370.4), Z = - 1.7, P < .093.

The achievement levels of the learners that did not have access to running tap water at home and learnt many interesting things in Mathematics (n = 1967) (Mdn = 327.3) differ significantly from the learners that did not have access to running tap water at home and did not learn many interesting things in Mathematics (n = 357) (Mdn = 303.9), Z = - 6.33, P < .000.

4.7.9.5 I like Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they liked Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.9.5.

Table 4.7.9.5: **Mathematics performance of learners relating to liking Mathematics**



	Agree	Disagree
———	373.7	380.1
- - - - - - - -	327.3	297

The solid line represents learners that had access to running tap water and the broken line to those that did not have access to running tap water at home.

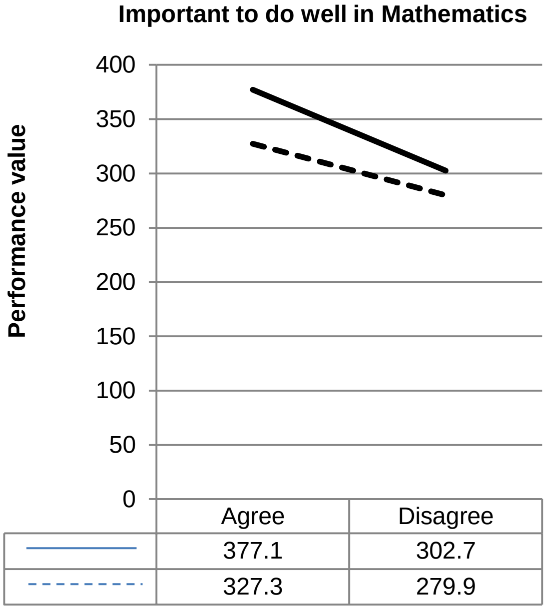
The achievement levels of the learners that had access to running tap water at home and liked Mathematics (n = 6970) (Mdn = 373.7)do not differ significantly from the learners that had access to running tap water at home and did not like Mathematics (n = 1516) (Mdn = 380.1), Z = - .739, P < .460.

The achievement levels of the learners that did not have access to running tap water at home and liked Mathematics (n = 2049) (Mdn = 297.0) differ significantly from the learners that did not have access to running tap water at home and did not like Mathematics (n = 327) (Mdn = 297.0), Z = - 8.0, P < .000.

4.7.9.6 It is important to do well in Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that it is important to do well in Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.9.6.

Table 4.7.9.6: Mathematics performance of learners relating to the importance of doing well in Mathematics



The solid line represents learners that had access to running tap water and the broken line those that did not have access to running tap water at home.

The achievement levels of the learners that had access to running tap water at home and realised the importance of doing well in Mathematics (n = 8270) (Mdn = 377.1) differ significantly from the learners that had access to running tap water at home and did not realise the importance of doing well in Mathematics (n = 361) (Mdn = 302.7), Z = - 15.72, P < .000.

The achievement levels of the learners that did not have access to running tap water at home and realised the importance of doing well in Mathematics (n = 2206) (Mdn = 327.3) differ significantly from the learners that did not have access to running tap water at home and did not realise the importance of doing well in Mathematics (n = 229) (Mdn = 279.9), Z = - 11.08, P < .000.

4.7.10 Mann-Whitney U results relating to the efficacy statements related to having access to television

The efficacy statements related to having access to television are shown in Figure 4.7.10

Figure 4.7.10: Efficacy statements relating to having access to television

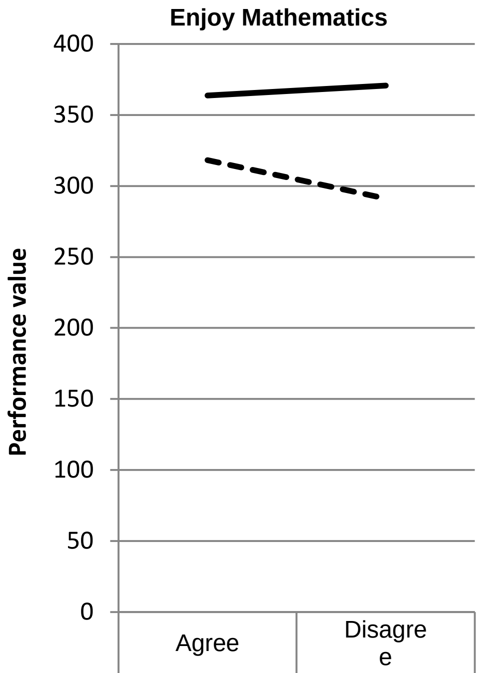
Efficacy statements (access to television)	
I enjoy learning Mathematics	**Mann-Whitney U**
I wish I did not have to study Mathematics	
Mathematics is boring	
I learn many interesting things in Mathematics	
I like Mathematics	
It is important to do well in Mathematics	

The Mann-Whitney U results relating to each efficacy statement is described in paragraph 4.7.10.1 – 4.7.10.6. (see Appendix F in the CD)

4.7.10.1 I enjoy learning Mathematics

A graph indicating the trend in Mathematics performance of the learners that agreed that they enjoyed learning Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.10.1.

Table 4.7.10.1: Mathematics performance of learners relating to enjoying learning Mathematics



	Agree	Disagree
——— (solid line)	363.7	370.8
- - - - - - - - (broken line)	318.2	291.1

The solid line represents learners who had access to television and the broken line to those that did not have television at home.

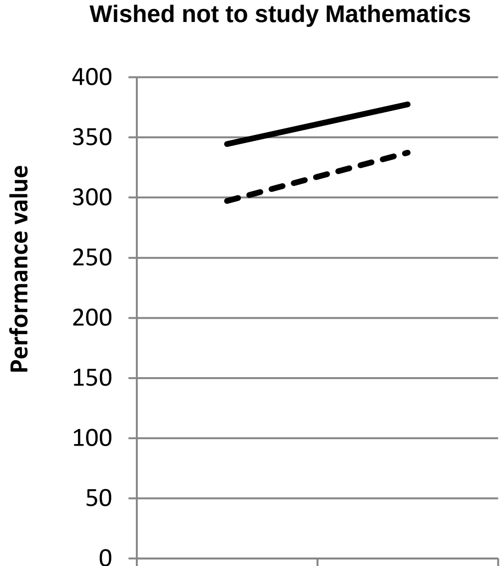
The achievement levels of the learners that had television at home and enjoyed learning Mathematics (n = 8945) (Mdn = 363.7) differ significantly from the learners that had television at home and did not enjoy learning Mathematics (n = 1364) (Mdn = 370.8), Z = - 2.1, P < .040.

The achievement levels of the learners that did not have television and enjoyed learning Mathematics (n = 811) (Mdn = 318.2) differ significantly from the learners that did not have television and did not enjoy learning Mathematics (n = 109) (Mdn = 291.1), Z = - 3.5, P < .001.

4.7.10.2 I wish I did not have to study Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they wished they did not have to study mathematic as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.10.2.

Table 4.7.10.2: Mathematics performance of learners relating to wishing they did not have to study Mathematics



	Agree	Disagree
——— (solid)	344.6	377.6
- - - - - - - (broken)	297.1	337.2

The solid line represents learners that had access to television and the broken line those that did not have television at home.

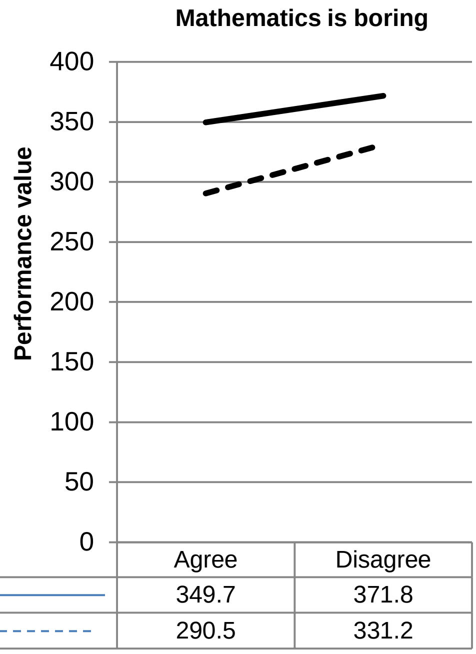
The achievement levels of the learners that had television at home and wished they did not have to study Mathematics (n = 3746) (Mdn = 344.6) differ significantly from the learners that had television at home and wished to study Mathematics (n = 6305) (Mdn = 377.6), Z = - 18.44, P < .000.

The achievement levels of the learners that did not have television and wished they did not have to study Mathematics (n = 387) (Mdn = 297.1) differ significantly from the learners that did not have television and wished to study Mathematics (n = 459) (Mdn = 337.2), Z = - 7.82, P < .000.

4.7.10.3 Mathematics is boring

A graph indicating the trend in the Mathematics performance of the learners that agreed that Mathematics is boring as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.10.3.

Table 4.7.10.3: Mathematics performance of learners relating to Mathematics being boring



The solid line represents learners that had access to television and the broken line those that did not have television at home.

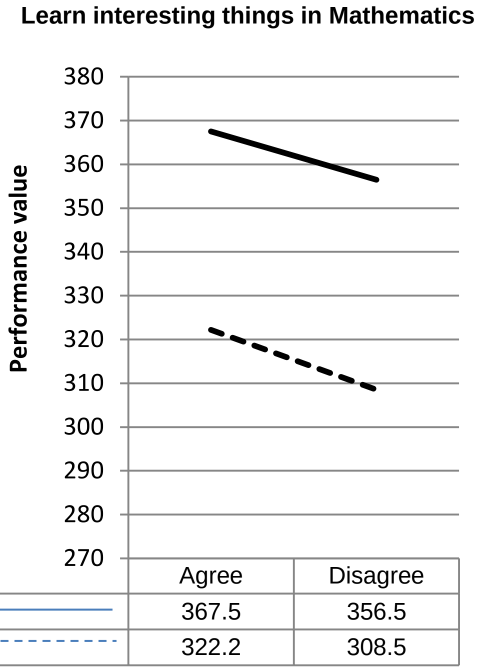
The achievement levels of the learners that had television at home and experienced Mathematics as boring (n = 3034) (Mdn = 349.7) differ significantly from the learners that had television at home and did not experience that Mathematics as boring (n = 6829) (Mdn = 371.8), Z = - 11.0, P < .000.

The achievement levels of the learners that did not have television and experienced Mathematics as boring (n = 264) (Mdn = 290.5) differ significantly from the learners that did not have television and did not experience Mathematics as boring (n = 543) (Mdn = 331.2), Z = - 8.0, P < .000.

4.7.10.4 I learn many interesting things in Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they learnt many interesting things in Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.10.

Table 4.7.10.4: Mathematics performance of learners relating to learning many interesting things in Mathematics



The solid line represents learners that had access to television and the broken line those that did not have television at home.

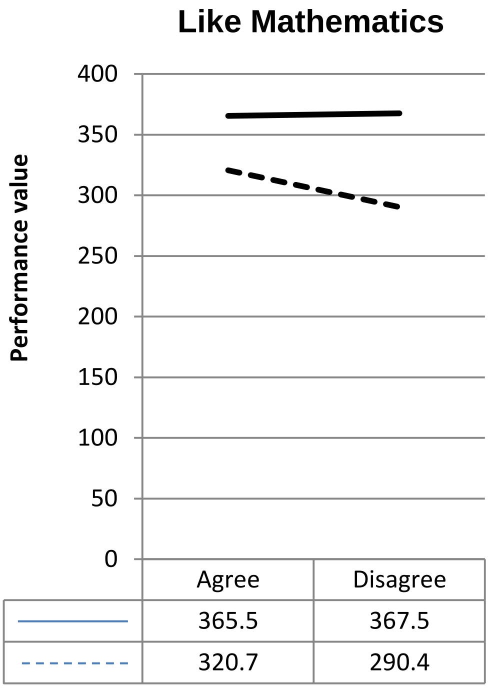
The achievement levels of the learners that had television at home and learnt many interesting things in Mathematics (n = 8565) (Mdn = 367.5) differ significantly from the learners that had television at home and did not learn many interesting things in Mathematics (n = 1465) (Mdn = 356.5), Z = - 3.52, P < .000.

The achievement levels of the learners that did not have television and learnt many interesting things in Mathematics (n = 658) (Mdn = 322.2) differ significantly from the learners that did not have television and did not learn many interesting things in Mathematics (n = 154) (Mdn = 308.5), Z = - 3.41, P < .001.

4.7.10.5 I like Mathematics

A graph indicating the trend in Mathematics performance of the learners that agreed that they liked Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.110.5.

Table 4.7.10.5: Mathematics performance of learners relating to liking Mathematics



The solid line represents learners that had access to television and the broken line those that did not have television at home.

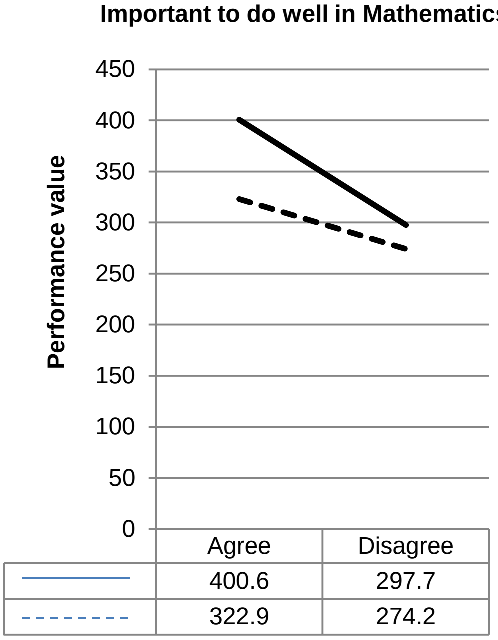
The achievement levels of the learners that had television at home and liked Mathematics (n = 8347) (Mdn = 365.5) do not differ significantly from the learners that had television at home and did not like Mathematics (n = 1719) (Mdn = 367.5), Z = -.62, P < .930.

The achievement levels of the learners that did not have television and liked Mathematics (n = 717) (Mdn = 320.7) differ significantly from the learners that did not have television and did not like Mathematics (n = 136) (Mdn = 290.4), Z = -4.29, P < .000.

4.7.10.6 It is important to do well in Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that it is important to do well in Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.10.6.

Table 4.7.10.6: Mathematics performance of learners relating to the importance of doing well in Mathematics



The solid line represents learners that had access to television and the broken line those that did not have television at home.

The achievement levels of the learners that had television at home and realised the importance of doing well in Mathematics (n = 9741) (Mdn = 400.6) differ significantly from the learners that had television at home and did not realise the importance of doing well in Mathematics (n = 491) (Mdn = 297.7), Z = - 19.11, P < .000.

The achievement levels of the learners that did not have television and realised the importance of doing well in Mathematics (n = 767) (Mdn = 322.9) differ significantly from the learners that did not have television and did not realise the importance of doing well in Mathematics (n = 121) (Mdn = 274.2), Z = - 7.24, P < .000.

4.7.11 Mann-Whitney U results relating to the efficacy statements related to having access to a video player

The efficacy statements relating to having access to a video player are shown in Figure 4.7.11

Figure 4.7.11: Efficacy statements relating to having access to a video player

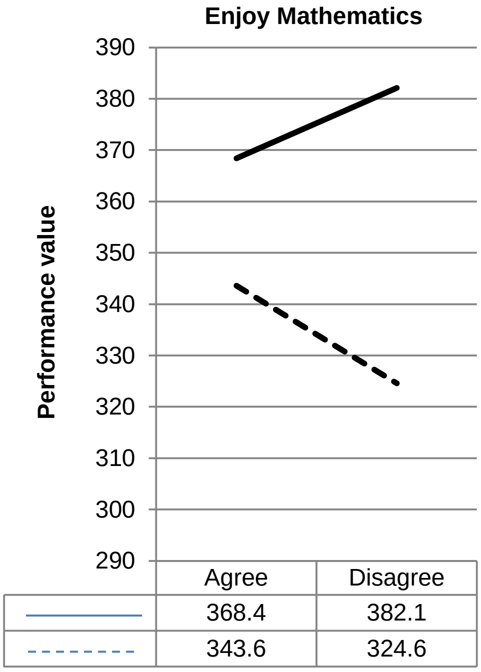
Efficacy statements (video player)	
I enjoy learning Mathematics	**Mann-Whitney U**
I wish I did not have to study Mathematics	
Mathematics is boring	
I learn many interesting things in Mathematics	
I like Mathematics	
It is important to do well in Mathematics	

The Mann-Whitney U results relating to each efficacy statement is described in paragraph 4.7.11.1 – 4.7.11.6. (see Appendix F in the CD)

4.7.11.1 I enjoy learning Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they enjoyed learning Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.11.1.

Table 4.7.11.1: Mathematics performance of learners relating to enjoying learning Mathematics



The solid line represents learners that had access to a video player and the broken line those that did not have access to a video player at home.

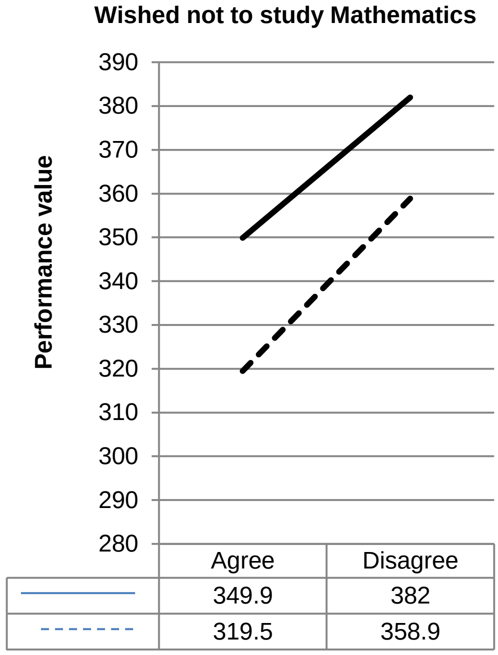
The achievement levels of the learners that had a video player at home and enjoyed learning Mathematics (n = 6774) (Mdn = 368.4) differ significantly from the learners that had a video player at home and did not enjoy learning Mathematics (n = 1092) (Mdn = 382.1), Z = - 2.92, P < .003.

The achievement levels of the learners that did not have a video player at home and enjoyed learning Mathematics (n = 2954) (Mdn = 343.6) differ significantly from the learners that did not have a video player at home and did not enjoy learning Mathematics (n = 374) (Mdn = 324.6), Z = - 4.00, P < .000.

4.7.11.2 I wish I did not have to study Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they wished they did not have to study Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.11.

Table 4.7.11.2: Mathematics performance of learners relating to wishing they did not have to study Mathematics



The solid line represents learners that had access to a video player and the broken line those that did not have access to a video player at home.

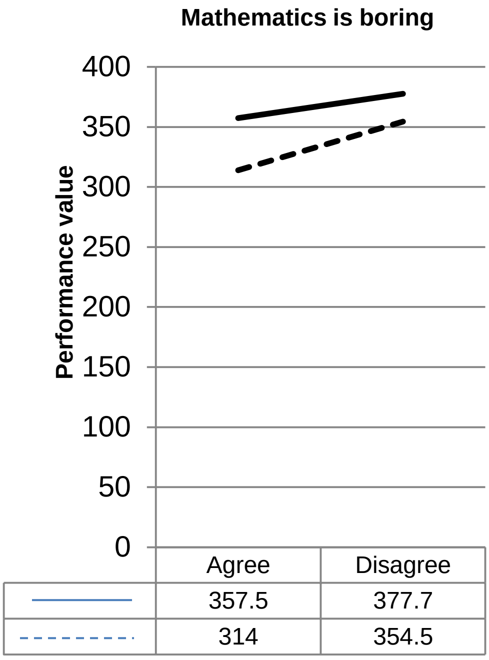
The achievement levels of the learners that had a video player at home and wished they did not have to study Mathematics (n = 2912) (Mdn = 390.9) differ significantly from the learners that had a video player at home and wished to study Mathematics (n = 4777) (Mdn = 382.0), Z = - 15.41, P < .000.

The achievement levels of the learners that did not have a video player at home and wished they did not have to study Mathematics (n = 1216) (Mdn = 319.5) differ significantly from the learners that did not have a video player at home and wished to study Mathematics (n = 1962) (Mdn = 358.9), Z = - 14.82, P < .000.

4.7.11.3 Mathematics is boring

A graph indicating the trend in the Mathematics performance of the learners that agreed that Mathematics is boring as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.11.3.

Table 4.7.11.3: Mathematics performance of learners relating to that Mathematics being boring



The solid line represents learners that had access to a video player and the broken line those that did not have a video player at home.

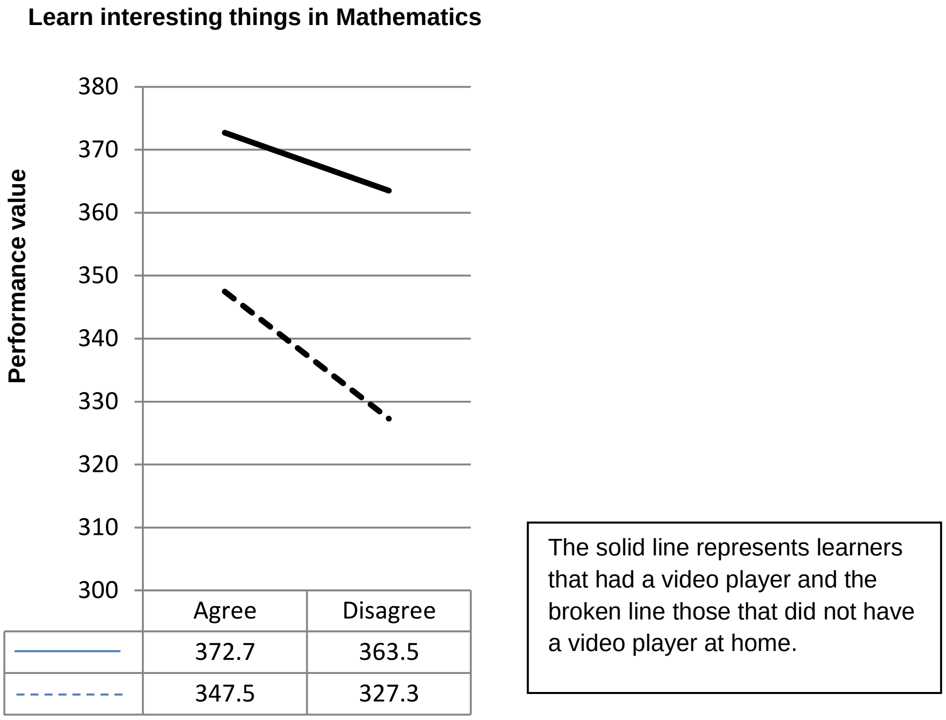
The achievement levels of the learners that had a video player at home and experienced Mathematics as boring (n = 2417) (Mdn = 357.5) differ significantly from the learners that had a video player at home and experienced that Mathematics as not boring (n = 5120) (Mdn = 377.7), Z = - 8.11, P < .000.

The achievement levels of the learners that did not have a video player at home and experienced Mathematics as boring (n = 864) (Mdn = 314.0) differ significantly from the learners that did not have a video player at home and did not experience Mathematics as boring (n = 2234) (Mdn = 354.5), Z = - 12.74, P < .000.

4.7.11.4 I learn many interesting things in Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they learnt many interesting things in Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.11.4.

Table 4.7.11.4: Mathematics performance of learners relating to learning many interesting things in Mathematics



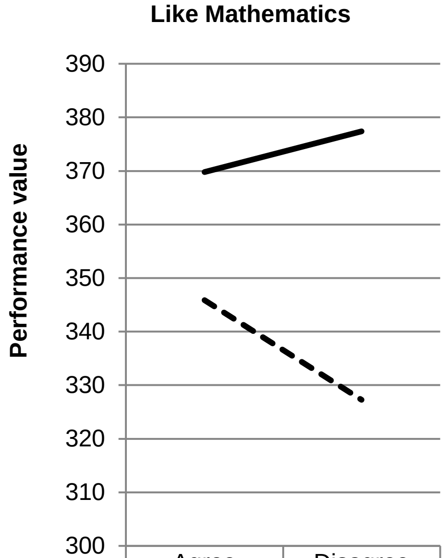
The achievement levels of the learners that had a video player at home and learnt many interesting things in Mathematics (n = 6516) (Mdn = 372.7) differ significantly from the learners that had a video player at home and did not learn many interesting things in Mathematics (n = 1147) (Mdn = 363.5), Z = - 2.80, P < .005.

The achievement levels of the learners that did not have a video player at home and learnt many interesting things in Mathematics (n = 2679) (Mdn = 347.5) differ significantly from the learners that did not have a video player at home and did not learn many interesting things in Mathematics (n = 464) (Mdn = 327.3), Z = - 5.0, P < .000.

4.7.11.5 I like Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that they liked Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.11.5.

Table 4.7.11.5: Mathematics performance of learners relating to liking Mathematics



	Agree	Disagree
———— (solid line)	369.8	377.4
- - - - - (broken line)	345.9	327.3

The solid line represents learners that had a video player and the broken line those that did not have a video player at home.

The achievement levels of the learners that had a video player at home and liked Mathematics (n = 6322) (Mdn = 369.8) do not differ significantly from the learners that had a video player at home and did not like Mathematics (n = 1370) (Mdn = 377.4), Z = - .619, P < .536.

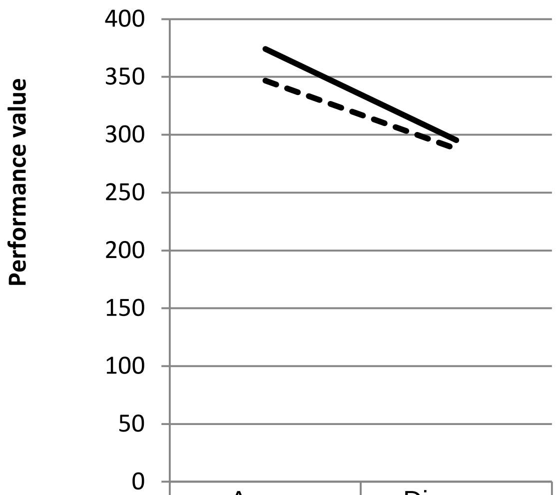
The achievement levels of the learners that did not have a video player at home and liked Mathematics (n = 2714) (Mdn = 345.9) differ significantly from the learners that did not have a video player at home and did not like Mathematics (n = 476) (Mdn = 327.3), Z = - 4.3, P < .000.

4.7.11.6 It is important to do well in Mathematics

A graph indicating the trend in the Mathematics performance of the learners that agreed that it is important to do well in Mathematics as well as the Mathematics performance of learners that disagreed is provided in Table 4.7.11.6.

Table 4.7.11.6: Mathematics performance of learners relating to the importance of doing well in Mathematics

Important to do well in Mathematics



	Agree	Disagree
——— (solid line)	374.2	295.2
- - - - - - - - (broken line)	346.8	287.8

The solid line represents learners that had a video player and the broken line those that did not have a video player at home.

The achievement levels of the learners that had a video player at home and realised the importance of doing well in Mathematics (n = 7441) (Mdn = 374.2) differ significantly from the learners that had a video player at home and did not realise the importance of doing well in Mathematics (n = 369) (Mdn = 295.2), Z = - 17.3, P < .000.

The achievement levels of the learners that did not have a video player at home and realised the importance of doing well in Mathematics (n = 3047) (Mdn = 346.8) differ significantly from the learners that did not have a video player at home and did not realise the importance of doing well in Mathematics (n = 231) (Mdn = 287.8), Z = - 11.4, P < .000.

Chapter 5

Discussion, Implication, Recommendations and Conclusions

5.1 Introduction

TIMSS summarises the Mathematics achievement of learners and provides an international assessment of countries compared to other countries; however, the comparison does not take into consideration the various different educational systems and the factors responsible for the variations in achievement.

Many countries, including South Africa that participated in TIMSS and that were examined in this study differ in with respect to their social and educational, cultural, historical and demographic contexts. These differences may affect the experiment of mathematics achievement among learners in each context.

This chapter discusses the conceptual framework developed and the methodology used. It also outlines how this research may contribute to the body of knowledge. Thereafter, recommendations for South African Mathematics education and TIMSS are made and finally conclusions are drawn.

5.2 Discussion

The purpose of this study was to explore the relationship between Mathematics performance and the self-efficacy beliefs of Grade 9 Mathematics learners that participated in TIMSS 2011. A theoretical framework was adapted to examine the extent to which learners' gender, language, ownership of books and learners' home resources were related to TIMSS 2011 Grade 9 Mathematics scores in South Africa.

5.2.1 Reflection on the methodology used

This study is a secondary analysis that used a large data set collected by IEA for TIMSS 2011. The researcher therefore saved time and even costs for the data collection process. The focus of the research was on data analysis. However, there were disadvantages in using secondary data analysis.

The primary limitation was that the researcher could not include everything that was necessary in the project since the data had already been collected. There were some significant factors worthy of exploration in the literature that were not explored because the TIMSS data could not support such research, especially as TIMSS collected data in various sections.

The amount of missing data from South Africa's participation due to sampling procedures, the assessment design where learners used only one test booklet or a subset of the entire test items and non-responses from participants, could affect the accuracy of the study results, especially when the missing data mechanism in each country was found not completely at random. It is important for future TIMSS studies that the design of these items and also the administration of the survey should be revisited in order to maximise participants' responses.

The construct of home resources in this study was initially conceptualised to include eleven indicators: the availability of a computer, study desk, ownership of books, having an own room, Internet connection, owning a cell phone, dictionary, access to electricity, running tap water, television and video player to use at home.

The results of this study are based on the relationship between learners' Mathematics performance and self-efficacy and background factors that were self-reported by learners. According to Rosenberg, Greenfield and Dimick (2006) self-reported data has several potential sources of bias, such as selective memory, telescoping and social desirability, which report behaviours that tend to be widely accepted by certain social groups rather than the behaviour actually exhibited by the respondents. So it is important to interpret the findings of this study with these limitations in mind.

5.3 Implication

Even though there were limitations, this study contributes to the field of educational research by investigating the relationship between self-efficacy beliefs and Mathematics performance in South Africa. The results of this study could be elucidating to national leaders, policy-makers and educators in South Africa, because the relationship was carefully examined by looking at learners' background and home resources. The results could be used to help evaluate and improve the effectiveness of the current Mathematics educational system.

Findings from this study provide evidence to support the view that positive self-efficacy beliefs in Mathematics increase Mathematics performance. Following the description of the research design, method and data analysis steps, this study serves as an example to motivate other countries that participated in TIMSS 2011 assessment or other international achievement databases to carry out similar studies. This study aimed at providing TIMSS researchers with suggestions for refinement and improvement for future TIMSS studies.

5.4 Recommendations

This research indicates that there are many variables in South African schools that should be considered to improve Mathematics performance. Policymakers should look at these variables and see which have a higher priority by looking at the complexity of relationships between important variables.

Improving learners' fluency in the language of instruction and learning: Language is a very important tool in Mathematics and Science education in the light of social constructivist theory, which contends that learners can gain knowledge based on language-based social interaction (Staver, 1998).

If learners do not have a good knowledge or command of the language of instruction, intended outcomes cannot be accomplished. Therefore the language of teaching must be taught from the beginning of schooling so that learners can improve before trying to learn complex knowledge-based subjects such as Mathematics. Changing the language of instruction and learning from one level of schooling to the next can really be confusing to the learners.

Improving instruction and learning culture and the environment of learners: This study has revealed that the usage of language of test at home by learners and the availability of home resources relate to an increase in Mathematics performance in South Africa.

There is a need for a safe and favourable atmosphere for reliable schooling. A safe environment is one of the conditions that determine quality education (UNESCO, 2000); the availability of basic human needs is a strong predictor explaining Mathematics performance at school level in South Africa.

The government or policy-makers need to see to it that learners have the basic human needs, like electricity, running tap water and other items at home, such as a study desk etc. and they need to understand that being educated is valued, essential and obligatory in a modern and democratic society like South Africa.

5.5 Conclusions

The TIMSS tables that summarise the mean achievement in Mathematics indicate that South Africa ranks at the lower end of the scale; it is 44th out of 45 countries with an average significantly lower than the TIMSS centre point.

However, before making any interpretations or drawing conclusions from the information presented in TIMSS, note should be taken that other countries that were also examined in TIMSS differ in many social and educational respects, such as culture, history and demography. Normally these differences affect the amount of variability in Mathematics performance among learners. It is because of these drawbacks that in-depth research such as this present study is necessary to use the TIMSS data wisely.

This national study in education provided the researcher the opportunity to examine how learners in similar educational systems perform in the same test and provided information about the relationship between learners' achievement and items that influenced them.

Although learners' conditions in South Africa differ from the perspective of home resources and language of instruction and learning spoken at home, it was important to find that the key variable, namely language, was important in learner performance in Mathematics. Other variables like access to basic human commodities and quality education could be developed into further studies.

Science education in itself is not a sufficient prerequisite or condition for greater economic development but scientific literacy cannot be separated from national development. This study contributes to South African Mathematics education by exploring the relationship between Mathematics performance and self-efficacy beliefs.

In order to reduce the bias in national achievement research, this study can be replicated with other learners and grades in South Africa that participated in TIMSS 2011. Further research using different existing large-scale international achievement data such as PIRLS and PISA can be conducted; different databases tend to provide different contextual and background variables.

To ensure that South African Mathematics and Science learners' needs are addressed, it is very important that basic home resources are provided and available. The government or educational policy-makers should encourage learners to speak the language of instruction and learning at home. This can be done by using the language of test from the intermediate phase to the higher phase of instruction and learning.

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Addendum A

About you

1

Are you a girl or a boy?

Fill one circle only.

Girl -- ◯

Boy -- ◯

2

When were you born?

Fill the circles next to the month and year you were born.

a) Month	b) Year
January -- ◯	1993 -- ◯
February -- ◯	1994 -- ◯
March -- ◯	1995 -- ◯
April -- ◯	1996 -- ◯
May -- ◯	1997 -- ◯
June -- ◯	1998 -- ◯
July -- ◯	1999 -- ◯
August -- ◯	2000 -- ◯
September -- ◯	2001 -- ◯
October -- ◯	Other -- ◯
November -- ◯	
December -- ◯	

3

How often do you speak <language of test> at home?

Fill one circle only.

- Always -- ◯
- Almost always -- ◯
- Sometimes -- ◯
- Never -- ◯

4

About how many books are there in your home? (Do not count magazines, newspapers, or your school books.)

Fill one circle only.

- None or very few (0–10 books) -- ◯
- Enough to fill one shelf (11–25 books) -- ◯
- Enough to fill one bookcase (26–100 books) -- ◯
- Enough to fill two bookcases (101–200 books) -- ◯
- Enough to fill three or more bookcases (more than 200) -- ◯

5

Do you have any of these things at your home?

Fill one circle for each line.

	Yes	No
a) Computer	○	○
b) Study desk/table for your use	○	○
c) Books of your very own (do not count your school books)	○	○
d) Your own room	○	○
e) Internet connection	○	○
f) <country-specific indicator of wealth>	○	○
g) <country-specific indicator of wealth>	○	○
h) <country-specific indicator of wealth>	○	○
i) <country-specific indicator of wealth>	○	○
j) <country-specific indicator of wealth>	○	○
k) <country-specific indicator of wealth>	○	○

Mathematics in School

14

How much do you agree with these statements about learning mathematics?

Fill one circle for each line.

	Agree a lot	Agree a little	Disagree a little	Disagree a lot
a) I enjoy learning mathematics	○	○	○	○
b) I wish I did not have to study mathematics	○	○	○	○
c) Mathematics is boring	○	○	○	○
d) I learn many interesting things in mathematics	○	○	○	○
e) I like mathematics	○	○	○	○
f) It is important to do well in mathematics	○	○	○	○