CAUSAL ATTRIBUTIONS OF SUCCESS AND FAILURE MADE BY GRADES 10-12 SCIENCE LEARNERS

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Thesis submitted in fulfillment of the requirements for the degree of Doctor of Philosophy (Learner Support) in the Faculty of Education at the Mafikeng Campus of the North-West University

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DECLARATION BY STUDENT

I, Shreen Gutta, declare that the thesis: *Causal Attributions of success and failure made by Grades 10-12 Science learners* is my own original work and design. All the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

This research is for the degree Doctor of Philosophy (Learner Support) in the School of Post Graduate Studies (Faculty of Education), North-West University, Mafikeng Campus and has not been previously submitted by me or anybody for a degree at another institution.

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ABSTRACT

The purpose of this study was to investigate the causal attributions of success and failure made by Grades 10-12 science learners from 30 schools in the Ngaka Modiri Molema and Dr Ruth Segomotsi Mompati regions within the North-West Province. Studies have shown that understanding of attributional styles among learners has a positive impact on educators' approaches to classroom situations. Yet, there is a lack of knowledge in our understanding of attribution patterns of learners in the North-West Province as well as understanding of how the variables such as achievement in science, achievement motivation levels, gender, and socio-economic factors could influence the attribution styles of learners. The focus was thus on understanding the dynamics associated with attributional styles among learners as a way that might provide light on how learners in science programmes might be encouraged to reach higher levels of achievement. The Attribution Theory may therefore serve as a useful framework to look at poor achievement of South African science learners as there is a relationship between attributional pattern and achievement in school.

The mixed-method approach was used for collection and analysis of data with quantitative administration of questionnaires and qualitative interviews. The study used systematic random sampling techniques to select the sample of 1773 male and female learners from lower and middle socio-economic backgrounds. The purposive sampling technique was utilized to select educators from the teaching staff and learners for interview purposes. Individual interviews with 1 principal, 3 HODs, 1 educator teaching physical science, and 5 grade 10-12 learners was used to collect data. Each of the following seven factors of attribution was scored on a 4-point scale: ability, effort, interest, task difficulty, luck, help and teaching methods. The questionnaires used for the study were: the Attribution Questionnaire, Achievement Motivation Questionnaire (AMQ) and the Socio-economic Status Questionnaire. The study used inferential statistics which included the Chi-Square, Analysis of Variance (ANOVA), the Statistical Package of Social Science (SPSS) - Version 20 and MINITAB as well as EXCEL to analyse the data.

The study revealed that high achievers and highly motivated learners made higher ability, effort, interest, task ease, and teaching method attributions than low achievers and low motivated learners. The results indicated a significant relationship between

attributional factors and achievement in science. The investigation also reported that females made slightly higher attributions to ability, effort, luck, help and teaching methods than males. Both males and females made similar attributions in terms of interest attributions. There were, however no significant differences between males and females in terms of science achievement. Regarding socio-economic status, the study showed that the higher income groups (HIG) and higher socio-economic (HSE) groups made higher ability, effort, interest and teaching method attributions than lower income groups (LIG) and lower socio-economic (LSE) groups. There is a statistical relationship between breadwinners' income, education level of breadwinner, number of bedrooms in the learners' home, access to television and laboratory relative to science achievement.

The findings reported in this study justify the importance of attributions and achievement motivation to science achievement of male and female learners from different socio-economic backgrounds. The current study will benefit our understanding of how learners' attributional styles may influence achievement motivation, and achievement of grades 10 to 12 science learners in the Ngaka Modiri Molema and Dr Ruth Segomotsi Mompati regions within the North-West Province. The findings have implications for science educators and it shows that awareness of attributional styles and achievement motivation is vital in educational settings to lead to better achievement of male and female learners from different socio-economic backgrounds. It is recommended that learners be encouraged to adopt an internal attributional style by stressing ability, effort and interest attributions as this may lead to higher achievement in science. It is hoped that these findings will assist educational researchers, science educators, parents, school authorities, government and other stakeholders who are concerned with science achievement of high school learners. Based on the findings, this study suggests the following areas for further research: The present study was limited to two regions in the North-West Province. Further research could include learners from other North-West Province regions. Learners from different educational levels could be included as well as students from tertiary level. Taking of attributional styles into consideration may contribute in creating learning pathways between the "real world" and places of learning.

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LIST OF ACRONYMS AND ABBREVIATIONS

AF	All Female Institution
AMQ	Achievement Motivation Questionnaire
AM	All Male Institution
ANOVA	Analysis of Variance
AO's	Area Offices
CAPS	Curriculum and Assessment Policy Statement
CE	Co Educational Institution
DoE	Department of Education
GET	General Education and Training Band.
HEB -	Higher Educational Background
HIG	Higher Income Groups
HSE -	Higher Socio-economic
LEB -	Lower Educational Backgrounds
LIG	Lower Income Groups
LSE	Lower Socio-economic
NCS	National Curriculum Statement
SAASTE	South African Association for Science and Technology Educators
SAARMSTE	South African Association for Research in Mathematics, Science and Technology Education
SES	Socio-economic Status
SPSS	Statistical Package of Social Science
TIMSS	Third International Mathematics and Science Study
TIMSS-R	Third International Mathematics and Science Study - Revised

CHAPTER ONE

ORIENTATION TO THE STUDY

1.1 INTRODUCTION

Our everyday experiences of life are characterised by events that influence our thoughts and perceptions. Studies have been conducted on how people interpret events and how this affects their thinking and behaviour (McClure, Meyer, Garisch, Fischer, Weir & Walkey, 2010:2; Hawi, 2010:1128). Such studies are collectively referred to as a branch of knowledge labelled the Attribution Theory. Attributions are made to predict the future and to exert some control over events. People are more likely to make attributions when outcomes are negative or unexpected and if the event has personal consequences (Bergh & Theron, 2006:129).

Heider (1958) is seen as the originator of the Attribution Theory and he elaborated on how one may make internal or external attributions (Nenty, 2010:94). Heider's studies were beneficial to understand how one may predict and modify future behaviour. Heider (1958) and Rotter (1954, 1966) were both concerned with perceived causes of success and failure and their locus. However, it was Weiner (2005; 2010:32) who created the framework that is used today in terms of academic achievement. Weiner stressed the relationship between a person's causal attributions for success and failure and academic achievement (Boruchovitch, 2004:53). The most prevalent factors that people use to justify their successes or failures are ability, effort, task difficulty and luck (Mudhovozi, Gumani, Maunganidze & Sodi, 2010:587; Boruchovitch, 2004:53). The causes, ability and effort, are considered internal since they originated within the person, while task difficulty and luck are seen as external, as they originated outside the person (Hareli & Weiner, 2002b:184; Weiner, 2010:31; Zewotir & Maqutu, 2006:35).

These perceived causes are classified into three causal dimensions: *Stability* shows how stable the perceived cause is, *locus* investigates whether the cause is internal or external and *controllability* examines whether or not the perceived cause can be controlled or not (Basturk & Yavuz, 2010:1940).

These attributional causes play a major role in moulding future expectancies and students' motivation to learn (Basturk & Yavuz, 2010:1940). Students' beliefs about their causes for success and failure greatly influence their academic achievement. There is a relationship between attributional pattern and achievement in school. Nenty (2010:93) noted that an internal attributional style leads to better achievement, whereas, external attributions are related to negative achievement.

Batool, Arief and Naseer Ud Din (2010:454) stated that gender inequalities in education have changed tremendously over the past decades. Gender, as well as socio-economic status, should be taken into account as factors affecting academic achievement. Some studies indicated that females made more internal attributions for academic achievement (McClure et al., 2010:2), enjoyed science less than other subjects (Quinn & Lyons, 2011:229; Desy et al., 2011:23), rated their ability in science lower than males (Quinn & Lyons, 2011:229). Males attribute failure to /external factors such as luck or the teacher and they make luck attributions for success in academic settings (Mudhovozi et al., 2010:590). Females attribute failures to unstable external variables like luck or internal causes such as effort to enhance their own image (Rusillo & Arias, 2004:104). Men attribute success to ability and women attribute success to task ease or luck, which are external factors (Meece, et al., 2006:354). Females tend to exhibit more negative attitudes toward science and a career in science than males (Desy et al., 2011:23).

In this study, attribution theories are used to provide an insightful understanding of the nature of factors that may be attributed to poor achievement in science. The Attribution Theory can serve as a useful framework to look at poor achievement of South African science learners. Basturk and Yavuz (2010:1940) suggest that changing the students' attributions could aid in avoiding failure.

Further elaboration on the Attribution Theory is clarified in Chapter Two.

South Africa is facing a major crisis in science teaching and learning as the number of science enrolments at high school level is dropping. There are many upgrading programmes and research conferences on science e.g., the Dinaledi Project (South African Association for Science and Technology Educators (SAASTE) and the South African Association for Research in Mathematics, Science and Technology Education (SAARMSTE) and yet the achievement in science is problematic. The North-West Department of Education (DoE) has introduced programmes for upgrading science educators and the SYSTEM project by the DoE to increase scientists (Muwanga-Zake, 2000). These efforts have contributed to South African science education, yet the state of science teaching and learning appears to be in a poor state (Ogunniyi, 1996:278).

Mere and Kwayisi (2012:172) stress that over-crowded classrooms, lack of teaching and learning resources, paperwork for educators, irrelevant content of textbooks, and learners' difficulties in understanding science concepts, retarded the educators' efforts in teaching science effectively. They also indicate that lack of parental involvement, learners' negative attitude towards science, lack of libraries and internet facilities contributed to the challenges faced by educators in schools. Schools in rural areas have no electricity to do laboratory work.

Several studies suggest that the following factors contribute to poor achievement of science learners: The low socio-economic background of learners (Legotlo, Maaga, Sebego, van der Westhuizen, Mosoge, Nieuwoudt & Steyn, 2002:115), a lack of well-trained teachers (Ogunniyi, 1996:278), teaching strategies, motivation, parental role in learners' education, language usage, perception of high school learners that science is a difficult subject (Makgato & Mji, 2006:253), lack of adequate resources discouraging interest in science, education enrolments at high school level which are dropping (Muwanga-Zake, 2000), and the under-representation of black students in science at higher education levels (Armien & Le Roux, 2010:42). Several studies show that issues faced by students in South Africa are also experienced universally (Legotlo, et al., 2002:115; Makgato & Mji, 2006:253). For instance, Aschbacher et al. (2010:564) noted that a problem in California, (USA), was that in some schools poor facilities, very few students choosing science as a career and Grade 12 learners not having strong science role models in their lives resulted in lower academic achievement. Anderman et al. (2012:89) contend that students in the United States are facing the following problems in science teaching and learning: availability of appropriate textbooks, classroom resources, increasing use of the internet as a source of information. Bang and Baker (2013:39) stated that Korean schools have very little support from their communities, poor lab equipment, very little resources in their libraries and teachers have negative attitudes to science.

The perception that science is a difficult subject (Makgato & Mji, 2006:253), has led to a vicious cycle of reduced interest in science, expectancy of failure in future, negative reaction to the teacher and resulting poor achievement.

South Africa needs educators who are able to stimulate the interest and abilities of students in science. In the South African White Paper on science and technology (1996:10), it is stated that science education will lead to an improvement in the quality of life.

It is important to find the causes that learners ascribe to success and failure in a subject such as science. This will assist educators to empower teachers to ensure the development of more desirable, internal attribution patterns among learners and thereby reducing failure in schools. Understanding attributional styles and motivation levels of learners will assist in planning academic support to reduce failure at schools. Therefore, attributions are the reasons that people offer to explain to themselves the degree of success they see in the outcome they experienced.

1.2 STATEMENT OF PROBLEM

As highlighted, there have been serious challenges faced by South African secondary school learners in the area of science teaching and learning (Armien & Le Roux, 2010:42; Makgato & Mji, 2006:253). The high dropout rates in science, poor achievement at secondary school level, the socio-economic background of learners, and teachers who are not adequately trained to teach the practical aspects of science are some of the factors which led to the crisis experienced in science.

Within the context of the new science curriculum, the Curriculum and Assessment Policy Statement (CAPS - Department: Basic Education: Republic of South Africa), there is a lack of knowledge in our understanding of attribution patterns of South African learners.

There appears to be a paucity of literature on causal attributions of science learners in the North-West Province of South Africa. Very few studies have looked at the relationship between science achievement and attributional style of learners. The studies conducted in South Africa, investigated the relationship between attitudes, interest and science achievement. However, the relationship between achievement in science and the attributional factors – ability, effort, task difficulty, luck and others - were not investigated (Legotlo, et al., 2002; Makgato & Mji, 2006; Armien & Le Roux, 2010). Hence, we do not yet fully understand how learners actually make attributions or what causal explanations they make for those attributions. Furthermore, there is a serious decline in the quality of education especially in South African high schools and the pass rate is decreasing (Aschbacher et al., 2010:564; Makgato & Mji, 2006:253; Ogunniyi, 1996:278). The failure rate has resulted in a lack of students following Science related courses at tertiary levels.

Studies on causal attributions have been conducted in New Zealand, Lesotho, Nigeria, Turkey, Pakistan, Brazil, Lebanon and other countries (McClure et al., 2010; Nenty, 2010; Tella, 2007; Basturk, & Yavuz, 2010; Batool, et al., 2010; Boruchovitch, 2004; Hawi, 2010). However, such studies have been limited in the South African context.

Studies investigated the motivation levels and achievement in science (Chow & Yong, 2013), achievement in science, gender and attitude towards science (Barmby, Kind & Jones, 2008). Consequently, there is a lack of knowledge in the understanding of attribution related to science. One needs to investigate how the achievement of learners in science, achievement motivation levels, gender and socio-economic status could influence the attribution patterns of learners in the North-West Province of South Africa.

It is therefore clearly evident that there is a need to investigate causal attributional patterns of science students at secondary school level in the North-West Province.

1.3 AIM OF THE STUDY

The aim of the study was to investigate the attributional patterns of learners from Grade 10 to 12 in Ngaka Modiri Molema and Dr Ruth Segomotsi Mompati regions. The focus was on understanding the dynamics associated with attributional patterns among females and males as a way that might provide light on how learners in science programmes may be encouraged to reach higher levels of achievement motivation.

Thus, the key objectives of the study were as follows:

- To determine the types of attributions that affect the science achievement of learners;
- to determine the influence of achievement motivation on attributions and science achievement of learners;

- to determine the influences of gender on the attributions and science achievement of learners; and
- to determine the influence of socio-economic status on attributions and science achievement of learners.

1.4 RESEARCH QUESTIONS

The following research questions were investigated in the current study:

- What types of attributions affect science achievement of learners?
- What are the effects of achievement motivation on attributions and science achievement of learners?
- What are the effects of gender on attributions and science achievement of learners?
- What are the effects of socio-economic factors on attributions and science achievement of learners?

1.5 THE SIGNIFICANCE OF THE STUDY

The current study will benefit our understanding of how learners' attributional styles may influence achievement motivation, and performance of learners in Grades 10 to 12 science programmes. Furthermore, the findings will assist educational researchers, science educators, parents, school authorities, government and other stakeholders to become aware of various attributional patterns of learners in the school setting and its relationship to academic achievement in science. It will especially benefit government education policy makers to amend policies to suit desirable goals.

1.6 DELIMITATIONS OF THE STUDY

This study was delimited to 23 secondary/high schools in the Ngaka Modiri Molema Region and 7 secondary schools from the Dr Ruth Segomotsi Mompati Region within the North-West Province. The total sample of respondents for the present study consisted of 1773 Grades 10 to 12 science learners. Some of the schools are located in rural areas, whereas others are in semi-urban areas such as Mmabatho and Mahikeng.

1.7 LIMITATIONS OF THE STUDY

A limitation for the present study was that it was not possible to conduct many interviews because of time and cost as well as travelling expenses. This limited the generalizability of findings to all participants in the regions. To overcome the problem of limited interviewees, questionnaires were used and were administered to 1773 students.

McClure et al. (2010:3) note that the validity of the transcripts is influenced by the students' language. In this study, the researcher ascertained that all respondents were proficient in english so that they could complete the questionnaires and the learners were able to voice their feelings and opinions freely.

Another limitation is that the learners who participated in the study have similar cultural and learning experiences and one may not find clear distinguishing attributional styles amongst these learners.

Due to paucity of literature on attributions of learners in the North-West region, the findings may not fully explain attributional styles of the participants in the study.

1.8 DEFINITIONS OF CONCEPTS

1.8.1 Attribution

Attributions are the causal explanations that people give for their behaviour. The Attribution Theory is concerned with how people interpret events and how this is related to their thinking and behaviour (Weiner, 2010c; Hawi, 2010:1128). This theory focuses on causes of events and outcomes including achievement related success and failure and the consequences of these beliefs (Basturk & Yavuz, 2010:1940).

In this study, learners attributed their success or failure in science to high or low ability, effort, interest, task difficulty, luck, help, and contribution of teaching methods.

1.8.2 Attributional styles

The attributional styles of learners may be internal or external (Hareli & Weiner, 2002:184; Weiner, 2010:31; Mudhovozi, et al., 2010:587).

1.8.2.1 Internal attributions

According to Weiner (2010:31), internal attributions ascribe the causes of behaviour to personal dispositions, traits, abilities and feelings. The causes ability and effort were considered internal since they originate within the person (Hareli & Weiner, 2002:184).

In the current study, attributions of test results to effort, ability and interest were seen as internal attributions.

1.8.2.2 External attributions

According to Weiner (2010:31), external attributions ascribe the cause of behaviour to situational demands and environmental constraints. Internal and external attributions can have a tremendous effect on everyday interpersonal interactions. When persons attribute their success or failure to luck and test difficulty/ease it is seen as an external attribution (Mudhovozi, et al., 2010:587).

In the present study, attributing the science test results to luck, test difficulty/ease, assistance from others and teaching methods were seen as external attributions.

1.8.3 Achievement motivation

Achievement motivation is an inner drive to achieve (Bakara, Tarmizia, Mahyuddina, Eliasa, Su Luana & Ayuba, 2010:4906) and is learned during the socialization process (Tella, 2007:151). Motivation is the driving force behind people's actions and it affects needs and desires (Tella, 2007:151). Achievement motivation can be seen as self determination to succeed in academic activities. The need of achievement varies from one individual to another (Tella, 2007:152).

In the present study the achievement motivation levels of learners were divided into low moderate and high achievement motivation. The achievement motivation level was determined from the scores achieved on the Achievement Motivation Questionnaire (Erwee, Boshoff & Lessing). Learners whose scores ranged from 1 to 9 were classified as low achievement motivated individuals, scores of 10 to 25 moderately motivated and scores of 25 to 33 were categorized as highly motivated learners.

1.8.4 High achievers

In this study, students who achieved 70% and above in their science test were classified as high achievers.

1.8.5 Average achievers

In the present study, students who achieved between 40-69% in their science test were seen as average achievers.

1.8.6 Low achievers

In the present study, learners who achieved below 39% were classified as low achievers.

1.8.7 Success

According to the Oxford Dictionary, the definition of success is the accomplishment of an aim.

For the present study, students who are successful are learners who achieved in the range of 40-100% in their science test.

1.8.8 Failure

Failure is defined as failing to achieve goals (Bergh & Theron, 2006:445). Failure is a common kind of frustration and frustration occurs in a situation where a goal is thwarted (Weiten, 1992:468). In the present study failure will mean students who achieve from 0-39% in their science test.

1.8.9 Fundamental attribution error

It is the tendency to attribute other students' failures to lack of personal characteristics e.g. low aptitude (internal) rather than to situational causes (Mudhovuzi et al., 2010:588).

In this study students who attributed their failure to lack of ability rather than to external causes were seen as applying the fundamental attribution error.

1.8.10 Self-serving attributional bias

Students attribute their highest marks to internal causes, and their lowest marks to external situational factors (Bong, 2004:290; McClure et al., 2010:2; Mudhovozi, et al., 2010:589).

In the present study leaners who attributed their success to ability, effort and interest and their failure to task difficulty, luck, help and teaching methods were applying the self-serving attributional bias.

1.8.11 Dimensions of attribution

Attribution is classified into three dimensions (Basturk & Yavuz, 2010:1940; Batool, et al., 2010:454): Locus (whether the cause is internal or external), stability (how stable the perceived cause is) and controllability (whether or not the perceived cause can be controlled).

In the present study ability, effort and interest attributions were seen as internal locus, whereas attributions to task difficulty, luck, help and teaching methods were seen as external locus. Ability is seen as a stable, internal and an uncontrollable cause, effort as an unstable, internal and controllable cause, task attribution as a stable, external and uncontrollable cause and luck as an unstable, external uncontrollable cause.

1.8.12 Curriculum and Assessment Policy Statement (CAPS)

In 1997 the Outcomes-Based Education was introduced. It has been reviewed in 2002 and again in 2009. From 2012 the two National Curriculum Statements for

Grades R-9 and Grades 10-12 were combined in a single document and are known as the National Curriculum Statement Grades R-12. It is a policy statement for learning and teaching in South African schools. It comprises of the following:

- Curriculum and Assessment Policy statements (CAPS) for all approved subjects;
- National Policy for promotion requirements; and
- National Protocol for Assessment Grades R-12.

1.8.13 National Curriculum Statement (NCS)

The NCS is an educational programme introduced by the government of South Africa. It has been implemented as an improvement on Curriculum 2005 (Department of Education, 2002:2).

1.8.14 Science

Science consists of four broad areas: Astronomy, physics, chemistry and earth sciences. The subject examines physical and chemical phenomena to predict events in the physical environment. It also deals with society's need to understand how the physical environment functions. The sciences promote knowledge and skills in scientific inquiry and problem solving. It helps learners to understanding the nature of science and its relationships to technology, society and the environment. (Department of Education, 2002).

1.8.15 Science learners

In this study science learners from grades 10-12 were selected to respond to questionnaires and interviews.

1.8.16 Ngaka Modiri Molema region

Ngaka Modiri Molema is a relatively big district with many high schools that are supported through 5 Area Offices (AO's), namely: Mahikeng, Lichtenburg, Kgetleng, Rekopantswe and Zeerust (Mahlomaholo, Mamiala, & Hongwane, (2010 et al., 2010:51). For the present study, the researcher focused on the Mahikeng region.

1.8.17 Dr Ruth Segomotsi Mompati regions

The Dr Ruth Segomotsi Mompati education district has 4 education Area Offices (AO), namely: Greater Delareyville, Greater Taung, Kagisano Molopo and Taledi (Mahlomaholo, et al., 2010:51). The Greater Delareyville area was used for the present study.

1.8.18 National Curriculum Statement (NCS) - Sciences

According to the National Curriculum Statement (NCS), sciences investigate physical and chemical phenomena. Learners develop communication skills, problem solving and reflective skills. By applying scientific models and theories one can explain and predict events in the physical environment. In sciences, challenges such as safe disposal of chemical waste, utilisation of resources and the environment are addressed (Department of Education, 2002).

Sciences build on the foundation laid by the natural sciences learning area in the General Education and Training (GET) Band. Learners in the sciences are expected to develop the following competencies:

- Scientific inquiry and problem-solving skills;
- construction and application of science knowledge;
- understanding the interrelationship between sciences, technology, the environment and society and different attitudes and values; and
- the science learner will be empowered with skills and knowledge for lifelong learning (Department of Education, 2002).

1.9 OUTLINE OF CHAPTERS

Chapter One: Orientation to the study

Chapter one provides background to the study including a discussion of the problem in area of attribution and the crisis experienced in science. The aim of the study was guided by from the research questions. This is followed by the research questions, the significance of the study, delimitations and limitations of the study. Definitions of relevant terms are given to clarify key concepts and this is followed by an outline of the five chapters in the thesis.

Chapter Two: Literature review

In this chapter, an introduction to the literature review on the theoretical background of attribution theories is provided. Literature from national and international perspectives elaborated on different approaches to Attribution Theory.

Chapter Three: Research and methodology

This chapter outlines the research design and methodology used in conducting the study. The following have been covered: Research design, population, sample and sampling technique, tools for data collection, administration of tools for data collection, validation of data collected, and procedure of how the data is presented and interpreted in chapter four of this research document.

Chapter Four: Data presentation and analysis

This chapter presents data analysis using inferential statistics which included the Chi Square, Analysis of Variance (ANOVA), Statistical Package of Social Sciences (SPSS), Version 20, MINITAB and EXCEL. Research findings are also dealt with in this chapter.

Chapter Five: Summary, conclusion and recommendations

The final chapter summarizes the research results, conclusions and recommendations as well as suggestions for future studies.

1.10 CONCLUSION

Chapter one provided orientation to the study and Chapter Two will focus on a literature review regarding different theoretical approaches to the Attribution Theory.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 INTRODUCTION AND BACKGROUND

In this chapter the framework and characteristics related to the Attribution Theory will be discussed within the context of various aspects related to poor achievement in science. Studies related to Attribution Theory focus on how we make sense of our social world, others' actions and the causes of other peoples' behaviour. Researchers (Kassin, Fein & Markus, 2008:103) note that when one asks people to explain why they behave in a certain way or why they succeed or fail, they come up with explanations which stress whether the behaviour is intentional or unintentional. The purpose of attributions is to change a person's behaviour and to improve the outcomes.

People are more likely to make attributions, when unusual events grab their attention, when events have personal consequences for them or when others behave in unexpected ways (Bergh & Theron, 2006:129). Unexpected outcomes will lead to attributional processes and the individual will seek reasons for the outcome (Weiner, 2000:2). When explaining the behaviour of another person one may attribute one or more causes to that behaviour. Thus, a three stage process underlies attribution:

- Firstly, the person will perceive the behaviour;
- Secondly, the person has to believe the behaviour was intentional, and
- Thirdly, the person has to determine whether they believe that the other person behaved because of the situation or because of personal constraints.

2.2 DEVELOPMENT OF THE ATTRIBUTION THEORY

There are several theoretical models on Attribution Theory. Heider (1958), who is regarded as the originator of the Attribution Theory, analyses the "common-sense psychology" by which people explain everyday events.

The present study used Weiners' framework (2005; 2010:32) that is used today in terms of academic achievement. Weiner expanded the theory of Heider (as indicated in Table 2.1 below) and he stressed the relationship between a person's causal attributions for success and failure and academic achievement (Boruchovitch, 2004:53). The Table summarizes the major developments of the Attribution Theory.

Table 2.1: Attribution Theory development

Author	Findings / Significance
Heider (1958)	He is seen as the originator of the Attribution Theory. He identified cognitive factors regarding internal/external attributions.
Heider (1958) Rotter (1954, 1966)	Heider (1958) and Rotter (1954, 1966) - concerned with perceived causes of success and failure and their locus. Rotter identified two causes: ability and luck. Heider identified 3 causes: Ability, effort and task.
Kelley (1967)	Identified cognitive factors when making internal/external attributions.
Weiner (1971/4)	Weiner et al. (1971) propose four main perceived causes of achievement outcomes: Ability, effort, task and luck.
Weiner (1980)	Three dimensions of Attribution Theory: *1 Locus of causality:* Internal/ external causes. *2 Stability*: Duration of a cause. 3 *Controllability*: Determines if perceived cause may be controlled.
Weiner (2000)	Expectancy and value theory.
Weiner (1985)	Ability attributions for success – achievement high.
Weiner (1985/6)	Ability and effort attributions equally predictive of achievement. Ability and effort attributions for outcome have positive influence on achievement motivation.
Hareli & Weiner (2002a)	Expectancy of future success is related to self-esteem, guilt and shame (intrapersonal theory of motivation). Causes determine future expectancies and motivation.
Weiner (2004)	Three psychological and behavioural consequences for the learner: Internal attributions for success - higher expectancies for the future. External attributions for success - lower expectancies for the future. Internal attributions for failure - focus on failure, do not look for improvement. Attribution of success to stable cause (ability) - likely to anticipate future success.
Weiner, 2010	Learners are strongly motivated by success. Understanding of attributional styles and achievement motivation levels among students have a positive impact on an educator's approach in educational settings.

Heider (1958) noted that there are four determinants of achievement: Ability, task difficulty and effort. He regards ability and effort as internal factors, whereas task difficulty is seen as an external causal factor affecting outcome. Heider (1958) and Rotter (1954, 1966) were both concerned with the perceived causes of success and failure and their locus of causation. Rotter (1954) agreed that there was one internal skill (ability) and one external cause (luck/chance).

2.3 KELLEY'S COVARIATION MODEL

Kelley (1967) identified cognitive factors that are considered when people make internal or external attributions. Like Heider, Kelley also believes that people are scientists who search for clues, make comparisons and think in terms of "experiments". According to Kelley, people make attributions by using the co-variation principle. For instance, for something to be the cause of behaviour, it must be present when the behaviour occurs and absent when it does not. Three kinds of co-variation information are particularly useful: Consensus, distinctiveness and consistency. For example, when student A keeps failing in the course one asks oneself why the student keeps on failing science (Kassin, et. al., 2008:104).

Consistency refers to whether an actor's behaviour in a situation is the same over time: "Is student A always failing in science?"

Distinctiveness refers to whether a person's behaviour is unique to the specific situation: "Does student A only fail science or other courses as well?"

Consensus refers to whether other people in the same situation tend to respond like the actor: "Does student A's classmates also fail science?"

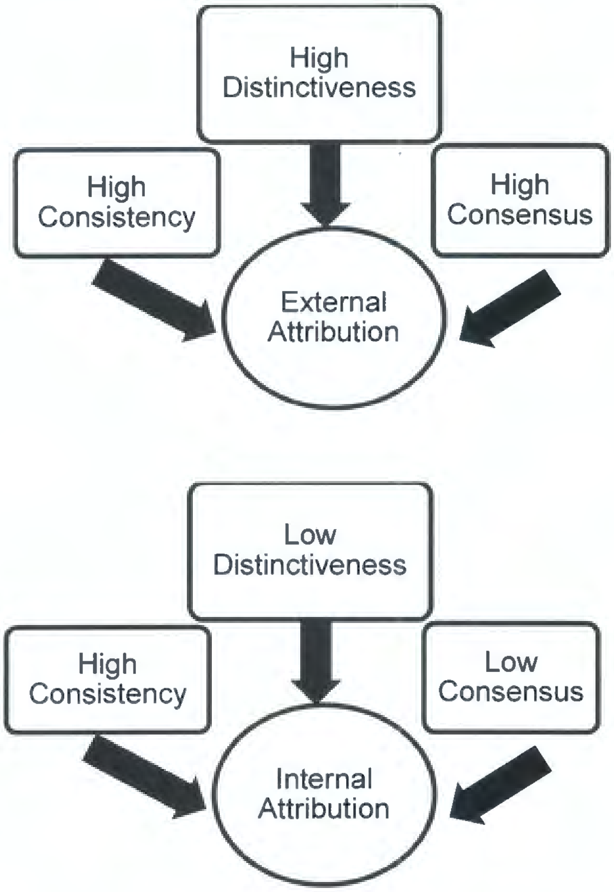


Figure 2.1: Kelley's Model of external/internal attribution

Figure 2.1 indicates that highly consistent behaviour is likely to result in external attributions when distinctiveness and consensus are high and internal attributions when distinctiveness and consensus are low (Kassin, et. al., 2008:104). For example, student A's outcome in an exam is persistent over time (high consistency), not unique to the other class members (low distinctiveness), and unlike the outcome of his classmates (low consensus). The teacher will be more likely to make an internal attribution and conclude that student A's failure is due to his personal disposition.

2.4 BERNARD WEINER'S ATTRIBUTIONAL MODEL

Weiner contended that the most prevalent factors that people use to explain the causes of their successes or failures are ability, effort, task difficulty and luck (Weiner, Frieze, Kukla, Reed & Rosenbaum, 1971; Weiner, 2010:31). These four causes are the answers to learners' questions related to why, for example, they have failed in the science test. Other factors are mood, fatigue, illness, bias, and teaching methods (Mudhovozi et al., 2010:587) as well as help or hindrance from others (Weiner, 2000:4), past history of success or failure and social norms (Weiner, et. al., 1971, Weiner, 2000:4). The causes ability and effort are considered internal since they originate within the person, while task difficulty and luck are seen as external, as they originate outside the person (Hawi, 2010:1127; Weiner, 2010:31).

Internal attributions ascribe the causes of behaviour to personal dispositions, traits abilities and feelings. External attributions ascribe the cause of behaviour to situational demands and environmental constraints. Internal and external attributions can have a tremendous effect on one's everyday interpersonal interaction (Weiner, 2010:31). The attribution pattern influences the learner's self-concept, expectancies for future situations and motivation.

Weiner (2010:32) created the framework that is popular in educational settings in terms of academic achievement. His theory stresses the idea that learners are strongly motivated by the pleasant outcome of being able to feel good about themselves. The amount of effort the student will exert on a given task will be determined by the person's attributions for his success or failure.

Weiner's Attribution Theory explains why students react in certain ways based on their achievement and expectations. He notes that people ascribe their own success or failure on future expectations of success, emotional reactions and self-esteem (Batool et al., 2010:454). Learners can benefit from the ability to reason about the causal relationship for their success or failures and it helps them to predict the outcomes of their actions (Zewotir & Maqutu, 2006:36).

2.4.1 Three dimensions of the attributional model

Weiner's theory of motivation explains how students can become motivated or demotivated in the classroom (Batool et al., 2010:454). According to Weiner (1980), Attribution Theory is classified into three dimensions. In Table 2.2 an explanation of the three dimensions of the Attribution Model is provided.

Table 2.2: Three dimensions of the Attributional Model

Author	Three Dimensions of Attribution Theory
Weiner, (1980)	Three dimensions of Attribution Theory: 1. *Locus of causality* Location of a cause within or outside a person. Ability, effort and interest in the task are considered internal causes, task difficulty, teaching methods and luck are considered external causes.
	2. *Stability* Duration of a cause. Luck is a temporary and changeable cause. Ability is considered a stable and constant cause.
	3. *Controllability* Determines whether perceived cause can be controlled. Effort can be changed. Luck and ability cannot be changed intentionally.

The first dimension, which is locus of causality, refers to the location of a cause within or outside of a person. Ability, effort and interest in the task are considered internal causes, whereas task difficulty, teaching methods and luck are considered external causes of causality. The second dimension, which is stability, refers to the duration of a cause. Some causes, such as luck, are perceived as temporary and changeable, whereas other causes such as ability are considered stable and constant. The third dimension, which is controllability, determines whether or not the perceived cause could be controlled (Basturk & Yavuz, 2010:1940; Batool et al., 2010: 454). Effort attributions could be changed, whereas other luck and ability cannot be changed intentionally.

The causal dimensions of the Attribution Theory are important in academic settings (Jungert & Gustafson, 2009:132). Hence, the need to focus on how they may be applied to the school setting and the purpose is to provide meaningful explanations of learning.

2.4.2 The three dimensions and their psychological consequences

Table 2.3 shows the three psychological dimensions of each of the attribution factors in Weiner's theory of motivation.

Table 2.3: Psychological consequences of the three dimensions

Factor	Dimension
Ability	Stable, internal, uncontrollable
Effort	Unstable, internal, controllable
Task	Stable, external, uncontrollable
Luck	Unstable, external, uncontrollable

Ability is stable and an internal factor over which the learner does not have much control (Batool et al., 2010:454). Task difficulty is stable, external and beyond the learner's control. Effort is unstable, internal and the learner has control. Luck is unstable, external and the learner has almost no control (Batool et al., 2010:454; Basturk & Yavuz, 2010:1940).

According to Weiner (2000:4), the major causal properties constitute two major determinants of motivation, namely: expectancy and value. Expectancy refers to the subjective chance of future success while value refers to the emotional consequences of an outcome. Weiner (2000:4) notes that there are three psychological and behavioural consequences for the learner. They affect achievement related to emotions, such as pride, anger, pity, shame, and hopelessness (Weiner, 2000:4). Students who adopt an internal attributional style for success tend to show higher success expectancies for the future than individuals with external attributions in success conditions whereas students who make internal attributions for failure, tend to focus on failure and do not look for improvement. Stability is positively linked with expectancy because if a cause is considered stable, the same outcome will be anticipated again following success or failure. If the student attributes his/her outcome (success) to a stable cause (ability) he/she is likely to anticipate future success. If students make stable attributions for success it will result in increased success expectancies and achievement motivation (Jungert & Gustafson, 2009:132).

The locus and stability of causal attribution determines expectancy of future success. When a student attributes his/her failure to a stable factor such as subject difficulty (external, stable and uncontrollable), he/she is likely to expect future failure. If failure is due to lack of ability (internal, stable cause) or an unfair teacher, then future failure will be anticipated. However, if failure is perceived as due to an unstable factor (bad luck or insufficient effort exerted on the task), failure will not be anticipated (Weiner, 2000:4). Locus and controllability, on the other hand, relate to affective states or the emotional value of outcomes. Locus influences feelings of pride and self-esteem, and controllability jointly influences feelings of guilt or shame with locus of causality. Thus, locus and control determine whether guilt or shame is experienced following failure and are independent dimensions. A cause may be internal to the person but uncontrollable, such as lack of height and not being selected for the basketball team (Weiner, 2000:4).

2.5 FUNDAMENTAL ATTRIBUTION ERROR

Table 2.4 summarizes the pattern of fundamental attribution error (Mudhovozi et al., 2010:589).

Table 2.4: Fundamental Attribution Error

Success	Failure
Others' success attributed to external factors (easy test) rather than internal causes.	Others' failures attributed to internal factors (low ability, unchangeable, uncontrollable) rather than external.

Attribution researchers have found that people often make misjudgements when evaluating the behaviour of others and tend to attribute the other's behaviour to their inner dispositions which are unchangeable and uncontrollable. Hence, they believe that they have control over their lives (Mudhovozi et al., 2010:588). This tendency is known as the fundamental attribution error where people are inclined to overestimate the role of internal causes (person's traits or attitudes) and underestimate the role of external factors in explaining other people's behaviour.

It is the tendency to attribute other students' failures to lack of personal characteristics e.g. low aptitude (internal) rather than to situational causes. Another student's success is explained in terms of an easy test (external) rather than to internal causes. A student's own failure is rationalized in terms of external causes such as task difficulty or bad luck (Mudhovozi et al., 2010:589). Success is attributed to internal factors: ability (internal, stable, and uncontrollable) and effort (internal, unstable, and controllable).

2.6 SELF-SERVING ATTRIBUTIONAL BIAS

Table 2.5 summarizes the findings of various authors on self-serving attributional bias (Bong, 2004:290; McClure et al., 2010:72).

Table 2.5: Self-serving attribution bias

Success	Failure
Students' own success attributed to internal causes.	Failure attributed to external situational factors.
Taking credit for success – gives student a sense of control over their lives.	Attribution of failure to the situation - protect the students' self-esteem.

Consistent with many previous studies on attributions and achievement, students show self-serving attributional pattern of attributing their highest marks to internal causes (effort, ability) more than their lowest marks, and attributing their lowest marks to task difficulty more than their high marks (Bong, 2004:290). However, counter to self-serving bias, they invoke luck more for best marks than worst marks (McClure et al., 2010:72).

By claiming credit for success it gives the student a sense of control over what happens in their lives and in other people's lives. In-group members' attribution of failure to the situation is a tendency to protect the students' self-esteem, and not feeling demoralised when they fail. This bias is universal across all cultures, genders and age groups (McClure et al., 2010:72).

Other studies also support an Enhancing Attributional Style (ENS) which is the tendency to attribute success to internal, stable and general causes (Mudhovozi et al., 2010:589).

2.7 ATTRIBUTIONS AFFECTING ACHIEVEMENT OF LEARNERS

Several studies have evidenced that attributions affect academic achievement of learners (Weiner, 2010:31; Mc Clure et. al., 2010). Addiba (2004) conducted a study in Pakistan to investigate the perceived causes of success and failure of secondary students' attribution patterns.

2.7.1 Perceived causes of success and failure of secondary students' attributions

Addiba (2004:85) used the four attributional factors in Weiner's theory: ability, effort, luck and task difficulty. Most respondents in Addiba's study (2004:149) made the highest attributions to internal factors (effort and ability respectively). High achievers attributed their success and failure outcomes more to effort followed by ability. Low achievers, on the other hand, made luck and task difficulty attributions. Most students in the success condition made effort attribution, whereas they made effort and task difficulty attributions in the failure condition (Addiba, 2004:87). Learners believed that they achieved high marks because of effort and ability and did not perform well because of internal factors (effort and ability).

The results were consistent with Weiner's theory that stated that high achievers had internal locus of control which could be associated with their outcomes relating to internal factors. Low achievers had external locus of control that associated their outcome with external factors (luck and task difficulty). Addiba's study did not reveal any significant differences in the attributional styles of rural versus urban groups. Male students attributed their success and failure to ability and no differences between rural versus urban groups were found.

McClure et al. (2010:72) investigated how the four attributional factors (ability, effort, task and luck) and the three social influences (teachers, peers and family) may affect motivation and achievement in four different cultures in New Zealand.

There is a relationship between students' attributions and their achievement (McClure et al., 2010:76). Year 11 students who attributed their best marks to internal factors (effort and ability) attained higher marks. In contrast, students who attributed their best marks to luck, family, and friends gained lower scores.

Students who attributed their worst marks to (low) ability, effort, high task difficulty, and the influence of the teacher attained higher scores whereas students who attributed their worst marks to family and friends, gained lower marks. This finding is consistent with Weiners' (1985, 2010) theory that external attributions for success lead to poorer achievement. The fact that students in the study of McClure et al. (2010:79) attributed their worst marks to lack of effort and to the teacher predicts high achievement. On the other hand, attributing worst marks to family and friends and attributing best marks to luck, predicts lower scores.

Attributing worst marks to the teacher is consistent with the self-serving bias where people attribute success to internal causes and failure to external causes to enhance self-esteem of the student.

Attributional theories propose that attributions have cognitive and affective consequences that are related to learners' achievement (Weiner, 1985; 2000:4). They contend that effort attributions (controllable) increase motivation and perseverance whereas ability attributions (stable, uncontrollable) weakens motivation and in extreme cases leads to learned helplessness (negative motivation). They further claim that ability attributions for success and failure predicted achievement better than effort attributions. Attributing success to ability leads to pride, self-efficacy and persistence. Lloyd and his associates (2005:401) also note that ability attributions for success have been related to higher academic achievement and enhanced perceptions of self-efficacy. Jungert and Gustafson (2009:132) assert that ability attributions for success will result in increased success expectancies and achievement motivation. Bong (2004) suggests that ability attributions are not predictors of achievement in general (McClure et al., 2010:72).

Other studies (Weiner, 1985; 1986; 2010:31) found ability and effort attributions were equally predictive of achievement. Weiner (1985; 1986; 2010:31) also notes that people make ability and effort ascription for their success and failure and these two factors have more positive influence on achievement motivation. Boruchovitch (2004:58) notes that ability combined with effort will lead to success.

Studies suggest that effort attribution is the strongest predictor of achievement. Mainstream females used effort attribution and their achievement was higher than those of males (Batool et al., 2010:455).

Research shows that when students combine effort orientation (mastery orientation) and ability orientation (achievement orientation) it results in high levels of achievement and it is the most adaptive strategy (McClure et al., 2010:73). Internal attributions for success are the best predictors of achievement (Mudhovozi et al., 2010:587).

2.7.2 Internal vs. external attributions

If success is attributed to an internal and controllable cause the student will experience feelings of pride and increments in self-esteem. Expectancy of future outcomes with emotional reactions determines the subsequent outcomes, that is, behaviour depends on thoughts as well as feelings. Failure to lack of ability (internal, uncontrollable) evokes feelings of shame, embarrassment and humiliation (Weiner, 2000:4). When learners' failure is attributed to internal factors, self-esteem can be diminished. In classroom settings, students need a sense of self-esteem and competence and they need to be reassured otherwise they give up and say that work is too difficult (Rusillo & Arias, 2004:101). If teachers set very difficult tasks, expansion of effort on the part of the students will not be relevant. When students realize that success is controlled within them they will aim to control success.

When teachers praise students for success from little effort it teaches learners not to work hard. If a teacher criticises learners for failure that could have been achieved with effort, it communicates to students that they have the ability to succeed and should have put forth effort (Batool et al., 2010:454). If teachers set very difficult tasks, expansion of effort on the part of students will not be relevant. When students realize that success is controlled within them they will aim to control success.

Batool et al. (2010:454) state that when a learner fails in an exam he is likely to attribute the failure to one of the following factors: internal, stable (lack of ability) or internal, unstable (inadequate effort) or external, stable or external, unstable (bad luck). They (Batool et al., 2010:454) also indicate that when a learner succeeds, the same four dimensions apply, namely: internal, stable (excellent ability) or internal, unstable (hard work) or external, stable (lack of competition) or external, unstable (good luck).

Other studies (Boruchovitch, 2004:58) showed that when students attribute their failure in the test to lack of effort rather than blaming it on external influences, they will be more likely to perform better in future tests. When students make stable attributions and believe that they succeeded because of effort that they put in, then they will put in more effort in the task at hand in order to succeed, and if they believe it was due to ability, they will then expend more effort to succeed. Students will not be interested if they believe that their success or failure is due to external factors.

Teachers must encourage students to believe that they have the ability (stable) and that they can control effort. Thus, ability combined with effort will lead to success.

Controllability has a powerful effect on a person's effect of causality and controllability rather than reality. The controllability dimension is related to emotions e.g., when a learner fails to complete a task, s/he feels failure is uncontrollable, becomes aggressive, feels helpless and reluctant to work as he assumes he will not produce any work. A teacher may convey unintended messages when he/she (the teacher) shows annoyance with unsuccessful students. It gives the message that the student had the ability to perform but did not succeed. When a teacher shows sympathy, it tells the student that even with effort he/she does not have the ability to succeed. High school or college students want to preserve their egos and in failure conditions they claim that they did not apply effort when completing a task. When they succeed they want to be considered "smart" (Hareli & Weiner, 2002b:188).

Attributions are complicated and have important implications for how people see themselves and others. However, certain attributional biases lead to inaccurate judgements of whether the cause is internal or external.

2.7.3 High school learners' poor achievement in science

Makgato and Mji (2006:253) investigated the factors that contributed to poor achievement of science learners in Tshwane North (Soshanguve - South Africa). The authors noted that the educational potential of black students has resulted in under-development of human potential due to limited resources during the apartheid era.

Table 2.6 summarizes the factors that lead to low achievement of science and mathematics learners in South Africa.

Table 2.6: Factors contributing to poor achievement of learners in South Africa

Author	Findings

Makgato and Mji (2006)	Factors contributing to poor achievement of learners in South Africa:
	• Limited resources to black students during the apartheid era.
	• Outdated teaching methods.
	• Language of instruction differs from mother tongue.
	• Lack of:
	    o motivation;
	    o qualified teachers;
	    o textbooks;
	    o laboratory equipment;
	    o parental involvement; and
	    o laboratory equipment.
	• Over-crowded classrooms.
	• Very few students choose teaching of science as a career.
	• Teachers rely on theoretical aspects in teaching of science.
	• Limited use of practical demonstrations.

Science and mathematics were affected because of weakness in the teaching and learning of science and mathematics in South Africa. This is indicated by the results of the Third International Mathematics and Science Study (TIMSS) conducted in 1995. South Africa was also involved in the study with 41 other countries. The South African learners performed very poorly in the mathematics test with a mean score of 351 as compared to international bench mark of 513. TIMSS-R which was repeated in 1999 indicates that Grade 8 learners again performed poorly. Later, TIMSS-R conducted in 2003 also indicated no improvement in mathematics achievement of South African learners (Reddy, van der Berg, van Rensburg & Taylor, 2004).

Makgato and Mji (2006:254) also indicated that other factors which lead to the poor achievement of learners were: teaching strategies, language usage, motivation, parents' role in learners' education, teachers teaching in over-crowded classrooms, lack of qualified teachers in South Africa and outdated teaching methods which are used in schools. They note that if South Africans wish to participate in international technological development, one would need a mathematically and scientifically literate society. Furthermore, they point out that very few students choose teaching of science as a career.

Teachers only rely on theoretical aspects in teaching of science and do not use practical demonstrations which could lead to better understanding of the course. To address the problem of under qualified teachers and few students who are interested in mathematics and science, the government has introduced a programme developed at national and provincial levels (Makgato & Mji, 2006:254). The Dinaledi schools project is a national strategy for science, mathematics and technology to improve learner achievement in Grades 10-12 in order to increase number of learners doing these subjects and to increase previously disadvantaged female learners in science and mathematics. The project is also intended to assist under qualified teachers in science and mathematics (Makgato & Mji, 2006:255).

Factors which directly impact on the poor achievement of learners in District 3 of Tshwane North (Soshanguve - South Africa) are teaching strategies, motivation, laboratory use and non-completion of the syllabus in a year. The researchers also found that parental role and language usage with understanding the science and mathematics were indirectly related to the poor achievement (Makgato & Mji, 2006:256).

During interviews by Makgoto and Miji (2006:20), learners explained that they did not lack motivation or interest. Learners blamed the educators and schools for lack of textbooks and not using experiments in science laboratories to enhance learning. Lack of laboratory equipment and non-completion of syllabus are also seen as problems by learners which contribute to low achievement. The learners as well as educators indicate that there is no parental involvement in improving the achievement in school.

The language of instruction was also mentioned during these researchers' interviews with learners. This resulted in learners not comprehending the science and mathematical concepts. Other studies in South Africa have documented the relationship between mathematics achievement and learners' proficiency in English (Howie, Scherman & Venter, 2008:40).

They point out that parents are at an advantage to provide a stable environment and may have a positive influence on learner achievement (Makgato & Mji, 2006:263).

Furthermore, the background of parents influences achievement. Children from historically disadvantaged schools have parents who have pressure at work and may not attend to children's' school activities (Makgato & Mji, 2006:264).

2.7.4 Use of effort and ability attributions to encourage better achievement

Studies show that teachers need to stress effort attributions (mastery goals) or ability attributions (achievement goals) to encourage better achievement in classrooms (Anderman, Sinatra & Gray, 2012; Linnenbrink & Pintrich, 2002). Other studies suggest encouragement of interest in science (Aschbacher et al., 2010:564) as it may lead to better achievement by learners (Anderman et al., 2012).

Anderman et al., (2012:90) noted that teachers need to decide on whether to focus on effort or ability attribution as teaching strategies in the classroom (Anderman et al., 2012:90). Linnenbrink and Pintrich (2002:321) conducted their study with students in USA and noted that learners may adopt either effort or ability attributions when performing a task.

Effort attributions (mastery goals) develop new skills, whereas, ability attributions (achievement goals) determine the students ability and self-worth by outperforming others in competition. Effort attributions encourage adaptive, motivational, cognitive and achievement outcomes. Ability attributions generate less adaptive outcomes (Linnenbrink & Pintrich, 2002:321) and such individuals avoid new learning opportunities because they feel incompetent (McClure et al., 2010:73).

When students focus on improving achievement based on past achievement it will help them to maintain their self-efficacy. In failure situations, they will be more likely to avoid negative anxiety affects and will increase their cognitive capacity by focusing on achievement. In contrast, when students want to out-perform others it will lead to negative anxiety affect and will diminish cognitive capacity and achievement (Linnenbrink & Pintrich, 2002:321). When teachers encourage effort attributions in science, it is positively related to deep level cognitive thinking, whereas, ability attributions are related positively with surface level cognitive strategies (memorizing of facts). Students who hold positive values about science, feel that science is useful, interesting, important and worth their time and they usually choose science-related careers.

Linnenbrink and Pintrich (2002:323) suggested that intervention techniques should be designed to promote adaptive motivational beliefs such as increased self-efficacy; attributions to internal controllable factors; interest in the academic course and focus on effort attributions.

2.7.5 Encouraging interest in science and pursuing science as a career

Lack of interest is seen as one of the challenges leading to poor achievement in science (Makgato & Mji, 2006:260). Researchers have investigated how science interest may be stimulated in learners so that it could lead to better achievement in classroom settings.

Aschbacher et al. (2010:564) conducted a long-term study in California, USA and investigated why some students persisted in doing science at high school while others dropped out. They explored family and school factors that may influence science identities of the different genders, socio-economic families and ethnic groups. Their aim was to see how the community, schools and families could make the studying of science an interesting course.

Some researchers are of the opinion that science is a difficult course and that students are not encouraged at home or in school to pursue science as a career (Mere & Kwayisi, 2012:172). There are also no opportunities provided for learners to work with science professionals. Their focus was on physical, biological, environmental and life sciences (Aschbacher et al., 2010:564).

During social interactions with families in the home environment and with significant people in the school, learners begin to establish their science identities in relation to their communities. Science identities are determined by how students see themselves and how they are viewed by others.

2.7.6 Attributions, assistance in science through family science programmes and science achievement

Assistance from teachers and significant people in learners' environment may lead to improvement of academic performance. Support from family members, and exposure to science role models allows learners to explore their science identities and leads to improved interest, enjoyment in the course and persistence up to tertiary level.

Aschbacher et al. (2010:576) discovered that the majority of Grade 12 learners did not have strong science role models in their lives. Also, learners had poor school science experiences which resulted in lower academic achievement. They (Aschbacher et al., 2010:576) were of the opinion that the learners had no support from significant people in their environment. An important finding with Grade 12 learners was that the learners who were provided with assistance in science, were the ones who persisted and achieved well.

They recommend that educators, families, students and schools need to be provided with programmes to make science more meaningful to them (Aschbacher et al., 2010:579), for instance, introduction programmes such as family mathematics or family science. The focus of the programmes is on promoting learning in a collective participatory manner. This would provide opportunities for more students to do science within their communities and schools. It would allow students to explore their science identities and abilities in an informal, active learning environment. They may then develop a sense of enjoyment in doing science (Aschbacher et al., 2010:579).

2.7.7 Science abilities of adolescent learners

Several studies are stressing the development of abilities in the science field which may promote positive identities, interests and higher achievement by learners (Anderman et al. 2012; Aschbacher et al., 2010; Linnenbrink & Pintrich, 2002). Anderman et al. (2012:90) conducted a study in Ohio State in the USA to explore the challenges of teaching and learning science in the 21st century. They investigated the abilities and constraints of adolescent learners and how teachers may create motivational environments in the Science classroom to develop their abilities.

According to Anderman et al. (2012:90), the types of assessments that students are given in science education affects the cognitive abilities that students will apply when studying science. Furthermore, they (Anderman et al., 2012:90) note that when exam assessment focuses on memorizing facts, students will be less likely to engage in higher-order cognitive strategy use, whereas, if assessment focuses on real-life problems, students will be more likely to engage in higher order thinking and conceptual change will occur. The teacher-student relationship facilitates learning because of adolescents' need to relate with both peers and teachers.

Anderman et al. (2012:100) recommend that educators should create productive and conducive learning environments which are flexible and cooperative for science learning in the classrooms as well as to promote students' personal interests and goals. Professional development should be provided for secondary-school science teachers, adolescent motivation, recognition of adolescent's cognitive abilities and independent problem-based learning (PBL). Educators need to promote students' personal interest and goals.

Adolescent students are in a stage of developing their identities and any adverse experiences for minority groups and female students could lead to other interests instead of science. These students should be provided with an opportunity for internship under the supervision of professional scientists. Assessments for adolescents ought to focus on higher-order learning. Science assessment has to determine prior knowledge of students and what they have learned from instruction through summative assessment. Classroom assessment must focus on formative assessment, higher level reasoning, and not to focus on extrinsic stress of grade outcomes. Linnenbrink and Pintrich (2002:324) note that much of the correlational studies are not conducted in classroom learning environments. They suggest that educational researchers need to work with teachers to implement the changes in the environments to assess the effectiveness of these theories of motivation. They also indicate that the Social Cognitive Theory should stress the role of affective processes and cognitions to understand motivation.

2.8 ATTRIBUTIONS AFFECTING ACHIEVEMENT MOTIVATION AND ACADEMIC ACHIEVEMENT

Studies have stressed that interest, motivation and/support from significant people in the environment will influence learners' academic support (Eccles & Wigfield, 2000).

2.8.1 Achievement motivation impacting academic achievement of secondary school students

Interest attributions leads to an increased level of achievement motivation of the learner and resulting in improved academic achievement (see Table 2.7).

Table 2.7: Achievement motivations affecting academic achievement

Factors which lead to poor achievement in science: • Lack of qualified teachers, • poor facilities; and • lack of equipment. Motivation influences academic achievement of learners. Factors which determine success in school subjects are: • Gender, • parental involvement/support and/or • peer influence. High-motivated students perform better than low-motivated learners. Successful students have higher motivation levels than 'failure' students. Improved interest lead to improved achievement at secondary school level. Lack of motivation on part of learners will lead to the following: • Negative attitude, • no interest, • students not listening to the teacher; and • poor achievement. High motivated learners expect success, exert effort on a task, receive higher grades. Lower motivated learners do not expect success.

Tella (2007:150) stressed that motivation has an impact on academic achievement of secondary school students with respect to gender. Lack of qualified teachers, poor facilities and the lack of equipment are factors which may lead to poor achievement in science and mathematics. The author cautions that gender, parental involvement/support and or peer influence determine success in school subjects.

Tella (2007:150) noted that highly motivated students perform better than low-motivated learners. It shows that successful students have higher motivation levels than 'failure' students. Tella (2007:150) further asserts that improved interest and positive attitudes are high motivating factors which may lead to better achievement on the part of the learner.

Furthermore, when learners make negative responses and do not expect success in future, it is demotivating to the teacher (Tella, 2007:150). The educator resorts to 'chalk and talk' and does not use any instructional media. Tella (2007:150) pointed out that this leads to a cycle of negative attitude which is passed down from one generation to the next. To break this cycle of negative attitude, no interest, students not listening to the teacher and poor achievement, educators have to motivate learners. Motivation is of vital importance in the school setting. If there is no motivation, no learning may take place. Therefore, educators are encouraged to stimulate the interest in learners (see Table 2.7).

Tella (2007:150) cautioned that there are individual differences in the need of achievement levels of learners. Some people have a high need for achievement whereas others have a low need of achievement. The level of need to achieve will be determined by the role models that the learners have been exposed to in their environment. Learners who expect success will exert effort on a task and will receive higher grades than children with lower expectations of success. Secondary school students differ significantly in their academic achievement which is determined by the extent to which they are motivated (Tella, 2007:150). Understanding the attributional styles and motivation levels of learners will assist in planning academic support to reduce failure at schools.

2.8.2 Cognitive perspectives of achievement motivation

The Attribution Theory serves as the transition into cognitive perspectives of motivation. Whereas earlier theories focused on the fear of success, the Attribution Theory stresses cognitive processes in the interpretation of achievement. Weiner (1985; 1986; 2010:31) noted that people make ability and effort ascription for their success and failure ,and that these two factors have a more positive influence on achievement motivation.

Table 2.8 indicates the findings by Meece et al. (2006) on attribution and motivation level of science learners.

Table 2.8: Attribution and motivation level of science learners

Author	Findings
Meece et al. (2006) USA	striving for success Achievement is emotional conflict between avoiding failure strive for excellence Success oriented persons: anticipate pride at winning Failure-oriented persons: avoid situations where they are likely to fail

Meece et al. (2006:354) claim that achievement is the result of an emotional conflict between striving for success and avoiding failure. Thus, one finds that success-oriented individuals strive for excellence by anticipating pride at winning. On the other hand, failure-oriented persons avoid situations where they believe themselves are likely to fail.

Individuals respond differently to perceived problems due to the need for achievement motivation levels. Kenny, Walsh-Blair, Blustein, Bempechat and Seltzer (2010:207) examined the value of work based learning in fostering academic motivation among adolescents. Research (Kenny et al., 2010:207) indicated that high-achievement motivated individuals tend to make higher attributions to ability and effort than low-achievement motivated individuals. On the other hand, low-achievement motivated individuals make lower attributions to ability and effort.

Basturk and Yavuz (2010:1940) investigated the causal attribution patterns of Turkish high school students after success and failure in mathematics. They assert that attributions exert an impact on students' motivation to learn. Hence, students' beliefs about their causes of success and failure could influence their academic achievement. They assert that attributions exert an impact on students' motivation to learn (see Table 2.9).

Table 2.9: Attribution and motivation to learn

Author	Findings

Basturk and Yavuz (2010)
 	
Turkish high school Students
	• Attributions influence:
	  o students' motivation to learn, and
	  o influence students' academic achievement.
	• Factors affects student poor achievement:
	  o Course books;
	  o teaching methods; and
	  o labelling students as unsuccessful.
	• They suggest:
	  o Changing student attributions to avoid further failure;
	  o be aware of factors that hinder learning; and
	  o take necessary precautions.

Basturk and Yavuz (2010:1942) indicated that course books, teaching methods and labelling students as unsuccessful are factors that affect the students' poor achievement.

They suggest that changing student attributions could help them in educational settings to avoid further failure. Furthermore, they caution that one should be aware of factors that hinder learning so that necessary precautions may be taken (Basturk & Yavuz, 2010:1943).

Hawi (2010:1128) noted that teaching styles and communication patterns affect children's attributions. Table 2.10 summarizes the findings by Hawi (2010) on increasing motivation of learners.

Table 2.10: Motivation and attributional re-training

Author	Findings
Hawi, 2010	Achievement motivation increases when: • Teachers are caring, supportive and give feedback. • Students may be motivated through attributional re-training. • Knowledge of causal attributions of learners will indicate the use of intervention strategies with low achievement students.

According to Hawi (2010:1128), children are motivated to achieve and to expect success when teachers are caring, supportive and give feedback. Students may be motivated through attributional re-training. If teachers have knowledge of causal attributions of learners they may use intervention strategies with low achievement students who hold self-defeating attributions.

2.8.3 Achievement motivation and attributional styles in educational settings

Research has shown that attributions for success and failure play a major role in moulding future expectancies and motivation (Basturk & Yavuz, 2010:1940). Table 2.11 below shows researchers views regarding achievement motivation and attributions.

Table 2.11: Achievement motivation and attributional styles in schools

AUTHOR	FINDINGS
Hareli and Weiner (2002)	Expectancy of future success is related to self-esteem, guilt and shame (intrapersonal theory of motivation). Attributional causes determine future expectancies and motivation.
Weiner, (2010).	Understanding of attributional styles and achievement motivation levels among students have a positive impact on an educator's approach in educational settings. High-achievement motivation high ability attributions.

Hareli and Weiner (2002a:257) note that expectancy of future success is related to self-esteem, guilt and shame (intrapersonal theory of motivation). Studies have shown that understanding of attributional styles and achievement motivation levels among students have a positive impact on an educator's approach in educational settings (Weiner, 2010:32).

2.8.4 Intra-personal theory of motivation

Weiner (2000:2) mentions two theories of motivation, namely, an intra-personal theory of motivation and an inter-personal theory of motivation. The intra-personal theory includes expectancy of success and is related to pride, guilt and shame.

Weiner's inter-personal theory includes beliefs about responsibility of others and other-direct d effects of anger and sympathy:

- Intra-personal theory → Expectancy of success → related to pride guilt and shame.
- Inter-personal theory → beliefs about responsibility of others → other directed affects.

Weiner's (2000) intra-personal Attribution Theory is not much concerned about the content of causal attribution but on the pattern of underlying characteristics of a major cause on the three dimensions discussed earlier: locus, stability and controllability. The Attribution Theory has played a leading role in motivation, Social Psychology and Educational Psychology. Weiner (2000:2) has presented his model of attribution to motivation and classroom concerns.

In order to predict whether a student who has failed an exam will continue or drop out, one will have to examine the subjective expectancy of future success and affective reactions such as self-esteem, guilt, shame and others. Weiner (2000:4) labelled these thoughts and feelings as intra-personal theory of motivation. If a student fails in an exam, teachers, parents and peers evaluate the person to be good or bad. This leads to anger or sympathy and it results in positive or negative feedback. These other-directed thoughts and feelings Weiner labelled as an inter-personal theory of motivation (Weiner, 2000:4).

2.8.5 Inter-personal theory of motivation

People are scientists, attempting to understand themselves and their environment. When a student fails he/she feels unhappy. The student wants to know what caused the negative outcome. The reasons will be based on past history of success and failure, social norms or the achievement of others, rules about relations between causes and hedonic bias.

This theory shows that if a person has always failed, the failure will be attributed to the self. If others succeed while the person fails, then the failure is more likely to be ascribed to the self (rather than to the task). If the person believes that he *did not* put enough effort into the task it will be related to a self-related ability belief.

The study of Hareli and Weiner (2002b:183) focused on the self- and other-directed emotions that are made in achievement-related situations following success and failure. They claim that achievement is not only determined by the learner, but also by external influences such as teachers, parents or peer group. These significant others react to the achievement of the student (interpersonal Theory of Attribution). Teachers and parents will engage in a causal search of a failing student. Cause is placed in a dimensional space and controllability is of vital importance. If failure is ascribed to lack effort (subject to volitional control) it will elicit anger at the child not studying. The child will be held responsible for the negative outcome. Anger in turn leads to punishment or reprimand from teachers/parents. On the other hand, if failure is due to lack ability (uncontrollable) the failing student is not held accountable and it elicits sympathy.

Learners are sensitive to others' reactions to their achievement in academic settings. The interpersonal setting has a variety of emotional consequences. When a learner succeeds in a difficult test, it leads to praise, envy or admiration from others. However, failure on the part of the learner may lead to pity from others.

Hareli and Weiner (2002b:184) claimed that self-directed emotions (pride, shame, guilt and hopelessness) are the same regardless of audience. These emotions may also be regarded as social emotions as they are based on social considerations. Their study revealed that when effort attributions for success are made it will result in feelings of pride and raise self-esteem. Effort, as compared to ability is controllable and, is therefore seen as playing a more important role in leading to feelings of pride. Effort ascriptions do not arouse envy and the learner is admired.

On the other hand, when the learner attributes his success to high ability and tells the teacher or peer, 'I succeeded because I am very smart' or 'I failed because I did not try', it may indicate arrogance on the part of the learner (Hareli & Weiner, 2002b:188). However, it may result in envy from others who do not have high ability.

If a student succeeds because of help from others it results in gratitude. It may lead only to gratitude if the help was intended and not forced on the person. There is a strong hedonic bias to take personal credit for success by attributing success to internal factors. The internal thoughts about the cause of success may not be the same as the beliefs expressed publicly. In many situations, pride may result because of politeness. It is assumed that gratitude expressed by students toward their teachers may increase teachers' motivation, job satisfaction and improve teachers' attitudes towards students.

Hareli and Weiner (2002b:188) also indicated that low ability attributions for failure situations produce shame, whereas a lack of effort attribution results in feelings of guilt (assuming a desire to reach the goal).

2.8.5.1 The consequences of emotions for future achievement

If failure is attributed to low ability or task difficulty, then hopelessness is experienced. Hopelessness is related to stability, pride (internal causality), shame (internal uncontrollable cause), guilt (internal, controllable) and gratitude (external, controllable).

Ability and task difficulty are constant. When failure is attributed to these causes it will lead to a perception that the learner will fail the same task in future and, in turn, this produces feelings of hopelessness (Hareli & Weiner, 2002b:186). However, hopelessness may be reduced if teachers give detailed feedback on reasons for failure.

2.8.5.2 Emotions of the other

Involved observers (teachers, peers) also experience affective reactions determined by the outcomes of achievement in the test the way learners do. When a student succeeds because of internal factors (high ability or effort) then an involved teacher may also feel proud and other students may feel proud as part of their identity. However, it may also result in envy from peers who may compare their achievements and efforts and also desire to achieve well (Hareli & Weiner, 2002b:187).

2.8.6 Eccles' expectancy-value theory of achievement motivation

Motivation theorists show how motivation influence learners' effort and achievement about expectancy in future tasks and how much they value the task. Atkinson (1964) and Eccles (2000) investigated adolescents' and children's' ability beliefs, expectancy for success and subjective values (Eccles & Wigfield, 2000:68).

Eccles defined ability as individuals' perceptions of their competence in different areas. In the expectancy-value model ability beliefs are regarded as competence in a given area, in contrast to one's expectancies for success on a specific task (Eccles & Wigfield, 2002). However, they have observed that children and adolescents do not distinguish between these two different levels of beliefs. Ability and expectancy beliefs are important concepts in the expectancy–value theory of motivation and are present in other theories as well. Weiner (2010) noted that ability attributions determine motivation. Attributing success to ability has positive motivational consequences, whereas attributing failure to lack of ability has negative consequences (Bøe, Henriksen, Lyons & Schreiner (2011:21). The abilities learners have will influence whether they will fulfil themselves and whether they expect success in future.

The article by Bøe et al. (2011:22) revealed that the model developed by Eccles et al. provides a very 'useful lens' through which to examine, structure and understand the literature regarding young people's decisions about science and mathematics.

Expectancy and value are assumed to influence achievement and effort. Person's effort and achievement about belief of how well they will do is determined by their belief of how much they value the activity (Atkinson, 1957; Eccles & Wigfield, 2000:69). Expectancies and values influence ability beliefs, the perceived difficulty of the task and affective memories. These social cognitive factors in turn are influenced by persons' perception of their previous experiences and socialization experiences (Eccles & Wigfield, 2000:69).

Eccles' achievement model includes different components of achievement:

- The attainment value has to do with how well the learner performs in the task.
- The intrinsic value is enjoyment derived from doing the task.
- Utility value or usefulness is how well it fits with persons' future plans.
- Utility value involves external reasons for performing the task, to achieve a certain goal.
- Extrinsic motivation; Interest value (intrinsic motivation) is enjoyment in the task.
- Cost to do one thing and give up another.
- Interest value (intrinsic motivation) is enjoyment in performing the task.
- Interest value (intrinsic motivation) is enjoyment in the task.

The attainment value, interest enjoyment value and utility value influences the expectation of success and subjective values and will determine whether or not the learner will choose a subject.

Regarding the attainment value, young people could be encouraged to choose science as a career by teaching and presenting the material in a way to acknowledge the identities of learners (Bøe et al. (2011:23). There is a challenge in keeping learners interested in science and to continue with science as a career at tertiary level. Teaching styles and textbooks could be helpful to increase the interest of learners in science. The common perception of learners to see science as 'dull' is disturbing since interest is important for young people. Furthermore, Bøe et al. (2011:22) suggests that interest and enjoyment in science subjects could be increased if subject matter links science to social issues of current interest. Role models are also powerful in influencing the learners by giving them information about various career opportunities. To increase the utility value of science, extrinsic rewards could be offered to encourage participation of more learners (Bøe et al. (2011:23).

Utility value is concerned with how helpful education choice is in reaching the learners' career goals. Bøe's review (2011:23) indicates that physics may have high utility value for learners who are interested in medical studies. In some schools systems, learners are rewarded with extra credits for science subjects. these subjects may have utility value by raising the learners' general qualification to ensure university entrance. Females rely more on the utility value of science subjects and they tend to choose science majors because they need to enter health professions.

2.9 GENDER DIFFERENCES IN ATTRIBUTIONS, ACHIEVEMENT MOTIVATION AND ACADEMIC ACHIEVEMENT

Literature on gender differences in attribution and achievement motivation has been the documented in many studies (Meece et. al., 2006:353; Batool et al., 2010:455).

Table 2.12 below explains the earlier theories of gender differences in motivation Levels

Table 2.12: Earlier theories of gender differences and motivation

Author	Findings
McClelland, Atkinson, Clark and Lowell (1953)	• Women less success–oriented than men. • Women fearful of success.
Atkinson (1964)	• Introduced expectancy-value theory of achievement motivation. • Expectancies and values were inversely related. • Atkinson's' expectancy-value theory stressed gender differences. Related to motive to approach/avoid success and concerns about failure. • Tasks that were more difficult would have more incentive value. • Highly valued tasks had low expectancies of success.
Horner (1975: 207)	• Females avoid success and expect negative consequences. • Expect social rejection. • Fear of success – psychological barrier to women's achievement.
Meece et al (2006:353)	• During 1970s and early 1980s the Attribution Theory was the predominant theory of motivation. • The Attribution Theory used to understand gender differences in achievement motivation. • Attribution theories stress the cognitive process involved in interpreting success and failure in achievement situations.
Eccles (1994)	• By the late 1970s motives to avoid success and fear of failure was disproved due to biases. • Studies did not take into account socialization process of men and women.
Weiner (1985; 1986)	• People make ability and effort attributions for achievement. • Ability and effort attributions have positive effects on motivation.

The gender differences may be due to the fact that gender inequalities in education have changed tremendously over the past three decades. In most societies the roles of men and women differ and women tend to have less access to resources than men (Batool et al., 2010:454).

During 1970s and early 1980s the Attribution Theory was the predominant theory of motivation and used to understand gender differences in achievement motivation (Meece et al., 2006:353). Early studies stressed differences in male and female motive to succeed. McClelland, Atkinson, Clark and Lowell (1953) used Thematic Apperception Test (TAT) to assess motives in college men and women. Women were seen as less success–oriented than men. Horner (1975) concludes that women have the tendency to avoid success, because they expect negative consequences. Thus, fear of success was seen as a psychological barrier to women's achievement.

Atkinson (1964) introduced the expectancy-value theory of achievement motivation and claimed that achievement motivation was a function of motive for success, expectation for success, the incentive value of success and the motive to avoid failure (Meece et al., 2006:353). This model includes the person's subjective expectations of success and the anticipated consequences of an outcome.

According to Atkinson's theory, tasks that were more difficult would have more incentive value for the person. Expectancies and values were inversely related so that highly valued tasks were those individuals who had low expectancies of success.

Like McClelland, Atkinson's Expectancy-Value Theory also indicates that gender difference exist related to motives to approach/avoid success, concerns about failure, and expectations for success. By the late 1970s, the hypothesis to avoid fear and failure were not proven. Eccles (1994) claimed that the studies did not take into account the socialization practices and education levels of males and females (Meece et al., 2006:352). The study of Addiba (2004) also indicated gender differences in attribution. Her study found that male students attributed their success and failure to ability. Batool et al. (2010:455) indicated that religious males use more ability attributions for success than females; however, their achievement was lower than females and contrasted with findings by Weiner (1985).

2.9.1 Gender and high school students' perceptions of science and science careers

Quinn and Lyons (2011:225) were concerned about the uneven distribution of males and females in senior science courses and careers in Australia. Therefore, they studied the differences in Australian high school perceptions of and attitudes towards school science, and how these differences relate to their intentions to study university science courses. According to Quinn and Lyons (2011:225), females tended to be over-represented in the life and health sciences, and under-represented in physics, earth science and engineering. Their study consisted of 3800 students who were 15 years old and the researchers investigated the gender differences of Australian high school students' perceptions of school science, their intentions to continue with science at tertiary level, job security, self-rated ability and enjoyment of school science. High school students were included in the study because Eccles (2009) noted tha intentions regarding potential careers are often formed in early high school (Quinn & Lyons, 2011:226). They play an important role in the perceived instrumental value of science subjects for senior high school, with students considering a science career for their long term goals.

However, males enjoyed science more than other subjects than did females, and they rated their ability in science higher than females. Quinn and Lyons (2011:229) noted that there were no significant differences between males and females intentions of choosing science as a career when leaving school. The strongest predictors were students' responses on their liking for school science and their awareness from school science of new and exciting jobs. This was followed by their perceived self-ability. Factors which also contribute to the development of poor science self-concept in females include lack of the opportunity to manipulate equipment, sex-bias in teaching materials, the absence of a more gender-inclusive curriculum and pedagogy (e.g. by using more cooperative learning strategies, incorporating topics of more interest to females, facilitating deep learning, providing authentic inquiry-oriented learning mastery experiences, high socio-scientific aspects (Quinn & Lyons, 2011:232). These factors are almost nonexistent in the 'cultural-milieu' of the majority of South African schools. Such negative factors may lead to poor performance in science. Attempts are however, being made to improve the situation with the implementation of the CAPS curriculum in the country.

2.9.2 Changing attitudes and interests of male and female learners in secondary school science

Barmby, Kind and Jones (2008) conducted a study in England and examined changing attitudes towards science over the first three years of secondary schooling and with gender. The study was an evaluation of the 'Lab in a Lorry' project, in which 932 learners completed a questionnaire to provide information about learners' views on the project and science. Lab in a Lorry is a visit of a mobile laboratory to schools to evaluate learners' change in attitude towards science after the visit.

Researchers in many countries are concerned about the reason why learners are not following science as a career. This is a concern for future physics teachers and professionals in science (Barmby et. al., 2008:10). Educators need to find ways to increase science learners in school and to see how to increase interest in science during secondary school.

The researchers discovered that during first years in secondary school (year 7 and 9), there was not much difference in the interest of learners. Their interest declined as they progressed through secondary school and this decline was more noticeable for female learners (Barmby et al., 2008:7). In the final part of the study the researchers interviewed 44 learners in five schools to get information about their views on the Lab in the Lorry project and science in general. Interviews with learners provided insights into why learners did not enjoy science and did not find it interesting as they progressed to higher levels (Barmby et al., 2008:6). The researchers noted that learners' interest in science was stimulated by practical work which was conducted in Lab in a Lorry. Learners asserted that they found the science course 'boring' because it was not well explained (2008:9). The study shows that teaching methods, and not the curriculum, makes a difference in encouraging interest in science at high school level (2008:11).

2.9.3 Interests and related attitudes in science among middle - and high school students

There has been a concern for the lack of interest towards science and science-related careers among U.S. students. This lack of interest and negative attitudes towards science is also found in South African schools (Mere & Kwayisi, 2012:168). Desy, Peterson and Brockman (2011:23) noted that explanations given for this state of affairs in the USA, included the development of negative attitudes toward science that originate during the elementary school years and persist through the secondary and post-secondary years. It was noticed that although a number of variables may affect students' attitudes toward science, gender and the quality of science instruction appeared to be the most influential. Studies by the American Association of University Women [AAUW] (1991) have shown that females tend to exhibit more negative attitudes toward science classes and a career in science than males (Desy et al. 2011:23). In addition, females' interest in science steadily declined from middle school to the high school.

According to Desy et al. (2011:23), the purpose of the research was therefore to measure attitudes and interest in science among middle school and high school students from rural, southwest Minnesota. Their primary goals were to 1) compare the science-related attitudes of middle school and high school students; 2) determine whether gender and attitude towards science differences in science-related attitudes exist for these students and what factors may be responsible for any observed differences; and 3) examine the types of college majors and careers that current 6^{th} - 12^{th} grade rural students were considering.

Desy et al., (2011:23) selected 1299 participant students in middle schools (Grades 6 - 8) and high schools (Grades 9 – 12) of 2007. The middle school sample consisted of 316 males, 307 females and 3 students who did not report their gender. The high school sample consisted of 326 males and 338 females.

Desy et al. (2011) used a 50-item survey instrument for their research requiring Likert style responses. Attitudes toward science scale items included perception of the science teacher, anxiety toward science, value of science in society, self-concept in science, enjoyment of science, motivation in science and attitudes toward science in school. Questions relating to student interest in science, encouragement they received from adults, participation in science, their personal connection to science, perceived opportunities in science for rural students and demographic characteristics, were included in the instrument.

According to Desy et al. (2011:28), main findings from this research indicated that the students had relatively neutral attitudes toward science. They continued that, lowest scores were obtained for the 'enjoyment of science' and 'motivation' in science scales, whereas 'value of science in society' and 'perception of the science in science teacher' were rated the highest. These findings suggest that although most students neither enjoy nor have an interest in science, they nevertheless recognise the importance of science in today's world. In fact, students are earning more high school credits in mathematics and science than they did two decades ago (U.S. Department of Education, 2007). Ratings were generally more positive for high school students than for middle school students, except for the 'self-concept in science' scale where high school students had lower scores. This finding may reflect the increased difficulty of science-related coursework at the high school level in the USA (AAUW, 1991).

Desy et al. (2011:28) also reported that gender differences in attitudes toward science were also evident in their sample. Females scores were lower than males on the 'enjoyment of science', 'motivation in scienc.' and 'attitude toward science in school and self-concept in science' scales. Females also reported a greater level of 'anxiety toward science' than males. Desy et al. (2011:28) continued that gender differences were larger and statistically significant among the high school students indicating a gender gap that widens with education level.

The report continues that gender differences in favourite and least favourite subjects were also more evident among high school students than middle school students. The top three favourite and least favourite subjects were almost identical for middle school males and females. For the high school students, however, English was much more popular among females than males, and science was much more popular among males than female.

Interestingly, mathematics topped the list of both favorite and least favorite subjects for high school females, suggesting that students have strong opinions about mathematics as a school subject – they either 'loved' it or 'hated' it.

The research examples above indicate the similarities of characteristics that associate student's attitudes to science learning and the factors that contribute to the developments of such attitudes.

2.9.4 Gender differences of Korean tenth graders' science achievement

Research has shown a difference between male and female attitude and perceptions towards science. Bang and Baker (2013:28) examined the gender differences of Korean tenth-grade students' science achievement and their attitudes and perceptions towards science. The study was conducted in different gender settings which were an all-male institution (AM), an all-female institution (AF), and a co-educational institution (CE). Results showed that learners from the three school types had significant differences regarding their attitudes and perceptions towards science. Students from CE schools had significantly higher science achievement and positive attitudes towards science, but significantly lower stereotypical images of scientists. Bang and Baker (2013:28) showed that male students consistently choose science-related careers more often than female students.

The results of the study with Korean learners showed that average gender differences of Korean showed a decrease from TIMSS in 1995 to TIMSS-R in 1999 and the 2000. However, the scores were still higher than the international average. The gap differences between male and female were most prominent in physics, chemistry, earth science and other science-related courses.

According to the researchers, the results demonstrate that the Korean schools have very little support from their communities, poor lab equipment, and very little resources in their libraries related to science topics. The teachers and principals also have negative attitudes to science and stereotypical perceptions about females.

Most studies agree that both male and females be given equal opportunity in science, stimulate science success for both, they need to develop positive attitudes and perceptions about science. Schools need to have equal opportunities for both genders especially in the area of science (Bang & Baker, 2013:39).

These researchers are of the opinion that the access of resources needs to be increased for females who have as much potential as their male counterparts that the community need to overcome cultural barriers which hinder the modern educational system.

2.9.5 The under-representation of females in science courses

Several studies have shown that there is a difference between males and females in terms of science interest. If the low achievement in science is to be improved we need to look at literature which gives us reasons why women are under-represented in science courses.

Bøe et al. (2011:12) reviewed literature and noted that young people are reluctant to take part in science subjects in highly developed and modernised countries such as Australia (Lyons & Quinn, 2010). Their review evidenced that young male and female learners in different countries made different choices about science participation. They noted that 15 year old boys were significantly more inclined towards future science-related study and careers than were girls. Students' interest in physics as a school subject was less related to their interest in physics than to the students' self-esteem as being good achievers. Thus, for school physics, it appears that interest and expectation of success are positively related, in line with Eccles and Wigfield's (2002) claim.

Lyons and Quinn (2010:229) found that declining science enrolments among Australian year 11-students were likely to be due to school science's failure to engage students, but unlikely to be due to a decline in general interest in science among today's young people.

Barmby et al. (2008:1085), suggested that learners need to find science enjoyable so that their interest is stimulated and they are encouraged to pursue science as a career. Bøe et al. (2011:12) noted that the physics curriculum does not take into account the interest of the learner, especially those of girls.

One reason why males are more interested in science as compared to females is that they have more childhood experiences involving science and technology (Hazari Sadler, & Tai, 2008). The decline in students' attitudes during secondary years has been especially pronounced for girls (Barmby et al., 2008).

Eccles (2009) noted that learners place higher value on subjects which fits with their identity. It is vital to experience success so that that personal needs are fulfilled (Eccles, 1994). Success makes learners proud of themselves and it encourages them to overcome challenges (Bøe et al. 2011:14). Eccles (2009) found that young American girls were less likely than boys to enrol in science courses because they found it less important, useful and enjoyable than boys (Bøe et al. 2011:15). Lyons and Quinn (2010) noted that Australians girls were less likely than boys to choose science as a career. They suggested that girls need to be given more information about science as careers for women (Bøe et al., 2011:15). Studies also indicated that young women lack role models which may have an effect on their science identities to pursue science as a career (Aschbacher, Li & Roth, 2010).

Bøe et al. (2011:19) stress that science careers are costly in terms of difficulty and many years of study, which discourages young people who will look for other careers which offer faster ways to earning a high salary.

Eccles and Wigfield (2002:119) define expectation of success as 'individuals' beliefs about how well they will do on upcoming tasks'. They distinguish between expectation of success in specific upcoming tasks and beliefs about their abilities in broader fields. However, they claim that the two concepts cannot be empirically separated.

High achievers in science subjects have been found to have lower expectations of success in science than in most other subjects (Lyons, 2006). This may have a negative effect on science enrolment, sense of mastery and expectation of success (Eccles & Wigfield, 2002). Boe's review shows that learners have lower expectations of success in science because science is perceived as a difficult and demanding subject.

Students' self-perception and expectation of success in science are shaped by parents and teachers, who thereby also influence future educational choices (Hazari et al., (2010:978).

The review of literature by Bøe et al. (2011:22) revealed gender differences in application of all the aspects of the Eccles model. Girls tend to have lower expectations of success and find science more difficult than boys. They identify less with role models in area of science and have different interests. Furthermore, girls are also less inclined to find satisfaction in achieving success in science related success than boys.

Young people's interest in science declines as they progress through school. Young people find that science does not suit their identities and they do not see themselves as following science careers. Many students are motivated to choose science subjects to gain admission to tertiary level and because of high salaries in the science field (Bøe et al., 2011:21).

Bøe et al. (2011:22) noted that the model developed by Eccles et al. provides a very useful lens through which to examine, structure and interpret the research literature concerning young people's relationships to and decisions about science and mathematics.

Researchers show that learners' interest in school science may be stimulated by using effective teaching methods and textbooks which are meaningful and includes topics in science that interest the learners. Also, to increase interest by relating subject matter in science to social issues of current interest and careers with which females can identify and not feel isolated (Bøe et al., 2011:23).

Bøe et al. (2011:24) made some suggestions to encourage learners' interest, enjoyment and motivation to succeed in science: reduce learners perception of science as difficult and demanding; make learners aware of the benefits of science subjects offered; have tutoring support groups to reduce fear of failure in science; explain to females that science is challenging and it contributes to make it more attractive; reduce cost for females by removing stereotype threat that women are less capable than men in STEM in subjects; choose subjects not conflicting with their identities; help learners to use their potentials and abilities; introduce STEM education programmes to recruit more young females and teaching materials should be easily accessible, require little additional preparation, and be straight-forward to incorporate into the curriculum (Bøe et al. 2011:25).

2.9.6 Gender differences in science participation and future achievement

As noted by Hazari et al., (2010:978), self-perception and expectations of students regarding success in science is shaped by parents and teachers

Studies show that physics identities are moulded by experiences in high school and their career expectations. Hazari et al. (2010:978) investigated how students physics identities are shaped by their experiences in high school and their career expectations. They asserted that students' self-perception and expectation of success in science are shaped by parents and teachers, who thereby also influence future educational choices (Hazari et al., 2010). Physics identities are important to determine later choosing physics as a career. The literature focuses on physics identity and includes dimensions of student achievement, competence, recognition by others and interest. Hazari et al., (2008) noted that males were more interested in science than females because of their childhood experiences regarding role models.

Hazari et al., (2010:978) asserted that females' physics identities appeared to be non-existent. Females reported to experiencing real world connections to science less frequently than men. The study gives us a good framework to study effort spent on science and change in high school physics teaching. Gender difference in physics participation and the lack of number of physics graduates every year has been a concern to science educators (Hazari et al., 2010:979).

Researchers in physics teaching and learning have shifted the focus to affective domains to better understand effort and gender differences in physics participation. The study looked at high school physics and career outcome expectations to predict how students, especially females, see themselves in terms of physics. They focused on students' identity rather than on students' attitude because they believed that it was a more meaningful measure.

Hazari et al., (2010) investigated how high school physics pedagogy, influences students' physics identity. They noted that students' interest, motivations, beliefs about themselves, influences the effort they will exert and their participation in science. According to the Social Cognitive Theory, interest is vital in decision of career studies and it is likely that there is relationship between interest and career choice which is influenced by changes in identity perception. Modifying the physics curriculum by taking into account the interests of females had significant positive effect on girl's physics self-concept (2010:978).

Researchers are concerned about the under-representation of females in physics and the loss of interest in physics at an early stage. Hazari et al. (2010:978) cited studies suggesting that parents' perception and expectations regarding child's abilities in science influence the child's self-perceptions and expectations. Furthermore, parents and peers have frequently been found to hold gender stereotypes favouring males when considering males' and females' abilities in science. This indicates that there may still be opportunities in high school to encourage female students' interest in science. There may also be the prospect to increase interest not only for girls, but also for boys, who are entering with negative attitudes. It may also encourage all learners who hold false stereotypical values regarding physics in the high school classroom, to follow science as a career. It would be ideal to intervene earlier, however, changes could also be effected at high school level (Hazari et al., 2010:981).

Hazari et al. (2008) noted that performance differences are greater in high school physics where female representation is smaller (Hazari et al., 2010:981). Thus, Hazari et al. (2010:981) stress that the way students perceive themselves in relation to physics performance, affects their career choices as well as their future performance.

2.9.7 Gender, motivational orientations and achievement of secondary school students in combined science

The following section looks at and discusses examples of research conducted on students' attitudes and or motivation towards science learning and the factors that contribute to the development of such attitudes or motivation and their effect on students' performance in science.

Chow and Yong (2013) investigated students' motivation in combined science. Firstly, their study examined the motivational orientations of year 11 art stream students towards learning combined science. Secondly, they investigated whether there were any significant differences in motivational orientations between males and females in learning combined science. Thirdly, they examined what the relationships were between year 11 art stream students' motivational orientations and achievement in combined science.

The research was based on the fact that science in Brunei, like South Africa, is given prominence in the school curriculum and that every Bruneian child has the opportunity to study science right from the primary to the secondary level of education. Concomitantly, and as in South Africa, much effort is put into enhancing the quality of science teaching and learning. Students' attitudes towards science are not different from that of South Africa. In Brunei, as in South Africa, as many as 75% of students fail to make the grade after completing 8 years of schooling to enter into the stream (Chow & Yong, 2013:213). They found it necessary to research the causes of this failure rate.

In their study, a sample of 324 Year 11 students from eight government secondary schools in Brunei Darussalam participated in the study. Of the sample, 141 were males and 183 were females and their average age was 16.4 years. The researchers used an adaptation of the motivation instrument from Glynn, Taasoobshirazi and Brickman (2009). The scales of test items were on intrinsic motivation, extrinsic motivation, personal relevance, self-efficacy, and self-determination and assessment anxiety. The descriptors included:

- Extent to which students learn science for its own sake;
- Extent to which students learn science to meet ends;
- Extent to which students learn science for its relevance to their goals;
- Extent to which students are confident that they can achieve well in science;
- Extent to which students believe they have some control over learning science; and
- Extent to which students feel tensed over their own grading in science.

Findings from the research indicated that the students displayed a moderate level of intrinsic motivation, personal relevance, self- determination and self-efficacy and a high level of extrinsic motivation and assessment anxiety in learning combined science (Chow & Yong, 2013:223). Results from the research also demonstrated significant differences in motivational orientation towards learning combined science between males and females and between high ability and low ability students. In addition, correlation analyses revealed that there were significant positive associations between students' motivational orientations and science achievement (Chow & Yong. 2013:213).

2.9.8 Role of gender in attribution

McClure et al. (2010:75) conducted a study in New Zealand and indicated that gender plays a role in attribution. Table 2.13 below indicates a summary of the findings by McClure et al. (2010) to show the relationship between attributions, gender and achievement.

Table 2.13: Gender differences of secondary students' general achievement

Author	Findings
McClure et al. (2010), New Zealand	Females' best marks - more to effort (unstable) than male. Females' worst marks – more to lack of ability than males. Females' more test difficulty attribution than males. Females' best and worst marks to teacher (little control) more than males. Males' worst marks more to bad luck than females.

According to McClure et al. (2010:72), the social context (such as family, friends and teachers) was more important for females and they attributed their best and worst marks to teacher and other uncontrollable influences more than male students, whereas males attributed their worst marks more to bad luck than females. Males attribute success to ability, effort, interest and self-confidence. Females made more use of effort (unstable) attributions for their best marks than males. They ascribed their worst marks more to lack of ability and test difficulty than males.

Other studies (Lloyd et al., 2005:402) showed that male students attribute their success to ability more than female students, whereas, female students attributed their success and failure more to effort and the teacher than male students.

2.9.9 Gender differences in proving Weiners' Attribution Theory of academic achievement

Batool et al. (2010) investigated the attributional style of Grade 10 learners and its effects on academic achievement (see Table 2.14 for details).

Table 2.14: Gender differences in proving Weiners' Attribution Theory

MALES	FEMALES
Males from mainstream schools – • External, stable and uncontrollable attributions. • Achievement low. • Mainstream results proved Weiners' theory.	Females from mainstream schools - • Internal, unstable and controllable attributions. • Achievement higher than boys. • Mainstream results proved Weiners' theory.
Males from religious schools – • Internal, unstable and controllable attributions. • Achievement lower than girls. • Religious results contradict Weiner's theory.	Females from religious schools – • External, stable and uncontrollable attributions. • Achievement higher than boys. • Religious results contradict Weiner's theory.

Their study demonstrated that Grade 10 males perceived themselves to be more competent than females. Males were less likely to attribute failure to lack of ability and more likely to attribute success to ability than females. Males from mainstream schools showed external, stable and uncontrollable attributions and as a result their achievement was also low. On the other hand, females from mainstream schools showed internal, unstable and controllable attributions and their achievement was higher than those of males (Batool et al., 2010:455). The mainstream results have proven Weiner's theory.

Males from religious schools showed internal, unstable and controllable attributions. However, their achievement was lower than that of females. Females from religious schools showed external, stable and uncontrollable attributions and their achievement was higher when compared to males. The results from religious schools have contrasted with the findings in Weiner's theory. Table 2.14 stresses the male and female differences in mainstream and religious schools as discussed by Batool et al. (2010).

The researchers (Batool et al., 2010:455) concluded that students from religious schools may have marked the statement of the attribution scale carelessly or due to their authoritarian background and a fear of their teachers, they kept their feelings hidden.

Meece et al. (2006:351) noted that male and female motivation-related beliefs follow gender role stereotypes. The males in their study showed higher ability and interest beliefs in science and mathematics. However, the females exhibited higher confidence and interest in language arts and writing. The researchers felt that the gender differences in motivation are due to ability, ethnicity, socio-economic status and classroom context. During the last three decades women have acquired a higher education and career level. More high school females are enrolled in science courses in the United States. However, females are less likely than males to find science courses interesting (Meece et al., 2006:352).

2.9.10 Gender difference is cognitive-motivational

Some studies suggest that gender difference is cognitive-motivational in nature (Rusillo & Arias, 2004:103). Mudhovozi et al. (2010: 589) contend that academic achievement attributions are gender neutral. In line with this finding, several studies have concluded that both male and female successful students made internal attributions and made external attributions for failure conditions (Batool et al., 2010: 590). Studies (Rusillo & Arias, 2004:103) indicated significant differences between male and female for attribution of success and failure. Table 2.15 below represents the gender differences in attribution.

Table 2.15: Gender differences for attribution of success and failure

Author	Males	Females
Rusillo and Arias, (2004).	• Males attribute failure to external factors – luck/ the teacher. • Luck attributions for success.	• Females attribute failure to internal factors (lack of effort or lack of ability) more than do males.
	• Males show greater extrinsic motivation than females.	• Females show less extrinsic motivation than males.
	• Males made more ability and luck attributions achievement.	• Females achieved better marks in language than males.
	Males and females made more internal, effort attributions for achievement.	

Rusillo and Arias (2004:103) assert that females take more responsibility and attribute failure to internal factors (lack of effort or lack of ability) than males. This reveals that female students rate internal factors more important than males (Mudhovozi et al., 2010:590). On the other hand, males attribute failure to external factors such as luck or the teacher and luck attributions for success in academic settings.

According to Rusillo and Arias (2004:104), males show greater extrinsic motivation than females and they tend to avoid negative judgements. There were no significant differences shown by males and females concerning internal motivation and academic self-concept. Males and females showed differences in terms of motivation levels. Females achieved better marks in language than males. Males and females made more internal, effort attributions when explaining their achievement, whereas, males made more ability and luck causal attributions for their academic achievement. Females attribute failures to unstable external variables like luck or internal causes such as effort to enhance their own image (Rusillo & Arias, 2004:104).

2.10 ATTRIBUTION AND SOCIO-ECONOMIC STATUS (SES)

Many studies have shown a relationship between socio-economic background of learners and achievement in school (Legotlo, Maaga, Sebego, van der Westhuizen, Mosoge, Nieuwoudt & Steyn, 2002; Howie, et. al., 2008; Reddy, et. al., 2012).

2.10.1 Poor achievement of disadvantaged learners in Grade 12

Legotlo et. al. (2002) assert that research has neglected to investigate the factors that lead to poor achievement of students in the Grade 12 National Examinations. Their study notes that most learners in South Africa are from disadvantaged and lower socio-economic backgrounds. Hence, there is a lack of resources provided for them in the educational setting and it leads to the poor achievement by learners in Grade 12. Table 2.16 below summarizes the findings by Legotlo et. al. (2002).

Table 2.16: Poor achievement of learners in Grade 12

Author	Findings
Legotlo et al., (2002)	Causes of poor achievement of learners in Grade 12: • Inadequate physical and human resources; • the low socio-economic background of learners; and • learners could not afford secondary education. Schools not well equipped with regard to following: • Electricity; • libraries; and • laboratories. Lack of: • appropriate textbooks; • learning and teaching aids; • classrooms; • space in classrooms; • qualified educators; • discipline in schools; and • parental involvement.

Legotlo et al. (2002:115) report that causes for poor achievement the Grade 12 National Examinations were: Inadequate physical and human resources; the low socio-economic background of learners which leads to most of the learners who could not afford secondary education without state assistance. Their study indicates that schools were not well equipped in terms of electricity, libraries and laboratories. Their study also showed that there was a lack of appropriate textbooks, a shortage of learning and teaching aids, a lack of classrooms and over-crowded classrooms. The shortage of qualified educators, disciplinary problems and inadequate parental involvement lead to poor achievement of learners.

The above factors leading to poor achievement demonstrates that the learners are from disadvantaged and lower socio-economic backgrounds. Hence, the poor achievement is determined by the socio-economic status of learners.

2.10.2 Gap between advantaged and disadvantaged science students in South Africa

According to Howie, Scherman and Venter (2008:29), the South African education system is marked by under-achievement of students at each level of the system. Students in rural areas are under-performing in the national Grade 12 final examinations. Table 2.17 summarizes the findings by Howie et al. (2008).

Table 2.17: Gap between advantaged and disadvantaged science students

AUTHOR	FINDINGS
Howie, et. al. (2008:29)	• Under-achievement of students at each level of the South African education system. • Students in rural areas are underperforming in the national Grade 12 final examinations. • Factors that affected the science achievement of learners from different socio-economic backgrounds: o Gender; o age; o religion; o locality of the school; o parental involvement in children's' education; o English language proficiency; o home language; and o self-concept of the students related to mathematics.

Howie et al. (2008:31) compared the science scores of advantaged, semi-advantaged and disadvantaged learners. Advantaged schools are well resourced and located in the urban regions whereas the disadvantaged, African schools are under resourced and located in the rural regions.

Howie et al. (2008:31) investigated to what extent the TIMSS-R (1999) may impact on science achievement and to see what other factors play a role. They also examined how the location of the school, the socio-economic background of learners and other factors affected achievement of science students in South Africa as it has to be kept in mind that the South African education system has been disadvantaged in terms of insufficient funding and resources because of the previous apartheid system.

Howie et al. (2008:31) noted that the following antecedent factors affected the achievement of learners: Gender, students' home background, age, religion and the locality of the school. Parental involvement in children's education includes assisting with assignments and parental interest in children's educational activities is positively related to achievement in science. The background of learners has a direct or indirect influence on science achievement of South African students (Howie et al., 2008:33).

The results from mathematics-related data from TIMSS 1999 analysed previously for South Africa. Howie et al. (2002) indicated a strong relationship with location, English language proficiency, language of the home, SES and self-concept of the students related to mathematics. The analysis reveals a similar pattern for science where there was also a very poor achievement by South African students in science (Howie et al., 2008:40). Howie concluded that there is a strong relationship between English language proficiency and the science scores.

The advantaged students had many books at home. The socio-economic status of learners, self-concept in science and the English test score (the most dominant factor) had direct effect on the science score. Factors which had an indirect effect on science scores were age, language spoken at home, books in the home environment (Howie et al., 2008:36) and SES which also had an indirect effect on science scores. Factors that had no effect were 'if science is important', language of learning, and location of the school.

Semi-advantaged students had more listed possessions than the disadvantaged students. They were also more likely to live in towns and cities (Howie et al., 2008:40). Four factors which had a direct effect on science achievement were language spoken at home, SES, language of learning and again the strongest effect – the English test score. Language spoken at home and SES also had an indirect effect on the science score.

The disadvantaged students achieved the lowest scores for science. Their home language differed from the medium of instruction. They were from rural areas, had fewer books and possessions in the home than children from other groups. Factors that had direct effect were language spoken at home, SES, science is important , language of learning in the classroom, location of the school, self-concept in science, and English test scores. Age, language spoken at home and location of the school had a weak and indirect effect on the science score (Howie et al., 2008:40). Howie concluded that there is a strong relationship between English language proficiency and the science scores. (See table 2.17 for summary of these results).

2.10.3 Comparison of middle and lower socio-economic groups in South Africa

Reddy et al. (2012:3) conducted a longitudinal study with a data set of learners at Grade 8 and Grade 12. They investigated whether the Grade 8 mathematics achievement in the Trends in International Mathematics and Science Studies (TIMSS) was related to their choice of mathematics at matriculation level.

They contend that during the apartheid era the South African schools system was made up of learners from the historically underprivileged lower socio-economic group learners. The majority were black African students with very little resources and English as their second or third language. On the other hand, there were learners from middle class families (white and Indian learners) who had better resources, and English was mostly their first language. Reddy et al. (2012:1) noted that academic achievement in earlier years predicted later achievement. They assert that socio-economic backgrounds results in gaps in cognitive abilities of learners.

Table 2.18 below gives a comparison of middle and lower socio-economic groups in South Africa.

Table 2.18 Comparison of middle and lower socio-economic groups in South Africa

Author	Findings
Reddy et. al. (2012:1)	Academic achievement in earlier years predicts later achievement. Socio-economic backgrounds result in gaps in cognitive abilities of learners. Middle class families, who perform poorly in academic work, may catch up. Disadvantaged learners with low scores may not cope with the work. Historically white middle-class students during apartheid era had a better progress rate than the poorer black students. Cognitive ability gaps amongst lower socio-economic group learners. Middle class families, who perform poorly in academic work, may catch up. Disadvantaged learners with low scores may not cope with the work. The South African government aims to provide good and quality education for all mathematics and science learners. Learners from lower socio-economic backgrounds are not performing well in science and mathematics. Mathematics achievement scores in South Africa are generally low. There was a different achievement pattern between middle and lower socio-economic groups. For middle class learners the Grade 8 scores were a good indicator of Grade 12 examination pass rate in mathematics. For lower socio-economic groups the relationship between Grade 8 scores and Grade 12 examination pass not clear. There was a stronger relationship between TIMSS Grade 8 scores and subject choice at matriculation level in mathematics by middle socio-economic groups than by lower socio-economic groups. There was a strong relationship between Grade 8 mathematics achievements and matriculation mathematics achievement. Mathematics scores should be raised from Grade 8 or earlier to result in better achievement by Grade 12.

Reddy et al. (2012:1) asserted that because of the unequal South African schools system, the progress rate was higher amongst historically white middle-class students, while the poorer black students were deprived. This lead to cognitive ability gaps for lower socio-economic learners. They further indicated that when middle class families performed poorly in academic work, they could catch up. On the other hand, learners from disadvantaged backgrounds who had low scores were unlikely to catch up with their work.

Furthermore, the South African government aims to provide good and quality education for all mathematics and science learners. Learners from lower socio-economic backgrounds are not performing up to standard and the school system requires better achievement from science and mathematics learners.

The achievement of mathematics high schools learners in South Africa was assessed in 2002. Learners from Grade 8 participated in the study and the researchers investigated the Trends in International Mathematics and Science Studies (TIMSS) and tracked it to Grade 12 examination results. The relationship between TIMSS and Mathematics success achievement in Grade 12 was compared for middle-and lower socio-economic groups (Reddy et al., 2012:1).

Their study found that the Mathematics achievement in South Africa was generally low and the achievement between middle and lower socio-economic groups were different.

The researchers discovered the following in their study as seen in Table 2.18:

- Mathematics achievement scores in South Africa are generally low and there was a different achievement pattern between middle and lower socio-economic groups.
- For middle class learners the grade 8 scores were a good indicator of Grade 12 examination pass rate mathematics (Reddy et al., 2012:5). Whereas, for the lower socio-economic group the relationship was not as pronounced.
- There was a stronger relationship between TIMSS Grade 8 scores and subject choice at matriculation level in mathematics by middle socio-economic groups than by lower socio-economic groups.
- The study also showed a positive relationship between achievement of Grade 8 mathematics learners and matriculation mathematics outcome; and

- Reddy et al. (2012:6) recommended that mathematics scores should be raised from Grade 8 or earlier to result in better achievement by Grade 12.

2.10.4 Challenges experienced in the North-West schools with Senior Phase science teachers

Mere and Kwayisi (2012:168) found that Senior Phase science teachers in the Mafikeng region experienced many challenges.

Through interviews and observations, Mere and Kwayisi (2012:172) discovered that educators found teaching Senior Phase science challenging because of the following reasons: Resources were not sufficient, the laboratory in the school was empty and teachers could not do practical work with insufficient resources, no chemicals and apparatus, any charts or pictures of scientific interest. Mere and Kwayisi (2012:173) noted that educators could not implement the curriculum because they faced the following problems: Over-crowded classrooms, lack of teaching and learning resources, lots of paper work for educators and irrelevant context of textbooks to the learners' environment made it difficult for learners to understand the science concepts. They also claim that teachers must be able to communicate effectively with learners.

Their study revealed that lack of parental involvement, learners' negative attitude towards science, lack of libraries and internet facilities, absenteeism among learners, lack of regular workshops by subject advisors and lack of some textbooks also contributed to difficulties in understanding science concepts. The schools' environment was not conducive to science teaching and learning and lack of some textbooks also contributed to difficulties in understanding science concepts (Kwayisi, 2006:162).

Table 2.19 outlines the challenges experienced in the North-West schools with Senior Phase science teachers

Table 2.19: Challenges experienced in the North-West schools

Author	Findings

Mere and Kwayisi (2012:168)	Senior Phase science teachers in the Mafikeng region experienced many challenges:
	• Lack of:
	  o Communication with learners;
	  o teaching and learning resources;
	  o equipment in laboratory;
	  o textbooks;
	  o teaching and learning resources;
	  o parental involvement;
	  o libraries and internet facilities;
	  o regular workshops;
	  o discipline among learners;
	o Teachers unable to do practical work,
	o over-crowded classrooms;
	o lots of paper work for educators;
	o learners negative attitude towards science;
	o absenteeism among learners;
	o environment not conducive to science teaching;
	o inadequate teacher qualifications;
	o incompetence in the medium of instruction;
	o no electricity in rural areas, and
	o no laboratory work in rural areas.

Other problems included inadequate teacher qualifications, incompetence in the medium of instruction and lack of discipline among learners. The schools in the rural areas had no electricity which made facilitation of laboratory work impossible (Mere & Kwayisi, 2012:174). They concluded that external as well internal factors lead to failure to adequate implementation of the curriculum. Table 2.19 above outlines the challenges experienced in the North-West schools with Senior Phase science teachers.

2.10.5 Socio-economic status and attribution

Some investigators are of the view that education is vital for women from lower socio-economic status backgrounds so that they may achieve social development and promote gender equality (Zewotir & Maqutu, 2006:39). According to Zewotir and Maqutu (2006:36), people have lower expectations for women and this leads to women making detrimental causal attributions about their success and failure. Women internalize the maladaptive patterns of belief and through education this negative perception may be eradicated. They noted that tertiary education in Africa is male dominated as culture and society prevent women from getting formal education. Furthermore, people have lower expectations from women and this may also result in negative attributional styles among females. Due to poverty, males are sent for further education and females are socialized to play a subordinate role in the home setting. This leads to a lack of self-confidence and low self-expectations by females (Zewotir & Maqutu, 2006:36).

Family background has to be considered with gender to see the achievement so that educators could help students who are not achieving (Batool et al., 2010: 454).

Various studies have shown that motivation is one of the factors leading to poor achievement of learners in mathematics and science (Makgato & Mji, 2006:253). Their study did not investigate the relationship between attribution and socio-economic status and focused more on learners' achievement in schools.

Legotlo et al. (2002) investigated the influence of disadvantaged and lower socio-economic backgrounds on achievement of students in the Grade 12 National Examinations. They stressed the factors that lead to poor achievement; however, they did not explore the attributional styles of learners. Armien and Le Roux (2010:42) noted that black students are under-represented in science and engineering courses at higher education levels because of the socio-economic status of the group. They indicated that, because of lower socio-economic backgrounds, education enrolments at high school level are dropping. Muwanga-Zake (2000) contended that socio-economic background and lack of adequate resources discourages interest of learners in science education. This results in poor achievement of secondary school students in science. Makgato and Mji (2006:253) stressed that South Africans need to become mathematically and scientifically literate so that it may participate in the technologically advanced international society.

Aschbacher Li and Roth (2010:564) noted that very few students choose teaching of science as a career.

The Attribution Theory may serve as a useful framework to look at poor achievement of South African Science learners. Basturk and Yavuz (2010:1940) suggested that changing the students' attributions could aid in avoiding failure.

2.10.6 Group learning environment to improve science achievement at higher education institutions

Armien and Le Roux (2010:42) conducted a study in Cape Town, with South African learners, at a higher education institution. They explored the influence of small group learning within communities to improve achievement in science and engineering at higher education institutions.

Armien and Le Roux (2010:42) stressed that the pedagogic practices which are appropriate in the institutions should be applied to achieve better academic results. They are of the opinion that students need to work in small groups inside and outside classrooms to benefit their learning of mathematics at high school level. Also, group learning will strengthen their sense of belonging and will help with problem solving skills. These researchers pointed out those black students were under-represented in science and engineering courses at higher education levels. Furthermore, the quality of schooling has contributed to the low achievement of students at tertiary level. They indicated that socio-economic backgrounds might influence the low achievement of students at high school level (Armien & Le Roux, 2010:43).

Many institutions provide bridging courses which provide students access to university science programmes. Armien and Le Roux (2010:43) claimed that social factors at the institutions should meet the needs of students because of the gap that exists between school and higher education.

2.11 IMPLICATIONS IN CLASSROOMS

Batool et al. (2010:456) noted that teachers must encourage students to believe that they are capable and that failure is temporary. They stress that if one wants to avoid failure one needs to persist on a task. It is vital that students believe that they have the ability to succeed. If students expend effort in the task and still fail, they lack ability, and this leads to diminishing of self-esteem and future effort will be pointless.

Educators should look at the perceptions of students and use attributions theory to help more students succeed. If students are encouraged to use an internal attributional style and they believe that they do have ability and that they may succeed with more effort, it will lead to a more positive self-concept and success.

Zewotir and Maqutu (2006:38) asserted that effort attributions Increase persistence more than ability, enhance achievement, and develop positive self-concept and leads to success. As effort is seen to increase persistence more than ability, students should be encouraged to focus more on exerting themselves in achievement tasks than on their abilities. McClure et al. (2010:71) agreed and claimed that attributing outcomes to controllable causes such as effort increases motivation and perseverance.

If students adopt a negative perception about their chances to succeed then it will lead to a low self-concept and consequently their ability will suffer. If students believe that their success was due to luck, their self-esteem will not be enhanced. If the success is attributed to ability and/or effort it will lead to pride in their achievement.

Batool et al. (2010:455) cautioned that teachers and parents should take into account those students who adopt "negative" and "non-productive" attributions as students acting on the basis of their beliefs. Teachers should discourage negative attribution patterns of students and that they should realize that there are gender differences in attributional patterns. Zewotir and Maqutu (2006:39) claimed that to change motivation one had to change the beliefs of students regarding attributions.

2.12 SUMMARY OF THE ATTRIBUTION THEORY AND POOR ACHIEVEMENT OF LEARNERS IN SCIENCE EDUCATION

The above literature shows that the Attribution Theory is concerned with causes of behaviour and outcomes of success and failure in achievement settings. The framework created by Weiner (2010:32) is most commonly used in educational settings in terms of academic achievement. The attributions given by learners for their success and failure will help educators to predict the future outcomes of learners and to exert some control over achievement of students.

Weiner's theory stresses the idea that learners are strongly motivated by the pleasant outcome of being able to feel good about themselves. According to Weiner, the amount of effort the student will exert on a given task will be determined by the person's attributions for his/her success or failure.

The research on attribution found that gender differences existed. However, it is somewhat confusing. Over the past decades, the sex roles of men and women have changed tremendously with the result that attributions for the different genders are also changing. Internal attributions lead to better achievement, whereas external attributional style leads to negative achievement.

This study investigates the different factors that males and females attributed to their academic achievement. The reasons that students give for their success or failure in science will help educators to encourage a more internal style of attribution.

Educators will become aware of students' use of ability and effort attributions. Research showed that an effort attributional style which is an unstable and internal pattern of attribution will stimulate the learners to persist in the task until they succeed.

The studies investigated also highlighted the negative influence of learners from underprivileged backgrounds, which has led to the high failure rate in science and mathematics.

The literature indicates that there is a drastic need for good achievement in science. The present study, therefore, aims to look at the different attributional patterns of learners related to gender, socio-economic status, and achievement in science and achievement motivation levels. This will help educators to become aware of those students who need to develop more adaptive attributions.

2.13 CONCLUSION

The literature presented in this chapter has important implications for educators teaching science at high school level. The awareness of attributional styles among educators will enable them to encourage learners to achieve well in science. It will also assist educators to become aware of those students who need to develop more adaptive attributions so that learners will persist in the task until they succeed. The literature discussed indicates that there is a drastic need for good achievement in science.

In Chapter 3, the research design and methodology will be discussed. Aspects related to mixed methods will be outlined and will include a framework on analysis.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 INTRODUCTION

This chapter focuses on the research design and methodology informing the research study so that valid data could be collected and analysed to create meaning. The following have been covered: The research design, population, sample and sampling technique, tools for data collection, administration of tools for data collection, validation of data collected and procedure of how the data is presented and interpreted in Chapter Four of this thesis.

3.2 RESEARCH DESIGN

Due to the nature of data which combines qualitative and quantitative characteristics, the research design chosen for this study is mixed methods as supported by Creswell and Clark (2011:65). With special reference to mixed methods, Creswell and Clark (2011:65) argue that the quantitative approach may be given priority over the qualitative aspect, if the quantitative data is much more detailed than the qualitative in the same research design. According to Creswell and Clark (2011:183), if the qualitative sample is much smaller than the quantitative sample it helps the researcher to get a better in-depth discussion through interviews and a "rigorous" quantitative investigation of the topic.

One of the designs highlighted by Creswell and Clark (2011:179) for the mixed method study is the Explanatory Design. This design was used by the researcher in this study wherein the quantitative data was first collected through questionnaires, thereafter it was analysed, and then were followed up with smaller qualitative data (Creswell & Clark, 2011:185).

3.3 RESEARCH METHODOLOGY

In harmony with Maxwell (2012:72), the research methodology covers population, sample and sampling techniques, tools for data collection, administration of tools for data collection, validation of data collected, and how the collected data will be presented and analysed.

3.3.1 Population

According to McMillan and Schumacher (2004:67), a population is a group of elements (a group of people) that conform to specific criteria and to which one intends to generalize the results of the study. The target population for the present study was taken from regions of Mahikeng, Mmabatho, Itsoseng (Ngaka Modiri Molema district) and Dr. Ruth Segomotsi Mompati (Greater Delareyville district) regions. This population covered Grades 10 to 12 learners that were doing Physical Sciences in the regions mentioned and teachers who were teaching Physical Sciences in the same schools.

3.3.2 Sample and sampling technique

Denscombe (2007:11) describes the sample as a portion of the whole that is representative in terms of characteristics. In harmony with the idea of sample and sample choice promoted by Bless and Higson-Smith (2005:88), the researcher in this study, chose a sample which is representative of the said population. The sample, in this study was made up of 1773 learners from the learners' population of 11,748. This sample was considered quite representative in that it constituted 15% of the population. To supplement the learners' views, the researcher in the current study interviewed 5 teachers (1 principal, 3 heads of departments and 1 teacher) and 5 Physical Sciences learners for more information on the attribution stance.

Edmonds and Kennedy (2013:15) advise that sampling strategies should be used to pick up a worthy sample from the population for the research study to be in the acceptable direction. From the two major regions of Ngaka Modiri Molema and Dr Ruth Segomotsi Mompati, the researcher used different strategies to pick a sample of 1773 learners from 30 of the 60 schools. This sample was selected by systematic random sampling method which, according to Maree (2010:174), is a process of selecting an individual member of the population in the "nth" (regular space interval) number. This strategy will lead the researcher to pick up quite a good number of individuals from that population without prejudice, because every individual qualifies to supply the required data.

To select the 30 schools from 60, the following procedure was followed: The Ngaka Modiri Molema Area Project Office (APO) of the North-West Provincial Department of Education provided the researcher with names of secondary/high schools in the

Ngaka Modiri Molema and the Dr. Ruth Segomotsi Mompati regions. The schools were arranged according to clusters and regions. Systematic random sampling as suggested by Maree (2010:174) was utilized, therefore, the schools were arranged in ascending order. The researcher started with the first school on the list, thereafter, every second school was selected until the target number of thirty schools was reached. Total number of schools in the study was 30. Due to cost and distance, more schools were chosen from the Ngaka Modiri Molema (Mahikeng) region than from the Dr. Ruth Segomotsi Mompati (Delareyville) region.

To randomly select the learners, the researcher obtained a class list from the relevant teacher/principal and assigned numbers in ascending order to the learners in each school and grade available for the study. The same procedure as was done with selecting the schools in the study was followed. Respondents were randomly chosen by taking every 5th learner in the class register for each school in the study until the target population of males and females were reached. The total sample consisted of 1773 Grades 10 to 12 science learners from 30 schools in the Ngaka Modiri Molema and Dr. Ruth Segomotsi Mompati (Delarey) regions.

After the employment of systematic random sampling the learners, the researcher, in the current study, employed the purposive sampling technique to select teachers from the teaching staff, which was research needy-based as advised by Edmonds and Kennedy (2013:17). The same purposive sampling was used to select 5 Physical Sciences learners for interviews purposes. There were 5 teachers who were available for the interviews and were involved in teaching Physical Sciences. Hence, there were 10 interviews which were conducted.

The findings have implications to Physical Science teachers and learners. The sample was selected because both teachers and learners are involved and affected by attributions of learners in doing Physical Science. Therefore they were included in the study.

Table 3.1 below provides the summary of the sampling process in the above stated areas and clusters of the regions.

Table 3.1: Summary of the sampling process

POPULATION			SAMPLE		
AO	**No of schools**	**No of learners in grade 10-12**	**No of Schools**	**No of learners in grade 10-12**	**Percentage of sample of learners**
1	10	2435	5	369	15
2	10	2494	5	378	15
3	6	1135	3	172	15
4	10	1524	5	231	15
5	6	1440	3	144	10
6	4	650	2	65	10
7	14	2070	7	414	20
TOTAL	60	11748	30	1773	100

Table 3.1 above shows that from the Ngaka Modiri Molema region, the researcher included 10 to 15% of the population for the sample. The sample from the Dr. Ruth Segomotsi Mompati region constituted 20% of the population.

3.3.3 Tools for data collection

Instruments used in this research study were questionnaires and interviews.

3.3.3.1 Questionnaires

An example of the quantitative method used in the research is the survey. McMillan and Schumaker (2004) maintain that in survey studies, researchers select samples of respondents before administering questionnaires or conducting interviews (Maree, 2010:155). Maree maintains that survey sample sizes are usually big; many variables are measured; and many hypotheses are tested (Maree, 2010:157). Kwayisi (2006:74) adds that in the survey method, the researcher gains knowledge directly from respondents. The data collected in the present study were through group administration questionnaires (quantitative) and face-to-face interviews (qualitative).

In the present study the Attribution Questionnaire, Achievement Motivation Questionnaire (AMQ), and the Socio-economic Status Questionnaire were used to identify the attributional styles, the effects of achievement motivation, gender and socio- economic status of learners on attributions and science achievement of learners. A cover letter was completed by the respondents to obtain information about the science performance and biographic information of the learners in the study (see Appendix F). The advantages of using the questionnaires in the present study, was that they are cost effective in terms of time, money and travelling; many subjects (1773) could be tested in group settings; the study may be generalized to a wider population; and confidentiality was maintained.

Two types of questions can be distinguished: Open- and closed-ended questions. Quantitative data were collected using closed-ended questions, while open-ended questions were utilized in the qualitative interviews. For the purpose of this study, the focus was on grids and scales as two types of closed-ended questions as discussed by Bell (2005) and Maree (2010:161). Grid questions were used to answer the biographical data in the questionnaire. Scales are useful ways in survey research to measure how respondents think or feel about something (Maree, 2010:167). In the current study, the Likert Scale was used to measure the strength of the seven attributional factors.

3.3.3.2 Interviews

Maree (2010:87) claims that an interview is a two-way conversation between the interviewer and the participant. It is an in-depth interaction on a one-to-one basis between the interviewer and interviewee. Maxwell (2004:17) indicates that the interview takes place in the context of a relationship. The aim of the interview is to gain valuable insight from the interviewee and "seeing through the eyes of the participants" and it helps interviewees to freely express their views. (Maree, 2010:51). This study used self-constructed interview schedule instruments for teachers and learners to collect information about learners' during individual interviews (see Appendix J and K). Use of interviews enhanced the value of the findings and gave a better insight of the underlying reasons of the attributional styles and achievement motivation levels of the learners from each school. Cohen, Manion and Morrison (2002:94) indicate that the main purpose of the interview is to obtain information of participants, their opinions, attitudes, values and their perception of their environment.

The researcher posed questions to the respondents and recorded the answers as suggested by Maree (2010:158). The individual interviews, according to Maree (2010:158), have the highest response rate; long questionnaires may be used; the interviewer can clarify issues which are ambiguous to the respondent; and it does not require a literate respondent.

3.3.4 Administration of tools for data collection

In administering the two tools for data collection, the following procedure was followed:

3.3.4.1 Questionnaires

The questionnaires were hand delivered after prior appointments had been made with the principals at the respective schools. They were administered to 1773 respondents from the Ngaka Modiri Molema and Dr. Ruth Segomotsi Mompati regions of the North-West Province. Teachers at the relevant schools assisted to clarify the procedures in completing the questionnaires.

According to Cohen et al. (2000:247), in closed-ended questions, the answers are structured to allow only answers which fit into groupings that have been decided in advance by the researcher. On a cover letter the learners provided biographical information such as the gender, age and home language of the learner. The respondents also indicated their percentage achieved in the physical science test (Appendix F). Related to Research Question 1, the physical science learner respondents in this study chose one of four options in the Attribution Questionnaire (see Appendix H) to indicate the type of attributions that affect their achievement in science. There were seven factors of attributions which included: Ability, effort, interest, task difficulty, luck, help and teaching method attribution. For example, the respondents indicated whether their science test mark was due to 'no ability', 'little ability', 'more ability' or 'a lot of ability' (see details in chapter four). For the qualitative interviews, 5 teacher respondents and 5 learners gave their opinion on whether learners had ability, exerted a lot of effort in preparation of the physical science test and were interested in science. They also gave their opinion on whether the test was difficult, whether they were lucky in achieving the results, whether they received assistance/help and whether the teaching methods contributed to their results.

According to Research Question 2 in the current study, achievement motivation is identified as affecting learners' attributions and science achievement. To address Research Question 2, the respondents chose one of two options in the Achievement Motivation Questionnaire (Appendix I) to determine the achievement motivation levels of physical science learners. Thereafter, the effects of achievement motivation on attributions and Science achievement of learners was investigated. The choice of different options in the Attribution Questionnaire and Achievement Motivation. The Questionnaire made it easier for the respondents to answer and they would not need to write extensively in responding to questions. The closed-ended questions generated frequencies of responses which according to Cohen et al. (2000:247) is an advantage as it is easily analysed. Denscombe (2005:156) adds that the structure imposed on the respondents' answers provides the researcher with information, which is of uniform length and may be quantified and compared.

Two factors were considered when assessing the achievement motivation levels of learners during the qualitative interviews: The first factor was to see the use of practical methods in teaching which increases the learners' interest and achievement motivation levels. The second factor was expectations of success. Learners who expected success were more highly motivated than learners who had a negative attitude to science and expected failure.

Research questions 3 and 4 were addressed by comparing the attributional styles and achievement levels of low and high socio-economic males and females in Physical Sciences.

3.3.4.2 Individual face-to-face Interviews

The individual interviews were conducted at the respective schools of respondents after prior appointments had been made with them. The researcher interviewed physical science teachers to get an objective view of the learners' attributional styles. The learner respondents gave a subjective opinion of their attributions. All respondents were assured of confidentiality. The purpose of the interview, data-collection technique of recording interviews and duration of the interviews was explained to the teachers and learner respondents at each school.

The open–ended questions of interviews has the advantages of fully reflecting the views held by respondents as suggested by Denscombe, (2005:155): Respondents give honest feedback; answers to complex questions are obtained; and interesting information may be derived (Maree, 2010:51). In the present study, respondents could give their personal opinions about how important each of the attributional factors was in affecting their achievement in science. During the interviews, the researcher could probe deeper into understanding the learners' explanations on how attributions influenced their achievement in science. Views of participants were followed by more probing questions to confirm and to clarify their responses. As suggested by Bless and Higson-Smith (2000:62), the researcher was alert to the learners' verbal as well as non-verbal communications during interviews. The teachers answered questions related to the attributional styles of Grades 10 to 12 physical science learners. The researcher made use of the "Live Scribe Smart Pen" to capture the audio recordings of interviews. The interviews were captured for transcription, analysis and interpretation.

3.3.5 Validation of data collected

3.3.5.1 Reliability

Reliability and validity are crucial in quantitative research (Maree, 2010:80). Reliability means that if the same instrument is used at different intervals or to different subjects from the same population, the findings are the same (Maree, 2010:215). To ensure the reliability and validity of the study, the attributional questionnaire was constructed by including the following factors of attributions from literature sources: ability, effort, interest; task difficulty, luck (Weiner, 2010c:31); help (Weiner, 2000:4), and teaching methods (Mudhovozi et al., 2010:587).

The achievement motivation of learners was determined by using the Achievement Motivation Questionnaire (AMQ) constructed by Pottas, Erwee, Boshoff and Lessing (1988) because it is more reliable in the South African context. The questionnaire was adapted by the researcher to make it more compatible to use with learners in the school setting. The AMQ Questionnaire by Pottas, et al., concentrated on tertiary students, therefore, the researcher made some modifications in the newly constructed questionnaire: The questions were rephrased to clarify the content to science learners. For example, words such as "work" was replaced with "science assignment" and "occupation" was replaced by "assignment". The original AMQ questionnaire consists of 84 items, while the present questionnaire was abbreviated to save time with administration of the questionnaire. The new abbreviated questionnaire consists of 34 items (Appendix I). The responses were marked according to a key provided and in this study learners were divided into three categories of motivation. Learners who obtained between 1 to 9 correct answers were classified as low achievement motivated individuals. Those who attained 10 to 25 correct answers were seen as moderately motivated, whereas 25 to 33 were highly motivated individuals. The different achievement levels were compared to the attributions and achievement of learners. For example, high achievement motivated learners made higher ability, effort and interest attributions than low achievement motivated individuals.

3.3.5.2 Validity

Pietersen and Maree maintain that for the measuring instrument to be standardised, it must be reliable and valid (Maree (2010:215). The validity of an instrument refers to the extent to which the instrument measures what it purports to measure. Before a questionnaire can be used for data collection the researcher has to make certain that it is valid. The aim is to ensure that one can draw correct and useful inferences from data generated in the study.

To supplement the questionnaire findings, interviews were conducted to validate the data quality. Therefore, it is considered trustworthy. Also, The results were discussed with the supervisors, peers and colleagues in the same area of study to ensure credibility and trustworthiness (see section 3.3.5.2)

3.3.5.3 The pilot study

Mouton (2001:103) suggests that the validity of the questionnaire for data collection is ensured by conducting a pilot study on a small population similar to the research sample. To ensure the reliability and validity of the instruments in this study, a pilot study was conducted by using a different sample of learners from Grades 10 to 12 who were not included in the final testing. The questionnaires were pre-tested at two high schools to see whether the questions were clear and relevant. The pilot study results revealed that the items on the socio-economic questionnaire were not well understood. Learners could not distinguish between the occupation of mother, father and guardian. The questionnaire was modified to make the tool authentic.

3.3.6 Data presentation and analysis

To present the data collected, the researcher made use of biographical data display tables and figures, and provided interpretation after each table and figure. The discussion that comes after biographical data display, is arranged according to research questions, i.e., interpretation will always follow the table or figure. Further details are given in Chapter four.

3.4 ETHICAL CONSIDERATIONS

According to Maree (2010:41) regarding ethical considerations in research, confidentiality is important therefore the following issues were adhered to:

In relation to the North-West University expectations, policies and procedures have been followed. Having a legitimate supervisor and adherence to supervisor-supervisee ethics. Letters of consent to conduct the research study were obtained from: The Director of Post Graduate Studies (Mafikeng Campus - North-West University) to the District Manager (Appendix A); The District Manager to permit to go to school; School principals to conduct the research; Consent forms from school principals to conduct the interviews with learners and teachers (Appendix C); and consent forms from teachers to conduct the interviews (Appendix D). Respondents gave permission for recording of interviews, were made aware of the purpose of the interviews, that their participation was voluntary, and assured of anonymity and confidentiality. General research route was followed and ethics observed.

3.5 CONCLUSION

Chapter Three discussed the mixed method approach utilized in the study with qualitative and quantitative characteristics. The chapter described how the population and sample was picked, the use of systematic random and purposive sampling technique, the questionnaires and interviews as tools for data collection and how they were administered and conducted. Furthermore, it describes how validity and reliability of data collection was ensured. The chapter concluded with how data will be presented and analysed in terms of research questions.

CHAPTER FOUR

DATA PRESENTATION AND ANALYSIS

4.1 INTRODUCTION

This chapter presents data collected and the analysis. These processes include quantitative and qualitative frameworks within them. Quantitative data were gathered from the questionnaires which were administered to the science learners and the findings were generalized to the wider population. Interviews were conducted with 10 respondents (principals, heads of departments, teachers and learners). The questionnaires were transcribed qualitatively.

Data were interpreted using simple descriptive statistics and raw data were captured and presented in tables and bar diagrams. Frequencies, percentages and means were worked out to represent data. Descriptive statistics were used to "organize and summarize the data meaningfully" and to understand the data characteristics (Maree, 2010:195).

Advanced statistical methods such as the Chi-Square Test and ANOVA were used to interpret the data. This chapter is divided into five sections: Introduction, biographical information, Research Questions–related data, analysis of interviews and the chapter summary.

4.2 BIOGRAPHICAL INFORMATION

The following clusters from the Mafikeng Area Project Office (APO) were selected for inclusion in the study: Mmabatho, Botshabelo, Montshioa Stadt and Tshwaranang.

Table 4.1 below shows that the study consisted of 5 schools from the Mmabatho Cluster (Kebonang Secondary School, Letsatsing Secondary School, Mmabatho High School, Sejankabo High School and Mococoe High School), 5 schools from the Botshabelo cluster (Batloung High School, Lapologang Senior Secondary School, Mafikeng High School, Molelwane Sec School and Sol Plaatjie Secondary School), 3 schools from the Montshioa Stadt Cluster (Barolong High school, Batswana High School and Kebalipile High School), 5 schools from the Tshwaranang Cluster (Danville Secondary School, Setlopo High school, Setumo, St Mary's High School, Mothuba High School) and 2 independent schools (ISSA, St Michaels) from the Mmabatho-Mahikeng Regions.

A further 3 schools from the Itsoseng Region (Boiphirima High School, Baitshoki High school and Boithaopo High) were selected.

There were 7 schools from the Dr Ruth Segomotsi Mompati Region (Ga-khunwana), Itshupeng Secondary School, Mampho Secondary School, Reabetswe Secondary School, Itlotleng, Boiphirima High School, Tswaing Ludirele High, (Delarey) were included in the total number of schools for the study.

Therefore, there was a total of 30 schools in the current study and these were significant to form the data output.

4.2.1 Learner distributions

Table 4.1 below indicates that the number of schools corresponds to the number of learners. This affirms the fact that the sample size was fair as reflected by the table.

The respondents composed of 369 (21%) learners from the Mmabatho cluster, 378 (21%) from the Botshabelo cluster, 172 (10%) from the Montshioa Stadt cluster and 231 (13%) learners from the Tshwaranang cluster in the Mmabatho-Mahikeng Regions.

A further 144 (8%) learners from the Itsoseng Region, 65 (4%) from independent schools and 414 (23%) learners from the Dr Ruth Segomotsi Mompati Region were included in the sample.

The total sample of learners consisted of 1773 learners (921 males and 846 female, 6 not completed) from 30 schools.

Table 4.1: Number of learners per school

Schools	Name of region	Schools in clusters and regions	Number of learners	Total
1	Mmabatho cluster	1	83	369
2		2	59	
3		3	49	
4		4	52	
5		5	126	
6	Botshabelo cluster	1	146	378
7		2	50	
8		3	50	
9		4	61	
10		5	71	
11	Montshioa Stadt cluster	1	50	172
12		2	30	
13		3	92	
14	Tshwaranang cluster	1	74	231
15		2	38	
16		3	31	
17		4	40	
18		5	48	
19	Independent schools	1	51	65
20		2	14	
21	Itsoseng Region	1	37	144
22		2	64	
23		3	43	
24	Dr Ruth Segomotsi Mompati	1	100	414
25		2	37	
26		3	62	
27		4	70	
28		5	57	
29		6	49	
30		7	39	
Grand Total				1773

Table 4.1 above indicates the number of learner respondents per school in each cluster. The total number of learner respondents from the Mmabatho cluster comprised of learners from the following schools: Kebonang Secondary School (83), Letsatsing Secondary School (59), Mmabatho High School (49), Sejankabo High School (52) and Mococoe High School (126).

From the Botshabelo cluster the learners were from the following schools: from Batloung High School (146), Lapologang Senior Secondary School (50), Mafikeng High School (50), Molelwane Secondary School (61) and Sol Plaatjie Secondary School (71).

Learner respondents from the Montshioa Stadt Cluster included 50 learners from Barolong High school, 30 from Batswana High School and 92 from Kebalipile High School.

The Tshwaranang Cluster included 74 learners from Danville Secondary School, 38 from Setlopo High school, 31 from Setumo High School, 40 from St Mary's High School and 48 learners from Mothuba High School.

From the independent schools there were 51 learners from ISSA and 14 learners from St Michael's School.

From the Itsoseng region there were 37 learners from Boiphirima High School, 64 from Baitshoki High school, 43 from Boithaopo High School. From the Dr Ruth Segomotsi Mompati region there were 100 learners from Ga-Khunwana, 37 learners from Itshupeng Secondary School, 62 learners from Mampho Secondary School, 70 learners from Reabetswe Secondary School, 57 learners from Itlotleng School, 49 learners from Boiphirima High School, 39 learners from Tswaing Ludirele High school. The total learners who responded to the questionnaire were 1773 (921 males and 846 females).

4.2.2 Gender of respondents

Figure 4.1 below illustrates the percentage of male and female respondents.

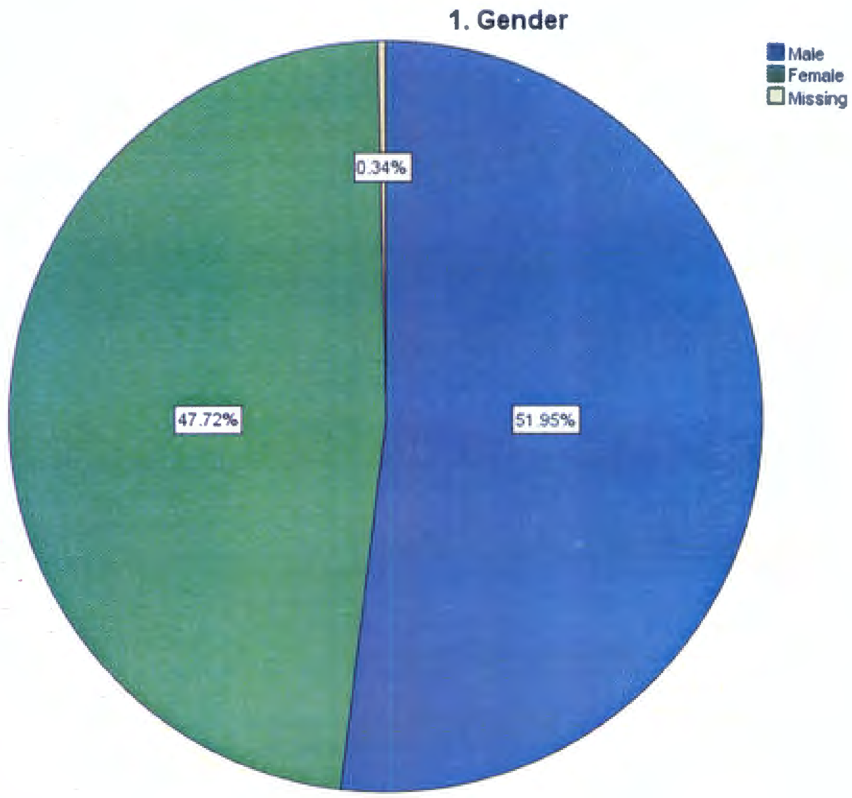


Figure 4.1 **Gender of respondents**

The percentage of male respondents in the study was 51.95% (921) and the percentage of female respondents was 47.72% (846). Six of the respondents (34%) did not complete the gender item in the questionnaire and were not included in the final analysis. Male and female learners responded to the questionnaires. Only completed questionnaires were used for analysis. There were more male respondents than females.

4.2.3 Grade distribution

Figure 4.2 below illustrates the grade distribution of learners.

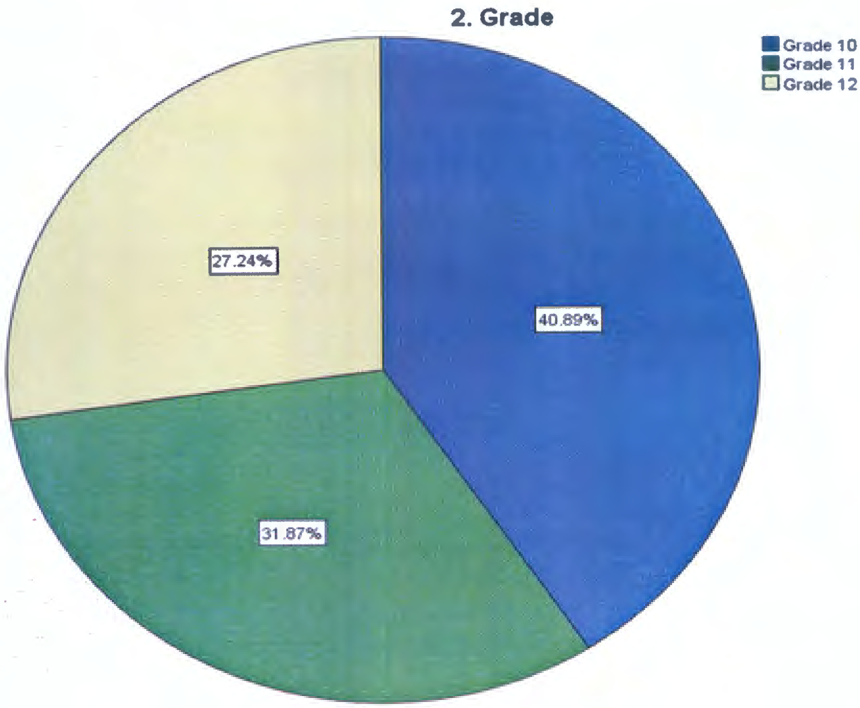


Figure 4.2 **Grade distribution**

From the total of 1773 respondents, 725 (40.89%), were from Grade 10, followed by 565 (31.87%) learners from Grade 11 and 483 (27.24%) from Grade 12. The least number of respondents were from Grade 12 because they were involved in activities and preparation for tests, with the result that they were not always available. Most of the learners were in Grade 10 as they were always available.

4.2.4 Home language of respondents

Figure 4.3 below illustrates the language spoken by learners in their homes.

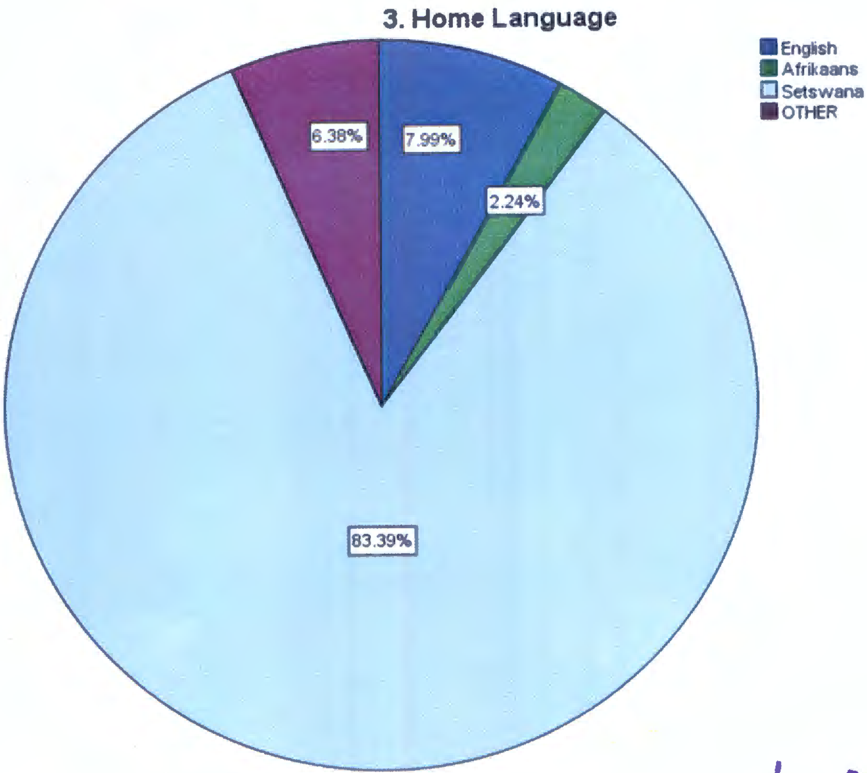


Figure 4.3 **Home language of respondents**

There were a total of 1740 respondents who completed the home language questionnaire. Figure 4.3 above indicates that the majority (1451 or 83.39%) of respondents were from the Setswana home language group, followed by English (139 or 7.99%), other languages (111 or 6.38%) and the least were Afrikaans (39 or 2.24%). Most of the learners were proficient in English and lessons were presented in English.

4.2.5 Age of respondents

Figure 4.4 below indicates the age group of learners who participated in the research study.

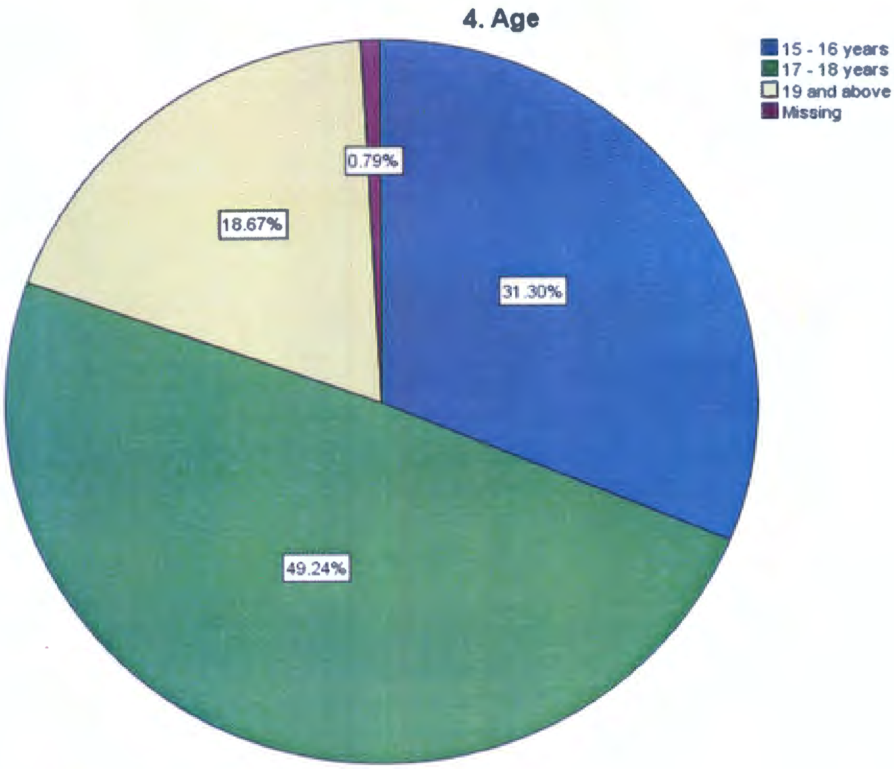


Figure 4.4 **Age of respondents**

From a total of 1759 learners, about half 873 or 49.24% were in the age range of 17-18 years, 555 or 31.3% ranged in age from 15-16 years, while the least (331 or 18.67%) were in the age range of 19 and above (see Figure 4.4 above).

4.3 RESEARCH RELATED DATA

In this section the attributions, achievement motivation levels, gender and socio-economic influences on attributional styles and science achievement of learners are discussed.

The Research Question findings are discussed in terms of the following: Quantitative results, statistical analysis for the particular question and qualitative interview results. Thereafter, final conclusions are drawn.

4.3.1 Types of attributions that affect achievement: related to Research Question 1

The present study investigated the following seven attributional factors on achievement of learners: effort, ability, interest, task difficulty/ease luck, help and teaching methods. Each of the attribution factors were scored on a 4-point Likert-Scale and were categorized into 4 levels. For example, in the case of ability attributions, learners indicated whether their last test results were due to level 1 - 'no ability', level 2 – 'little ability', level 3 – 'more ability' and level 4 –'a lot of ability'. The attribution factors were classified as internal (ability, effort and interest) or external (luck, task ease/difficulty, help from others and teaching methods).

The respondents indicated their last science test achievement mark on the questionnaire. The science achievement of learners was measured in three levels: Low achievers scored between 0-39% on the test, average achievers attained 40-69% and high achievers obtained a mark of between 70-100%. The results of the present study showed that that there were 20% of low achievers, 64% of average achievers, and 16% of high achievers among the science learners. This shows that the majority of learners achieved within average of 40 to 69%.

4.3.1.1 Ability attributions by science achievement

Ability is one of the attributional factors which are identified in the current study as contributing to learners' science achievement. The learners indicated whether their last science test performance was due to 'no ability', 'little ability', 'more ability', or 'high ability'.

Table 4.2 below indicates the total of learners according to their past achievements as related to attributions of ability.

Table 4.2: Levels of ability attributions

Ability attributions	Total raw Score	Total %
1. No ability	69	4%
2. Little ability	631	37%
3. More ability	733	43%
4. A lot ability	281	16%
Total	1714	100.0%

Table 4.2 illustrates that 69 (4%) learners made 'no ability' attributions, 631 (37%) learners made 'little ability' attributions, 733 (43%) learners made 'more ability' attributions and 281 (16%) learners made high ability attributions. In terms of no ability and high ability attributions, the data indicate that 4% of the science learners made no ability attributions, whereas, 16% made high ability attributions. This implies that science learners adopt an internal attributional style by making higher ability attributions.

Figure 4.5 below deals with ability attributions affecting learners' science achievement

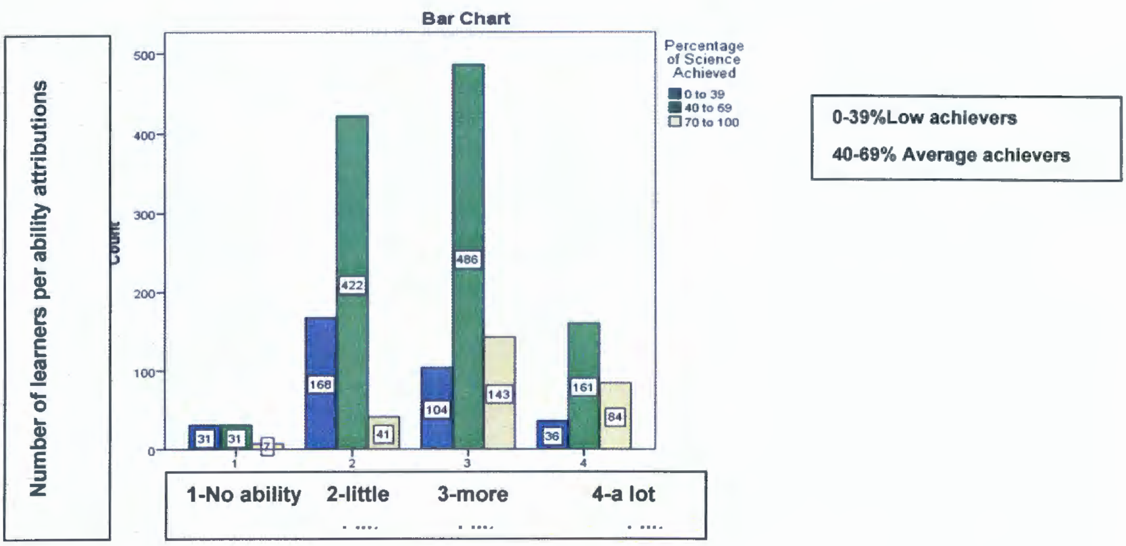


Figure 4.5 **Ability attributions by achievement distribution in science**

Figure 4.5 above reveals the following results: Firstly, 84 high achievers (30%) and 161 average achievers (57%) who were successful condition, tended to make higher ability attributions than the 36 low achievers (13%). Secondly, 31 low achievers (45%) and 31 average achievers (45%) perceived themselves as *having no ability* when compared to only 7 high achievers (10%) who believed that they had no ability. Thirdly, 168 low achievers (27%) and 422 average achievers (67%) perceived themselves as having 'little ability', compared to only 41 high achievers (6%). Fourthly, 143 high achievers (20%) and 486 average achievers (66%) believed that they had 'more ability', whereas, only 104 low achievers (14%) perceived themselves as having 'more ability'.

In terms of high versus low achievers, the current study demonstrates that 84 (30%) high successful achievers made higher ability attributions than 36 (13%) low achievers who failed the test. On the other hand, 31 (45%) low achievers who failed in the science test believed that they had no ability, whereas only 7 (10%) high successful achievers perceived themselves as having no ability in science.

Chi-Square results for ability attributions relative to achievement in science

This section deals with the ability attributional factors from Question 1, which investigates the effects of attributional styles affecting learners' science achievement. According to Question 1, there is a significant relationship between attributional styles and science achievement.

The question was tested using the Chi-Square Test and is demonstrated in Table 4.3 below.

Table 4.3: Chi-Square Test for ability attributions by science achievement

Chi-Square statistics	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	139.201[a]	6	.000
Likelihood Ratio	138.131	6	.000
Linear-by-Linear Association	111.957	1	.000
N of Valid Cases	1714		

0 cells (0.0%) have expected count less than 5.)

The minimum expected count is 11.05. Table 4.3 above shows that the obtained p-value of 0.000 is less than the 0.05 level. Therefore, the study shows a significant relationship between ability attributions and science achievement. The Chi-Square Test of significance attests to this ($P<0.05$; df = 6).

4.3.1.2 Effort attributions by science achievement

According to this research, hard work and effort are identified as attributions that can contribute to learners' achievement in science. The learners indicated whether their last science test performance was due to 'no effort', 'little effort', 'more effort', or 'high effort'. Table 4.4 below represents the data collected in terms of levels of effort attributions.

Table 4.4: Levels of effort attributions

Effort attributions	Total raw score	Total %
1. No effort	69	4%
2. Little effort	609	35%
3. More effort	792	46%
4. High effort	247	14%
Total	1717	100.0%

Table 4.4 above indicates that 69 (4.0%) of science learners made no effort attributions, 609 (35%) learners made 'little effort' attributions, 792 (46%) learners made 'more effort' attributions and 247 (14%) learners made high effort attributions. In terms of no effort and high effort attributions, the data indicate that only 4% of the science learners made no effort attributions, whereas, 14% made high effort attributions. Thus, the current study shows that science learners exhibit an internal attributional style by making higher internal effort attributions.

Figure 4.5 below addresses effort attributions from Research Question 1, which investigates the type of attributions that affects the achievement of learners.

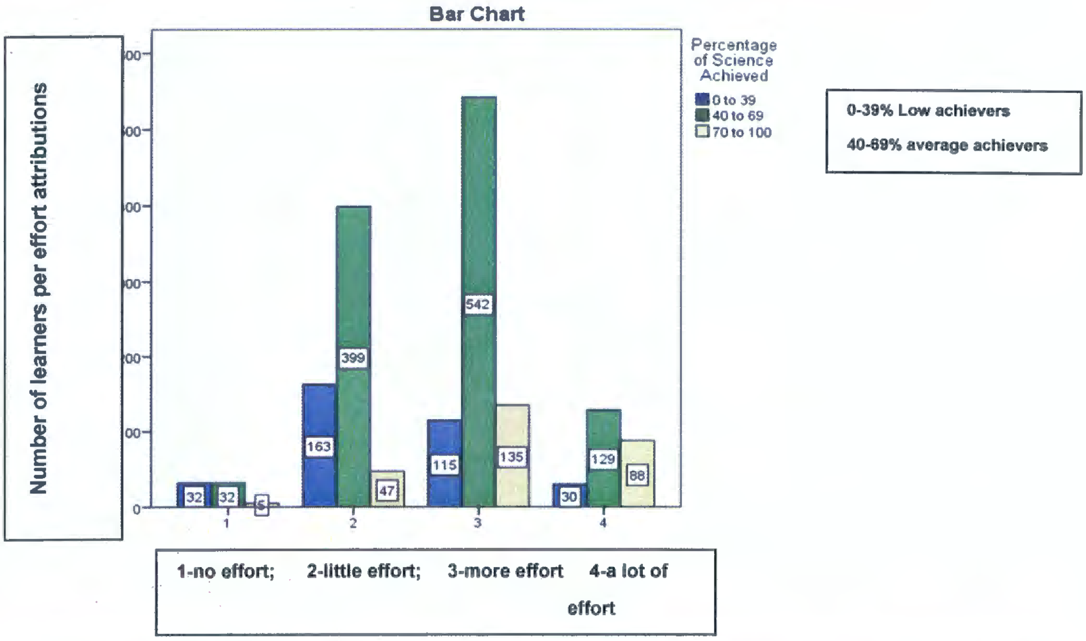


Figure 4.6 **Effort attributions by achievement distribution in science**

Figure 4.6 above reveals the following results: Firstly, 88 high (35%) and 129 average achievers (52%) who were in the successful condition tended to make higher effort attributions than the 30 low achievers (12%). Secondly, 32 low achievers (46%) and 32 average achievers (46%) believed that their outcome in the test was due to no effort whereas only 5 high achievers (8%) believed that they did not exert any effort. Thirdly, 399 average achievers (65%) and 163 low achievers (27%) compared to only 47 high achievers (8%) made 'little effort' attributions. Fourthly, 542 average achievers (68%) and, 135 high achievers (17%) compared to made 115 low achievers (15%) made 'more effort' attributions. Thus, the results confirm that successful high achievers made higher internal *effort attributions* than low achievers.

Furthermore, 46% (32) low achievers (32) in the failure condition than 8% (5) high achievers who were successful assert that their outcome in the test was due to no effort. Finally, explaining outcome in science exams in terms of no effort increased significantly with lower performance.

In terms of high versus low achievers, the results demonstrate the following: High achievers who were successful tend to make higher effort (36%) attributions than low achievers who were in the failure condition (12%). Furthermore, more low achievers in the failure condition (46%) than high achievers who were successful (7%) assert that their outcome in the test was due to no effort. Finally, explaining outcome in science exams in terms of no effort increased significantly with lower performance.

Chi-Square results for effort attributions relative to achievement in science

The following Chi-Square Test of analysis was conducted to test effort attributions by science achievement.

Table 4.5: Chi-Square Test for effort attributions by science achievement

Chi-Square statistics	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	158.635[a]	6	.000
Likelihood Ratio	144.985	6	.000
Linear-by-Linear Association	124.143	1	.000
N of Valid Cases	1717		

0 Cells (0.0%) have expected count less than 5. The minimum expected count is 11.05.)

Table 4.5 above shows that the obtained p-value of 0.000 is less than the 0.05 level. The study indicates a significant relationship between effort attributions and science achievement. The Chi-Square Test of significance attests to this ($p<0.05$; df = 6).

4.3.1.3 Interest attributions by science achievement

In the present study, interest is one of the attributional factors that can contribute to learners' achievement in science. The learners indicated whether their last science test achievement was influenced by 'no interest', 'little interest', 'more interest', or 'high interest' in science. The data collected is presented in Table 4.6 below.

Table 4.6: Interest attributions by achievement in science

Interest attributions	Total raw	Total
1. No interest	115	7%
2. Little interest	435	25%
3. More interest	763	44%
4. High interest	406	24%
Total %	1719	100.0%

Table 4.6 above indicates that 115 (7%) of science learners were not interested in science, 435 (25%) learners showed 'little interest', 763 (44%) learners indicated 'more interest' and 406 (24%) learners were highly interested in science. In terms of high versus no interest in science, the current results show that only 7% of science learners did not indicate any interest in science. On the other hand, almost a quarter (24%) of science learners was highly interested in science. Interest is an internal attributional factor. Thus, the current study shows that science learners exhibit an internal attributional style.

Figure 4.7 below addresses interest attribution from Research Question 1 investigating type of attributions that affects science achievement.

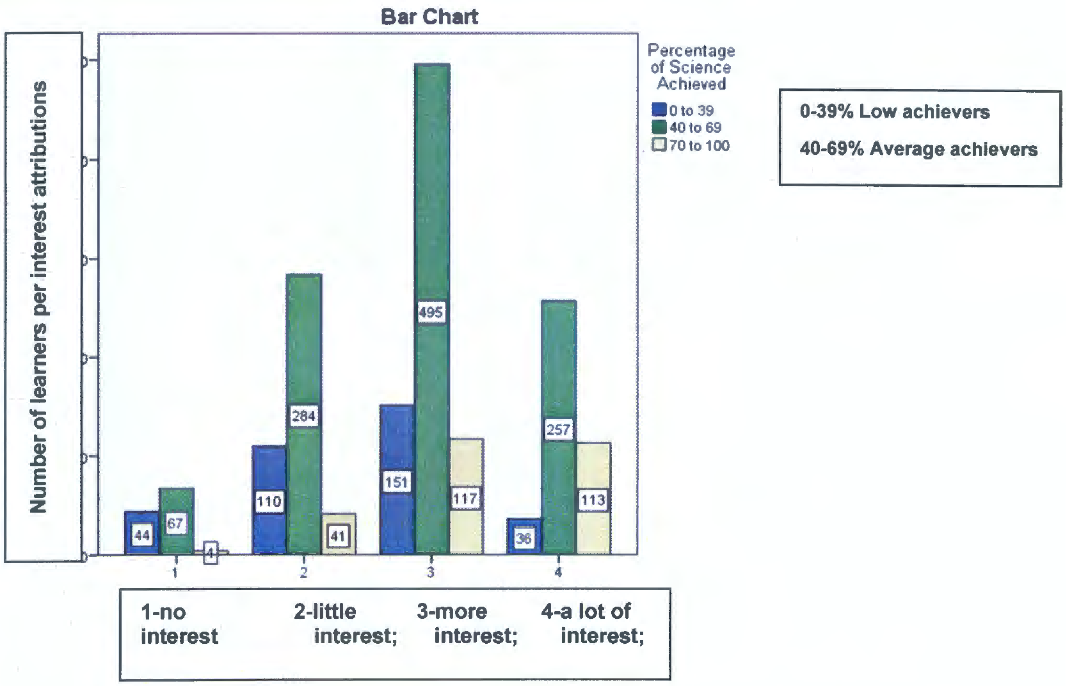


Figure 4.7 **Interest attributions by achievement in science**

The results in Figure 4.7 above indicate the following: Firstly, 113 high achievers (28%) and 257 average achievers (63%) tended to make higher interest attributions than the 36 low achievers (9%). Secondly, 44 low achievers (38%) and 67 average achievers (58%) indicated no interest in science. Comparatively, only 4 high achievers (4%) confirmed no interest in science. Thirdly, 284 average achievers (65%) and 110 low achievers (25%) made 'little interest' attributions, whereas, only 41 high achievers (10%) made 'little interest' attributions. Fourthly, 495 average achievers (65%) and 151 low achievers (20%) compared to 117 high achievers (15%) indicated 'more interest' in science.

In terms of high versus low achievers, the current results demonstrate the following: high achievers who were successful tended to make higher interest (28%) attributions than low achievers who were in the failure condition (9%). Furthermore, more low achievers in the failure condition (38%) than high achievers who were successful (4%) confirmed that their outcome in the test was due to lack of interest. Thus, the results of the present study confirm that successful high achievers made higher internal interest attributions than low achievers in the failure condition.

Chi-Square Test for interest attributions by science achievement

Table 4.7 below indicates the Chi-Square Test results for interest attributions by science achievement.

Table 4.7: Chi-Square Test for interest attributions by science achievement

Chi-Square statistics	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	110.409[a]	6	.000
Likelihood Ratio	113.007	6	.000
Linear-by-Linear Association	103.589	1	.000
N of Valid Cases	1719		

0 cells (0.0%) have expected count less than 5. The minimum expected count is 18.40.)

The Chi-Square results demonstrated that the obtained p-value of 0.000 is less than the 0.05 level. Therefore, the study confirms a significant relationship between interest attributions and science achievement. The Chi-Square Test of significance attests to this ($p<0.05$; df = 6).

4.3.1.4 Task difficulty attribution by science achievement

According to this research, task difficulty is identified as one of the attributional factors that can affect the learners' achievement in science. The learners indicated whether their last science test performance was due to 'no task difficulty', 'little difficulty', 'more difficult', or 'very difficult' (see Table 4.8 below).

Table 4.8: Task difficulty attributions by achievement in science

Task difficulty Attributions	Total raw	Total
1 Not Task difficulty	116	7%
2 Little Task difficulty	931	54%
3 More task difficulty	479	28%
4 Extremely difficult task	188	11%
Total	1714	100.0%

The results indicated that 116 (7%) of science learners found the test easy, more than half (931or 54 %) found the test a 'little difficulty' (level 2), 479 (28%) made 'more difficult' attributions (level 3), and 188 (11%) found the test extremely difficult. The present study demonstrated that only 7% of science learners did not find the science test difficult. On the other hand, 11% of science learners found the test extremely difficult. Figure 4.8 below addresses Research Question number 1 which investigates the type of task difficulty attributions that affects science achievement.

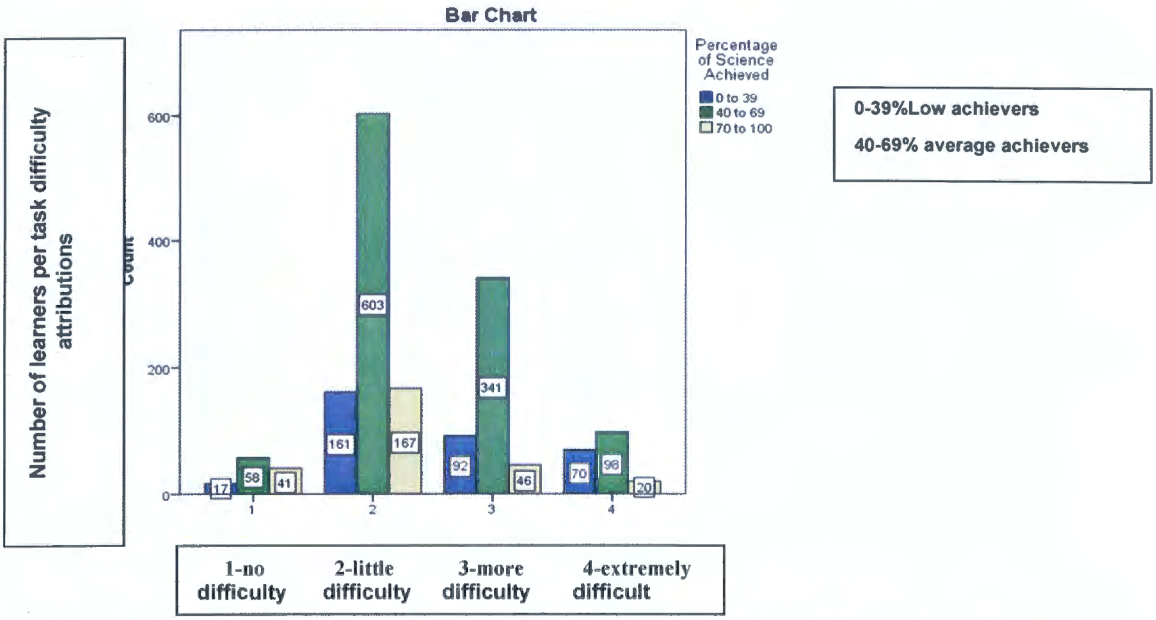


Figure 4.8 **Task difficulty attributions by achievement distribution in science**

The results in Figure 4.8 above show the following: Firstly, 70 low achievers (37%) and 98 average achievers (52%) tended to make higher task difficulty attributions than the 20 high achievers (11%). Secondly, 41 high achievers (35%) and 58 average achievers (50%) indicated that the test was not difficult when compared to only 17 low achievers (15%). Thirdly, 603 average achievers (65%) and 167 high achievers (18%) as compared to 161 low achievers (17%) found the test a 'little difficult'. Fourthly, 341 average achievers (71%) and 92 low achievers (19%) indicated that the test was 'more difficult' compared to only 46 high achievers (10%).

In terms of high versus low achievers, more successful high achievers (35%) than low achievers (15%) found that the test was not difficult. On the other hand, more (37%) low achievers who failed than successful high achievers (11%) found the science test extremely difficult. Thus, the results confirm that low achievers made more use of external *task difficulty* attributions than low achievers.

Chi-Square results for task difficulty attributions relative to achievement in science

Table 4.9 below indicates the Chi-Square Test results for task difficulty attributions by science achievement.

Table 4.9: Chi-Square Test for task difficulty attributions by science achievement

Chi-Square statistics	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	89.977[a]	6	.000
Likelihood Ratio	80.181	6	.000
Linear-by-Linear Association	54.578	1	.000
N of Valid Cases	1714		

0 cells (0.0%) have expected count less than 5. The minimum expected count is 18.54.)

The results demonstrate that the obtained p-value of 0.000 is less than the 0.05 level. Therefore, the study shows a significant relationship between task difficulty attributions relative to science achievement. The Chi-Square Test of significance attests to this ($p<0.05$; df = 6).

4.3.1.5 Luck attributions by science achievement

Luck is one of the attributional factors in the present study which affects learners' science achievement. The learners indicated whether their last science test performance was due to 'no luck', 'little luck', 'more luck' or 'high luck'. Table 4.10 below indicates the total learners according to their past achievements as related to attributions of luck.

Table 4.10: Luck attributions by achievement in science

Luck	Total raw	Total %
1 No luck	556	32%
2 Little luck	720	42%
3 More luck	310	18%
4 High luck	129	8%
Total	1715	100.0%

The results indicate that 556 (32%) science learners perceived themselves as not being lucky, 720 (42%) made 'little luck' attributions, 310 (18%) believed they were more lucky and 129 (8%) learners made high luck attributions. This indicates that 32% of science learners believed that they were not lucky, whereas, only 8% made high luck attributions for their science test results. Thus, science learners did not stress external luck attributions affecting their achievement.

Figure 4.9 below addresses Research Question number 1 which investigated the type of luck attributions that affects science achievement.

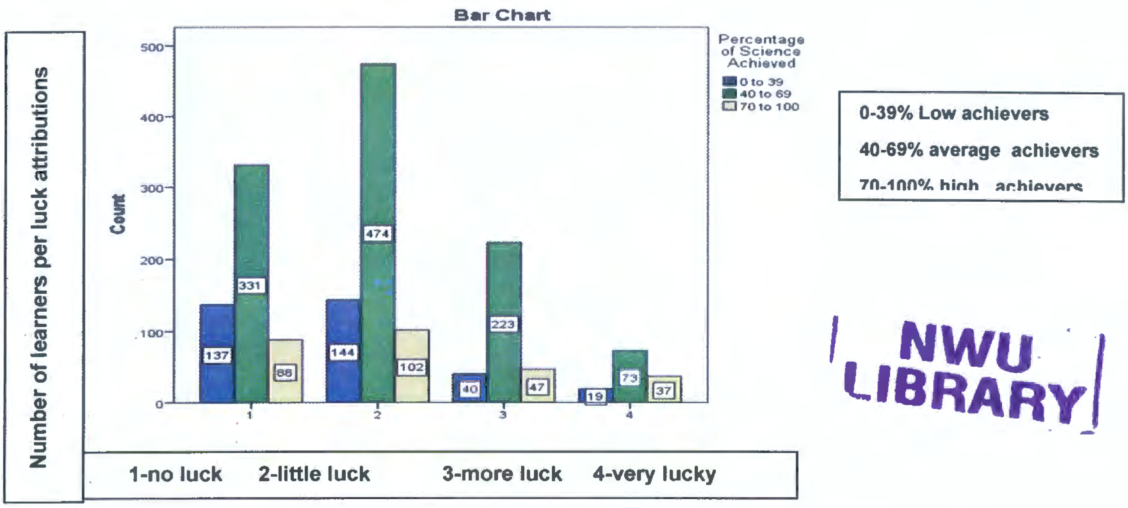


Figure 4.9 **Luck attributions by achievement distribution in science**

The results in Figure 4.9 above reveal the following: Firstly, 37 high achievers (29%) and 73 average achievers (56%) tended to make higher luck attributions than the 19 low achievers (15%). Secondly, 331 average achievers (59%) and 137 low achievers (25%) compared to only 88 high achievers (16%) made 'no luck' attributions. Thirdly, 474 average (66%) and 144 low achievers (20%) compared to 102 high achievers (14%) made 'little luck' attributions. Fourthly, 223 average (72%) and 47 high achievers (15%) believed that they were 'more lucky' than the 40 low achievers (13%).

Thus, more low achievers (25%), who failed in science, than high achievers (16%) made no luck attributions. On the other hand, more high achievers (29%) and less low achievers (15%) tended to attribute their outcome to high luck.

Chi-Square results for luck attributions relative to achievement in science

Table 4.11 below indicates the Chi-Square Test results for luck difficulty attributions by science achievement.

Table 4.11: Chi-Square Test for luck attributions by science achievement

Chi-Square statistics	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	36.583[a]	6	.000
Likelihood Ratio	34.877	6	.000
Linear-by-Linear Association	17.341	1	.000
N of Valid Cases	1715		

0 cells (0.0%) have expected count less than 5. The minimum expected count is 20.61)

Table 4.11 shows that the obtained p-value for luck is 0.000 and is less than the 0.05 level. Therefore, the study shows a significant relationship between luck attributions relative to Science achievement. The Chi-Square Test of significance attests to this ($p<0.05$; df = 6).

4.3.1.6 Help attributions by science achievement

According to this research, help attribution is identified as one of the attributional factors that can affect the learners' achievement in science. The learners indicated whether their last science tests performance was due to 'no help', 'little help', 'more help', or 'a lot of help'. The data collected is presented in table 4.12 below.

Table 4.12: Help attributions by science achievement

Help Attributions	Total raw score	Total
1 No help	724	42%
2 Little help	613	36%
3 More help	283	16%
4 A lot of help	95	6%
Total	1715	100.0%

The results in Table 4.12 above, suggests that that 724 (42%) of the science learners asserted that they did not get assistance from others for their science preparation, 613 (36%) learners asserted that they got 'little help', 283 (16%) had 'more help' and 95 (6%) learners received a lot of assistance from others.

The results of the current study indicate that only 6% of learners received a lot of help from others, while 42% did not get any help from others. Help is one of the four external attributional factors investigated in the study. Therefore, the present research demonstrates that science learners did not see help from others as important and they used low external help attributions for their achievement.

Figure 4.10 below addresses Research Question 1 which investigated the type of help attributions that affects science achievement.

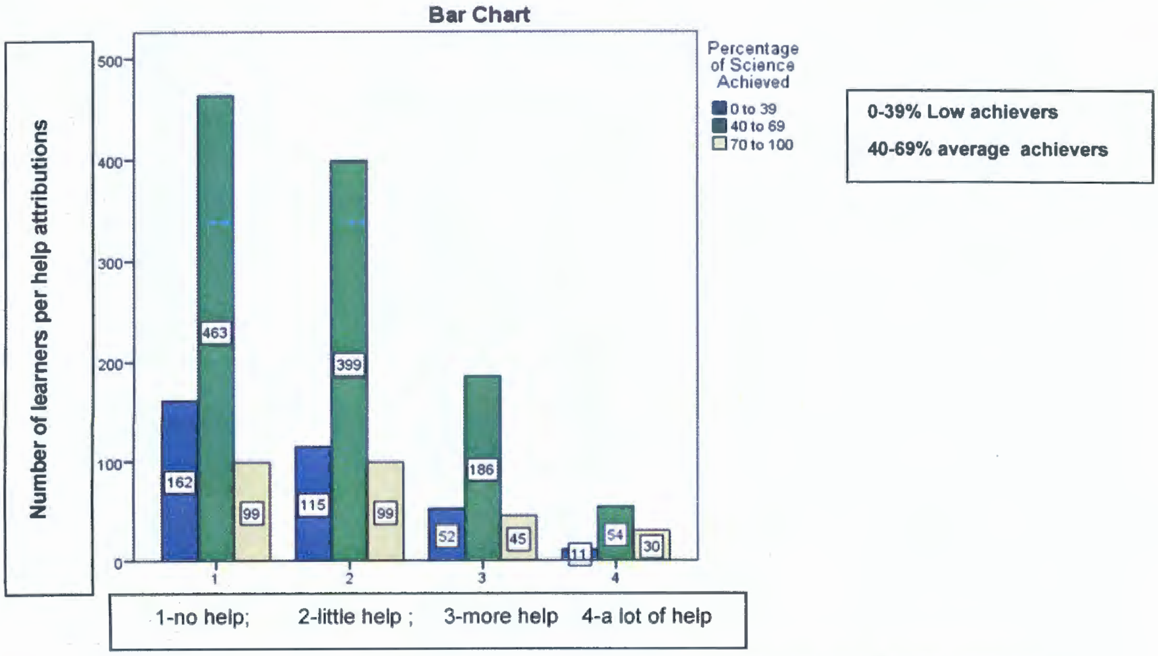


Figure 4.10 **Help attributions by achievement distribution in science**

Figure 4.10 above demonstrates the following: Firstly, 30 high achievers (32%) and 54 average achievers (57%) got a lot of help from others as compared to only 11 low achievers (12%). Secondly, 162 low achievers (22%) and 463 average achievers (64%) compared to only 99 high achievers (14%) did not receive help from others. Thirdly, 115 low achievers (19%) and 399 average achievers (65%) compared to 99 high achievers (16%) received a 'little help' from others. Fourthly 52, low achievers (18%) and 186 average achievers (66%) compared to 45 high achievers (16%) received 'more help' from others.

The study indicates that fewer (14%) high achievers who were successful, confirmed that they did not receive any help for the science test, whereas more (22%) low achievers who failed the test did not receive any help. On the other hand, more high successful achievers (32%) got a lot of help from others whereas fewer low achievers (12%) in the failure condition received a lot of help (external attribution) in the science subject.

Chi-Square results for help attributions relative to achievement in science

Table 4.13 below indicates the Chi-Square Test results for help attributions by science achievement.

Table 4.13: Chi-Square Test for help attributions by science achievement

Chi-Square statistics	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	24.218[a]	6	.000
Likelihood Ratio	21.572	6	.001
Linear-by-Linear Association	14.742	1	.000
N of Valid Cases	1715		

0 cells (0.0%) have expected count less than 5. The minimum expected count is 15.12.)

Table 4.13 shows that the obtained p-value of 0.000 is less than the 0.05 level. Therefore, the study shows a significant relationship between help attributions relative to science achievement. The Chi-Square Test of significance attests to this ($p<0.05$; df = 6).

4.3.1.7Teaching method attributions by science achievement

According to this research, teaching method is identified as one of the attributional factors that can affect the learners' achievement in science. The learners indicated whether their last science tests performance was due to 'no help', 'little help', 'more help', or 'a lot of help'. The data collected is presented in table 4.14 below.

Table 4.14: Teaching method attributions by achievement in science

Teaching methods	Total raw	Total %
1. No contribution	199	12%
2. Little contribution	606	35%
3. More contribution	548	32%
4. A lot contribution	361	21%
Total	1714	100.0%

The results in Table 4.14 above reveal that 199 (12%) of science learners believed that teaching methods did not contribute to their outcome in the science test. Slightly more than a-third (606 or 35%) were of the opinion that teaching methods made 'little contribution' to their outcome, 548 (32%) learners made 'more teaching method' attributions and 361 (21%) learners made high teaching methods attributions.

The results of the current study suggest that 12% of science learners were of the opinion that teaching methods did not contribute to their science test results, whereas 21% believed that teaching methods made a lot of contribution to their results.

Figure 4.11 below addressed Research Question number 1 which investigated the type of teaching method attributions that affects science achievement.

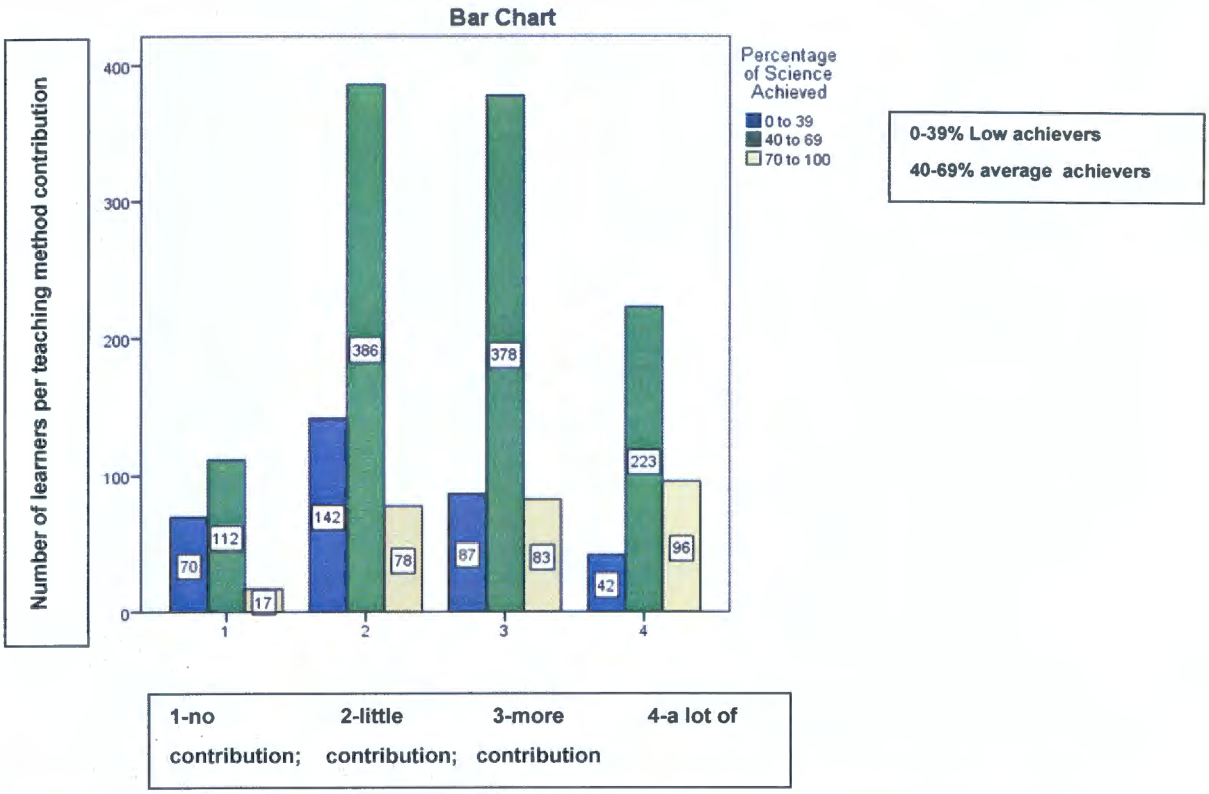


Figure 4.11 **Teaching method attribution by achievement distribution in science**

The results in 4.11 above show the following: Firstly, 223 average achievers (62%) and 96 high achievers (27%) compared to only 42 low achievers (11%) believed that teaching methods made a lot of contribution to their outcome in the test. Secondly, 70 low achievers (35%) and 112 average achievers (56%) compared to only 17 high achievers (9%) were of the opinion that teaching methods did not contribute to their test outcome. Thirdly, 142 low achievers (23%) and 386 average achievers (64%) compared to only 78 high achievers (13%) believed that teaching methods made 'little contribution' to their test mark. Fourthly, 87 low achievers (16%) and 378 average achievers (69%) compared to 83 high achievers (15%) believed that teaching method made 'more contribution' toward their science achievement.

Thus, the results indicate that more low achievers (35%), perceived teaching methods as not making any contribution to their test score, whereas, only 9% of high achievers found that teaching methods did not contribute to their results. On the other hand, fewer low achievers (11%) found that teaching methods contributed a lot to their test results as compared to more high achievers (27%) who perceived teaching methods as making a lot of contribution to their test score. The findings in the present study suggest that high successful learners attributed *their success* to good teachers and they made high teaching method attribution.

Chi-Square results for teaching methods attributions relative to achievement in science

Table 4.15 below indicates the Chi-Square Test results for teaching method attributions by science achievement.

Table 4.15: Chi-Square Test for teaching method attributions by science achievement

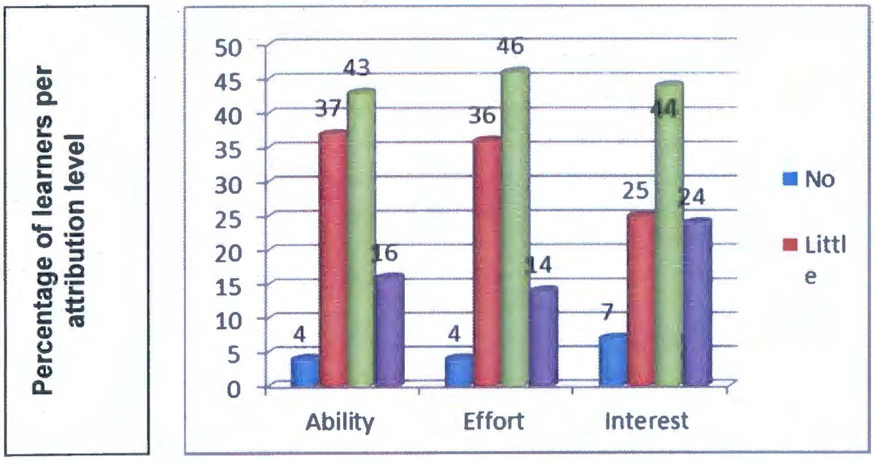
Chi-Square statistics	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	84.473[a]	6	.000
Likelihood Ratio	79.859	6	.000
Linear-by-Linear Association	72.694	1	.000
N of Valid Cases	1 714		

0 cells have expected count less than 5. The min. expected count is 31.81

Table 4.15 shows that the obtained p-value of 0.000 is less than the 0.05 level. Therefore, the study shows a significant relationship between teaching method attributions relative to science achievement. The Chi-Square Test of significance attests to this ($p<0.05$; df = 6).

4.3.1.8Types of attributions and their levels

Figure 4.12a and Figure 12b represent the seven attribution factors in terms of levels of attributions. The four levels are categorized as 'no', 'little', 'more' and 'high' levels of each factor of attribution. The factors of attribution are as follows: ability, effort and interest (internal attributional style), task difficulty, luck, help from others and contribution of teaching methods (external style of attribution).



Results in Figure 12a above indicated that most of the science learners made the highest attribution to 'more ability' (43%), 'more effort' (46%), 'more interest' (44%). The attribution factors ability, effort and interest constitute an internal attribution style therefore, most science learners made high internal attributions (see Figure 12a).

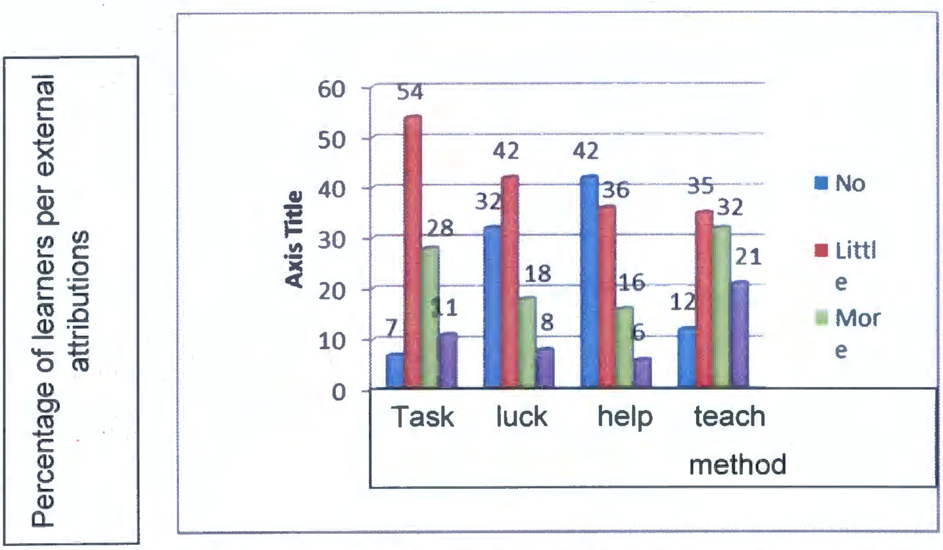


Figure 4.12b **Percentage of attribution factors by levels of external attributions**

Figure 4.12b above indicates that the science learners used less external attributions (little task difficulty, little luck, no help from others and little teacher contribution). The internal (ability, effort, interest) and external attributions (task difficulty, luck, help, teaching method) were assessed in terms of low achievers (0-39%) and high achievers (70-100%) in science.

The present study indicates that high successful achievers attributed their outcomes to internal ability, effort and interest attributions to a greater extent than did low achievers in the failure condition. This indicates that high achievers made more use of internal attributional styles, whereas, low achievers made less internal attributions.

Weiner (1980) classified attributions into three dimensions: *locus* of causality (internal or external to the person), *stability* and *controllability*. Stability in Weiner's theory refers to the duration of a cause. Ability is a stable cause and cannot be changed volitionally, whereas, effort is an unstable and changeable attribution because the individual can increase or decrease effort expenditure of effort. Effort can be controlled, whereas, ability cannot be controlled and is constant.

In terms of dimensions of attribution, the present study shows that high achieving learners attributed their outcome to ability (stable, internal, uncontrollable factor), effort (unstable, internal, controllable) and teacher contribution (unstable, external). Research showed that locus and stability dimensions determine expectancy of future success or failure (Weiner, 2000:4, section 2.4.2). Low achievers in the present study made low ability attributions (internal, stable cause). It is likely that these learners will anticipate future failure. However, if failure is perceived as due to an unstable factor (insufficient effort exerted on the task) failure will not be anticipated (Weiner, 2000:4). In the current study, low achievers made lack of effort attributions for their failure. It is likely that these learners, who failed and asserted that they had not exerted sufficient effort in the test preparation, may not expect future failure. In future they will spend more effort on the task and expect to succeed. The current study shows that low achievers in the failure condition made 'no' interest attributions (Figure 4.7). Past studies have indicated that if failure is attributed to internal factors, self-esteem can be diminished (Weiner, 2000:4; Rusillo & Arias, 2004:101).

The finding in the present study that low achievers attributed their failure to lack of ability (Figure 4.5), inadequate effort (Figure 4.6) and lack of luck (Figure 4.9) is in line with findings of Batool et al. (2010:454). They stated that when learners fail in an exam, they are likely to attribute the failure to unstable (no luck) factors. The finding in the present study is also consistent with the results by Boruchovitch (2004:58) who noted that attributions of failure to external influences are not likely to lead to better performance in future.

The current findings regarding high achievers' attribution of success to high ability (Figure 4.5), hard work (Figure 4.6), and high luck (Figure 4.9) is in line with results by Batool et al., (2010:454). They indicated that when learners succeed, their success is attributed to internal, stable (excellent ability) or internal, unstable (hard work) or external, unstable (good luck). In the current study, it is likely that successful high achievers who made unstable attributions and believed that they succeeded because of effort, will put in more effort in the task in order to succeed, and if they believe it was due to ability, they will then use more effort to succeed. Learners will not be interested if they believe that their success or failure was due to external factors. Teachers must encourage learners to believe that they have the ability (stable) and that they can control effort. Thus, ability combined with effort will lead to success (Boruchovitch, 2004:58).

The findings in the present study are also in line with the findings of Boruchovitch (2004:58) who found that successful learners made internal and external attributions and attributed their success to effort (internal), good teacher and task ease (external). The current findings which indicated that learners attributed failure to lack of effort, task difficulty and lack of luck were also supported by the results of Boruchovitch (2004:58, see Table 2.10).

The present study demonstrates that on the three external attributions (luck, help and teaching method), the high achievers showed an external style of attribution. More high achievers tended to attribute their outcome to a lot of luck (unstable, external, uncontrollable), a lot of help and a lot of contribution to the teaching method, which are external factors. The findings that high achievers attributed their success to high luck (external, unstable) and their failure to lack of luck (unstable, external) are also in harmony with results by Batool et al. (2010:454).

More high achievers made low task difficulty attributions as compared to low achievers. Thus, high achievers found the test easier than low achievers. Low achievers in the present study attributed their failure to task difficulty factors (stable, external, uncontrollable). Weiner (2000:4) indicated that when failure is attributed to a stable factor such as subject difficulty, the learner is likely to expect future failure. Thus, in the current study, the high subject difficulty attributions for failure by low achievers may lead to higher expectations of future failure. The findings in the present study are also in line with the findings of Boruchovitch (2004:58) who found that successful learners attributed their success to task ease and failure to task difficulty. According to Boruchovitch (2004:58), attributions of failure to external influences are not likely to lead to better performance in future. It is likely that that the low achievers who made task difficulty attributions (external attributions) will not expect to perform better in future.

An ANOVA test of significance was performed on the above seven attributions and the results are indicated as follows.

ANOVA results for attribution factors by science achievement

The ANOVA test of significance showed that there is a significant relationship in the indicates the results yielded by the ANOVA test.

Table 4.16: ANOVA test results of attributions relative to science achievement

Attributions	df	F	Sig.
Ability	6	35.562	.000
Effort	6	40.169	.000
Interest	6	27.278	.000
Task	6	13.465	.000
Luck	6	5.633	.000
Help	6	5.013	.000
Teaching methods	6	17.941	.000

As seen in Table 4.16 above, there was a significant relationship between ability, effort, interest, task difficulty, luck, help and teaching method attributions relative to science achievement. The ANOVA Test of significance attests to this ($P<0.05$).

The data above, addresses Research Question 1. The ANOVA test of significance indicated a significant relationship between the seven attributional factors and achievement in science (Table 4.16).

A regression model was developed to act as a concise summary for the individual ANOVAS and Chi-Squares, where their inter-relationships are catered for and is discussed below.

Regression model

The regression model is usually used to predict continuous dependent variable based on an independent continuous variable.

In the present study it is used to explore relationship, but not to predict, more so that the variables are "ranked" values.

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.435[a]	.189	.186	1.354
a. Predictors: (Constant), (g) TEACHING METHODS, (e) LUCK, (d) TASK, (f) HELP, (a) ABILITY, (c) INTEREST, (b) EFFORT				

ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	718.050	7	102.579	55.927	.000[b]
	Residual	3074.014	1676	1.834		
	Total	3792.064	1683			
a. Dependent Variable: 5. Percentage achieved on science Test						
b. Predictors: (Constant), (g) TEACHING METHODS, (e) LUCK, (d) TASK, (f) HELP, (a) ABILITY, (c) INTEREST, (b) EFFORT						

Coefficients						
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.922	.198		9.732	.000
	(a) ABILITY	.248	.055	.129	4.548	.000
	(b) EFFORT	.308	.060	.156	5.173	.000
	(c) INTEREST	.211	.047	.120	4.518	.000
	(d) TASK	-.317	.043	-.163	-7.315	.000
	(e) LUCK	.085	.039	.051	2.212	.027
	(f) HELP	.084	.039	.050	2.152	.032
	(g) TEACHING METHODS	.101	.040	.064	2.540	.011
a. Dependent Variable: 5. Percentage achieved on science Test						

$$\hat{Y}_t = 1.922 + 0.248\, Ability + 0.308\, Effort + 0.211\, Interest - 0.317\, Task + 0.085\, Luck + 0.084\, Help + 0.101\, Teaching\ Methods$$

The model seems to be moderate with (R^2= 0.189), all variables are significant since p-values are all less than 0.05. Equally so, all variables contribute significantly on the model. The regression model can only explain 19% of variation of the science achievement, it cannot be used to predict, but for exploratory purposes it explains that all the attributions contribute positively to science achievement, except the task attribution that contributes negatively. This will be the bases model to be developed for conscience relationship between this variables and achievement in science.

4.3.2 The influence of achievement motivation on attributional styles and science achievement of learners: Related to research Question 2

This section deals with Research Question 2 which is quantitatively investigating the effects of achievement motivation levels on attributional styles and science achievement of learners. According to this research, achievement motivation levels of learners are identified as affecting the learners' attributions and achievement in science. A total of 1735 respondents completed the Achievement Motivation Questionnaire. The Achievement Motivation Questionnaire consists of 33 questions and the respondents were classified as low, moderate and high achievement motivation groups. The responses were marked according to a key provided to divide the learners into three categories of motivation. Learners who obtained between 1 to 9 correct answers were classified as low achievement motivated individuals. Those who attained 10 to 25 correct answers were seen as moderately motivated, whereas 25 to 33 were highly motivated individuals. The respondents were also divided into three levels based on their achievement in the science test: Low achievers scored 0-39% on the test, average achievers attained 40-69% and high achievers achieved 70-100%. (see Table 4.17 below).

Table 4.17: Levels of achievement motivation of science learners

Achievement motivation	Total learners	Total %
Low achievement motivation	73	4%
Moderate achievement motivation	1018	59%
High achievement motivation	644	37%
Total	1735	100%

Table 4.17 above indicates that from a total of 1735 respondents, there were 73 (4%) low motivated learners, 1018 (59%) moderately motivated learners and 644 (37%)

highly motivated learners. This illustrates that more than half of the learners were moderately motivated followed by more than a third of the learners who were highly motivated. The table demonstrates that very few learners (4%) from the total respondents, lacked motivation.

4.3.2.1 Achievement motivation levels by attribution means

Means were computed for the seven attribution factors (ability, effort, interest, task difficulty/ease, luck, help and teaching methods) and compared to low-, moderate- and high- achievement motivated learners.

Figure 4.13 below addresses the effects of achievement motivation levels on attributional styles of science learners.

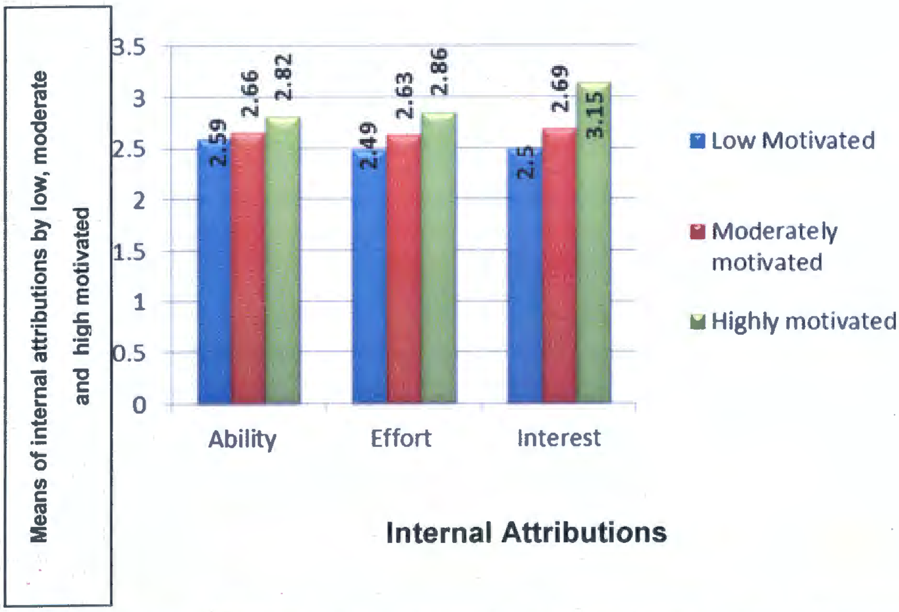


Figure 4.13 **Means of internal attributions by learners' achievement motivation level**

Figure 4.13 above demonstrates that highly motivated groups made the higher interest (3.15), ability (2.82) and effort (2.86) attributions than low motivated groups who made lower interest (2.50), ability (2.59), and effort (2.49) attributions. The moderately motivated groups also made the lower interest (2.69), ability 2.66), and effort (2.63) attributions than the highly motivated group. Thus, the present study demonstrated that the highly motivated group made higher internal attributions (ability, effort and interest) than the low and moderately motivated groups.

The finding in the present study regarding high interest attributions by highly motivated individuals is in harmony with Tellas' study (2007:150) which stresses that interest is important in increasing the motivation levels of learners. Lack of interest leads to a lack of motivation which in turn leads to poor performance (see Table 2.8).

The results in the current study show that highly motivated learners made higher ability attributions and that high and low motivated learners made different teaching method attributions are in line with Basturk and Yavuz (2010) assertion that teaching methods affects learners' attributions (see Table 2.12). It is also in harmony with findings by McClure et al. (2010:76) who noted that Grade 11 learners who made ability, effort, and teacher attributions were more likely to have higher levels of achievement (see Table 2.7).

Figure 4.14 below illustrates the external attributional styles of science learners in terms of their motivation levels.

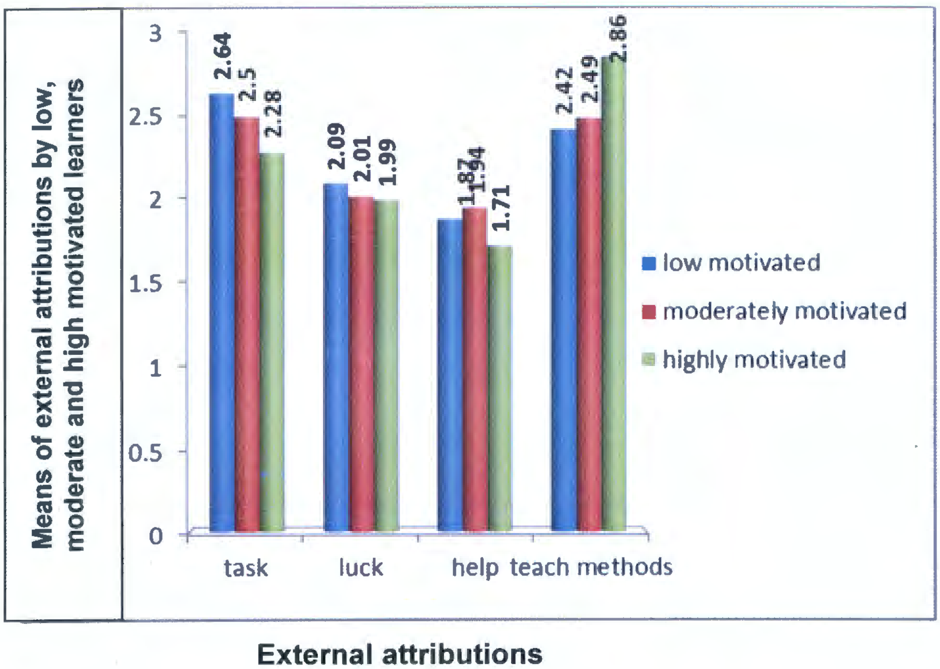


Figure 4.14 **Means of external attributions by learners' achievement motivation**

Results indicated that high achievement motivated learners made higher external teaching method (2.86) attributions than low achievement motivated learners (2.42) and moderately motivated individuals (2.49). This may indicate that the highly motivated group found the teaching methods of the teacher good and that this led to motivating the learner to get better results. Tella (2007:151) suggests that teaching styles affect learners' attributions.

In the present study, highly motivated learners made higher teaching methods attributions. High motivated individuals made lower external task difficulty (2.28), and help (1.71) attributions than low motivated groups who made higher external task difficulty (2.64), and help (1.87) attributions. Regarding luck attributions, there were no significant differences between high, low and moderately motivated learners in terms of luck attributions. The moderately motivated group also made higher task difficulty (2.5) and help (1.94) attributions than high achievers. This shows that the low- and moderately motivated groups found the test more difficult than the highly motivated group. It also indicates that the low- and moderately motivated groups made higher external attributions by attributing their outcome to task, and help more than the highly motivated groups.

4.3.2.2 Achievement motivation by achievement in science

There were 1735 respondents who completed the achievement motivation questionnaire. Figure 4.15 below represents the effects of different motivation levels on science achievement of learners in Grades 10-12.

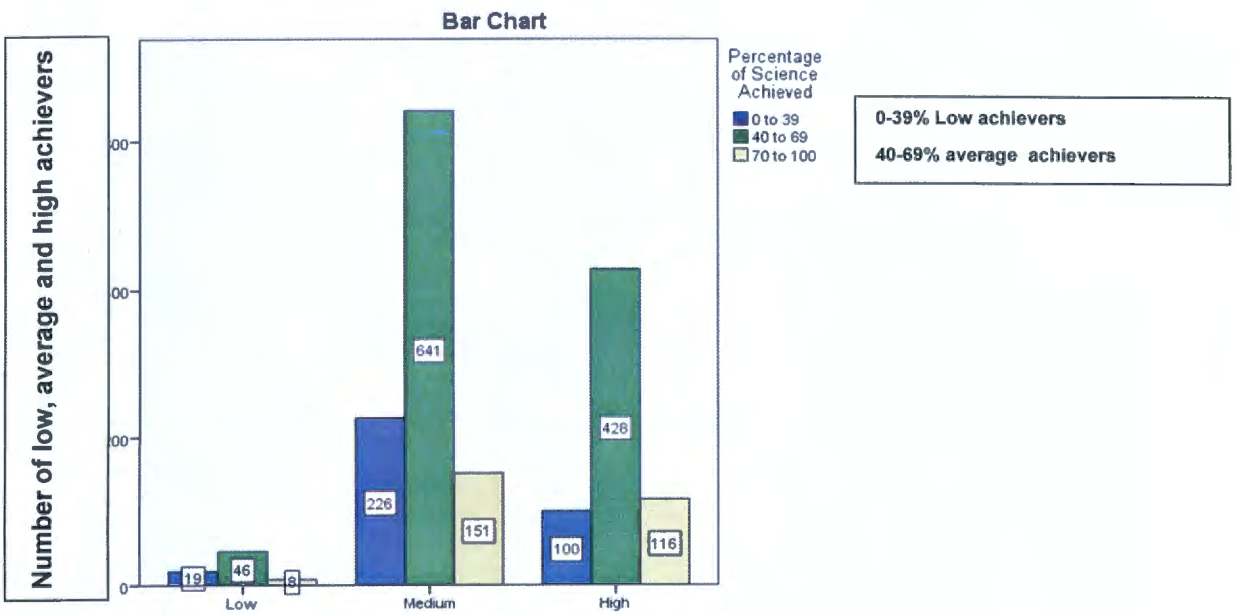


Figure 4.15 **Achievement motivation level by achievement in science**

The total of 1735 learners was divided into low, moderate and high achievement motivated groups. Figure 4.15 above shows that there were 19 (26%) low achievers, 46 (63%) average achievers and 8 (11%) high achievers from the low motivated group. In terms of low and high achievers, there were 26% of low achievers who lacked motivation, whereas, there were 11% of high achievers who lacked motivation. Thus, there were more low achievers among the low motivated group, which shows that poorly motivated individuals perform poorly.

There were 226 (22%) low achievers, 641 (63%) average achievers and 151 (15%) high achievers who were moderately motivated. In terms of low and high achievers, there were 22% of low achievers who were moderately motivated while 15% of high achievers were moderately motivated.

From the highly motivated group, there were 100 (16%) low achievers, 428 (66%) average achievers and 116 (18%) high achievers. In terms of high and low achievers, the findings indicate that there were 18% of high achievers who were highly motivated as compared to 16% of low achievers who were highly motivated. Thus, there were more high achievers among the highly motivated group.

The statistical analysis of the responses to Research Question 2: The ANOVA results for achievement motivation levels relative to attributions

An ANOVA test of significance was performed to investigate whether there are differences in the achievement motivation levels of learners relative to attribution factors. Table 4.18 below indicates the ANOVA results for achievement motivation relative to attributions. :

Table 4.18: ANOVA results for achievement motivation by attribution factors

ATTRIBUTIONS	F	df	Sig.	p-value
Ability * Achievement Motivation Score	9.336	2	.000	<0.05
Effort * Achievement Motivation Score	21.543	2	.000	<0.05
Interest * Achievement Motivation Score	67.494	2	.000	<0.05
Task * Achievement Motivation Score	19.206	2	.000	<0.05
Luck * Achievement Motivation Score	.398	2	.672	>0.05
Help * Achievement Motivation Score	13.472	2	.000	<0.05
Teaching methods * Achievement Motivation	32.426	2	.000	<0.05

Table 4.18 above illustrates that the p-value for six of the attribution factors (ability, effort, interest, task, help and teaching methods) are less than 0.05 (<.05). Therefore, it shows that there are statistically significant differences between achievement motivation and the six attributions.

The p-value for luck is .672 which is more than 0.05 (p>.05). This shows that there is no significant difference between achievement motivation and luck attributions.

The Chi-Square Test for achievement motivation by science achievement

The Chi-Square Test results are presented in table 4.19 below.

Table 4.19: Chi-Square Test for achievement motivation by achievement in science

Chi-Square statistics	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	14.711[a]	4	.005
Likelihood Ratio	15.058	4	.005
Linear-by-Linear Association	13.296	1	.000
N of Valid Cases	1735		

0 cells (0.0%) have expected count less than 5. The minimum expected count is 11.57).

Table 4.19 above shows that the obtained p-value of 0.005 is less than the 0.05 level of significance. Therefore, the study shows a significant relationship between achievement motivations relative to science achievement. The Chi-Square Test of significance attests to this ($p<0.05$; df = 4).

ANOVA for achievement motivation by science achievement

The ANOVA test of significance was performed to investigate the relationship between achievement motivations by science achievement. Table 4.20 below indicates the achievement motivation scores and percentages of the achievement motivations levels of science learners.

Table 4.20: ANOVA test results for achievement motivation scores by science achievement

Achievement Motivation	Between Groups	Sum of Squares	Df	Mean Square	F	Sig.
Score	Between Groups	396.126	2	198.063	7.964	.000
Score P	Between Groups	3672.036	2	1836.018	7.823	.000
Total			1734			

Table 4.20 above illustrates that the p-value of .000 for achievement motivation is less than 0.05 ($p<.05$), which shows that there is a statistically significant relationship between achievement motivation and achievement in science. The ANOVA results for the present study reveal that there is a significant relationship between achievement motivations and science achievement.

4.3.3 Effects of gender on attributions and science achievement: Related to Research Question 3

This section deals with Research Question 3 which is quantitatively investigating the effects of gender on attributional factors and achievement of science learners.

4.3.3.1 Gender of respondents by attributional factors

A total of 1767 (921 males and 846 females) learners responded to the gender questionnaire. Only completed questionnaires were used in the final analysis for each of the attribution factors. Means were computed for the seven attributional factors (ability, effort, interest, task difficulty/ease, luck, help and teaching methods) and compared to males and females. Figure 4.16 below represents the effects of gender on the attributional styles of science learners.

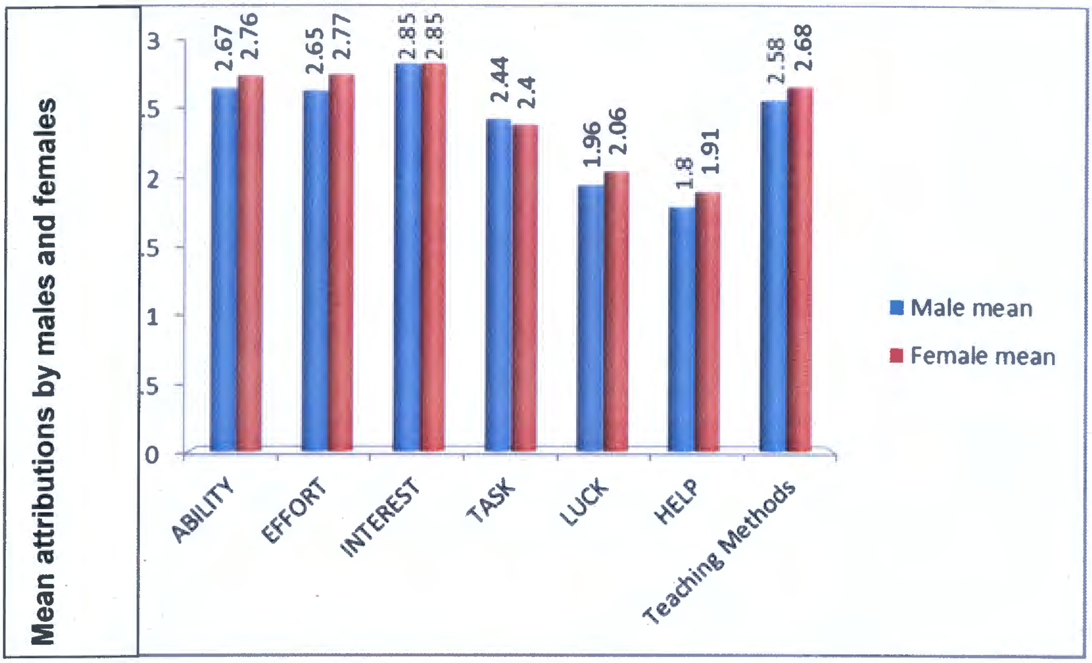


Figure 4.16 **Gender by attributions**

Figure 4.16 above indicates that females demonstrated slightly higher ability attributions (m=2.76) and effort attributions (m=2.77) than males who made lower ability (m=2.67) and effort attributions (m=2.65) in science. Both males (m=2.85) and females (m=2.85) made high interest attributions. Ability, effort and interest attributions are internal factors of attribution. The findings of the study, thus, suggests that although both male and females made internal attributions, females have a tendency to be more internally attributive than males in terms of ability and effort attributions. This finding is in harmony with results indicated by McClure et al., (2010:2) who found that females made more internal attributions for academic achievement than males. However, the finding regarding higher ability attributions by females contradicts the findings by Meece et. al. (2006:354) found that males attributed their performance in science to high ability. Regarding interest attribution it was observed that both male and females made equal interest attributions in the science course.

Regarding the external factors, Figure 4.16 demonstrates that females made higher luck (m=2.06), help (m=1.91) and teaching methods attributions (m=2.68) than males who made lower luck (m=1.96), help (m=1.80) and teaching methods (m=2.58). This suggests that females perceived themselves to be luckier than males and they found external help and teaching methods as more important than males did. The finding that females made higher luck attributions is in line with findings by Mudhovozi et al. (2010:587) who confirmed that women attribute success to external factors such as luck, but it is disconfirmed by Meece who found that women attribute success to bad luck. On the other hand, females and males made similar task difficulty attributions (m=2.4), whereas Meece, et al. (2006:354) indicated that women attribute success to task ease.

4.3.3.2 Gender by science achievement

This section deals with Research Question 3 which is quantitatively investigating the effects of gender on attributional styles and achievement of science learners. Section 4.3.3.1 addressed the effects of gender on attributional styles of learners. This section will present the findings on the effects of gender relative to achievement of science learners. Only completed questionnaires were used in the final analysis, consequently there were 1729 (97.5%) responses for gender relative to science achievement. Table 4.21 below presents the total of male and female respondents in terms of low, average and high achievers.

Table 4.21: Gender by total learners in science achievement

Low achievers	**345**	**20%**
Average achievers	1113	64%
High achievers	271	16%
Total	1729	100%

Table 4.21 above indicates that from a total of 1729 respondents, there were 345 20.0%) low achievers, 1113 (64%) average achievers and 271 (16%) high achievers. This illustrates that almost two-thirds of the learners (males and females) were average achievers. Whereas, there were 20% of low achievers and 16% of high achievers. Figure 4.17 below represents male and female learners in terms of their achievement in science.

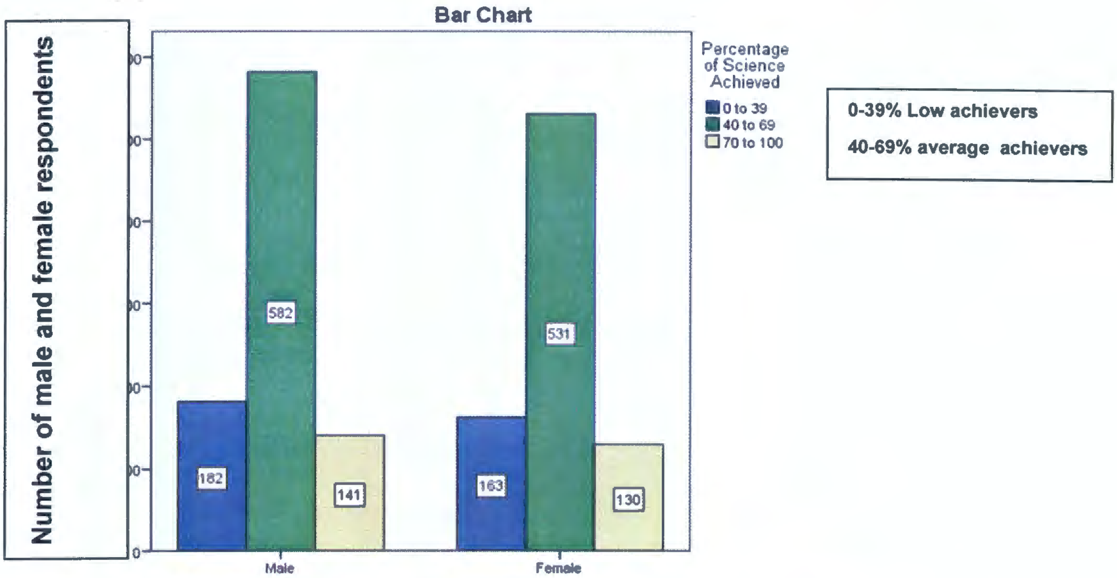


Figure 4.17 **Gender by percentage achieved in science**

Figure 4.17 above reveals that 582 (64%) of the males were average achievers, while 531 (64.4%) of the females achieved in the average range. This indicates that most learners (males and females) were average achievers. There were 182 (20%) male low achievers and 163 (20%) female low achievers.

Regarding the high achievers, there were 141 (16%) male high achievers compared to 130 (16%) female high achievers. This indicates that there were no significant differences between male and female achievers.

The statistical analysis of the responses to question 3: The ANOVA results for gender by attribution factors

The ANOVA results for the present study was performed and yielded the results as shown in Table 4.22 below.

Table 4.22: ANOVA of gender by attributions

Attributions	df	F	Sig.
Ability	1	6.128	.013
Effort	1	12.660	.000
Interest	1	.004	.949
Task	1	1.088	.297
Luck	1	5.360	.021
Help	1	6.591	.010
Teaching methods	1	5.178	.023

Table 4.22 above indicates that the p-values for ability (.013), effort (.000), luck (.021), help (.010) and teaching methods attributions (.023) are lower than 0.05 level. Therefore, the study shows a significant relationship between gender relative to ability, effort, luck, help and teaching method attributions of science learners. The ANOVA Test of significance attests to this ($p<0.05$).

The p-values for interest (.949) and task difficulty (.297) are above 0.05 levels. Therefore, the study shows an insignificant relationship between gender relative to interest and task attributions of science learners ($p>0.05$). Thus, the ANOVA test of significance showed that there is no statistical difference between gender relative to interest and task difficulty attributions ($p>.05$).

Chi-Square results for gender relative to science achievement

Table 4.23 below indicates the Chi-Square Test results for gender by science achievement.

Table 4.23: Chi-Square results for gender by achievement in science

Chi-Square statistics	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.035[a]	2	.983
Likelihood Ratio	.035	2	.983
Linear-by-Linear Association	.034	1	.855
N of Valid Cases	1729		

0 cells have expected count less than 5. The minimum expected count is 129.15.

The question was tested using the Chi-Square Test. Table 4.23 below shows that the obtained p-value for gender is .983 and is more than the 0.05 level. Therefore, the Chi-Square test results showed that there is no statistical difference between achievement in science relative to gender. The Chi-Square Test of significance attests to this ($p>0.05$; df = 2).

4.3.4 Effects of socio-economic status on attributions and science achievement: Related to Research Question 4

This section deals with Research Question 4 which is quantitatively investigating the effects of socio-economic background on the attributional styles and science achievement of learners. According to this research, socio-economic status of learners is identified as affecting the learners' attributions and achievement in science.

The following factors were used to determine the socio-economic level of learners:

- Income per month of the breadwinner in the family;
- highest level of education of the breadwinner in the family;
- breadwinners occupation;
- number of bedrooms in a household;
- access to television in the learners' home;
- laboratory in school; and
- community library in the learners' area.

Each of the above factors was assessed in terms of attributions styles and achievement in science. To assess the science achievement the learners were divided into three levels of achievement in the science test: Low achievers scored 0-39% on the test, average achievers attained 40-69% and high achievers 70-100%.

4.3.4.1 Income per month of the breadwinner

The first factor used to determine the socio-economic level of learners, was the income per month of the breadwinner (see Table 4.24 below).

Table 4.24: Total learners by breadwinners' income per month

Income per month of the Breadwinner	Total	Total %
Below <R1,000	448	28%
R1,000 - R5,000	457	28%
R6,000 - R10,000	335	21%
R10,000 above>	380	23%
Total	1620	100

Table 4.24 above indicates that from a total of 1620 respondents, there were 448 (28%) learners who came from a family background who earned below <R1, 000 (lower-socio-economic group – LSE). Whereas, there were 457 (28%) learners whose family earned R1, 000-R5, 000. There were 335 (21%) learners from families whose monthly income was R6, 000-R10, 000. Finally, there were 380 learners from the higher income group of R10,000 above> (higher socio-economic group – HSE).

Income per month of the breadwinner by attributional styles of learners

The income per month of the breadwinner indicated whether learners were from a higher socio-economic (HSE) background or from a lower socio-economic (LSE) environment. In the case where the breadwinner earned below <R1,000 the learner was categorized as LSE group. On the other hand, where the breadwinner earned above >R10,000 the learner was categorized as HSE group. Means were computed for the seven attributional factors (ability, effort, interest, task, luck, help and teaching methods) in terms of the breadwinners' income per month (see Table 4.25 below).

Table 4.25: Income per month of the breadwinner by attributions

Income	Ability	Effort	interest	Task	Luck	Help	Teaching Attribution
Below <R1,000	2.60	2.62	2.72	2.47	2.02	1.90	2.53
R1,000 - R5,000	2.64	2.70	2.84	2.38	2.10	1.90	2.66
R6,000 - R10,000	2.77	2.78	2.95	2.38	2.10	1.90	2.66
R6,000 - R10,000	2.77	2.78	2.95	2.49	1.91	1.85	2.61
R10,000 above>	2.97	2.84	2.99	2.43	2.00	1.84	2.76
Total	2.73	2.73	2.86	2.44	2.02	1.88	2.63

Table 4.25 above demonstrates that learners from a higher income group (HIG, breadwinners' monthly income R10,000 above>) made higher ability (m=2.97), effort

(m=2.84) and interest (m=2.99) attributions than learners from a lower income group (LIG, breadwinners' monthly income below <R1,000). Learners from a LIG made lower ability (m=2.60), effort (m=2.62) and interest (m=2.72) attributions than learners from a HIG. These results indicate that learners from higher income families were more internally attributive than learners from lower income families.

Table 4.25 further indicates that there were not many differences between the task, and help attributions by learners from LIG and HIG. Task attributions by LIG was (m=2.47) and HIG was (m=2.43). The help attributions by LIG was (m=1.90) and for the HIG was (m=1.84). There was a slight difference between the luck attributions by LIG (m=2.02) as compared to the HIG (m=2.0). Regarding teaching method attributions, the present study showed that learners from the HIG made higher teaching method attributions (m=2.76) than learners from the LIG (m=2.53). This indicates that learners from the higher income groups found that teaching methods contributed highly to their success in the science test.

Income per month of the breadwinner by science achievement

Figure 4.18 below compares learners from four income levels with three levels of achievement in science (low, average and high). For the purpose of the present study income of below <R1,000 will be categorized as learners from the lower socio-economic group (LSE). On the other hand, an income of R10,000 above > will be categorized as learners from the higher socio-economic group (HSE).

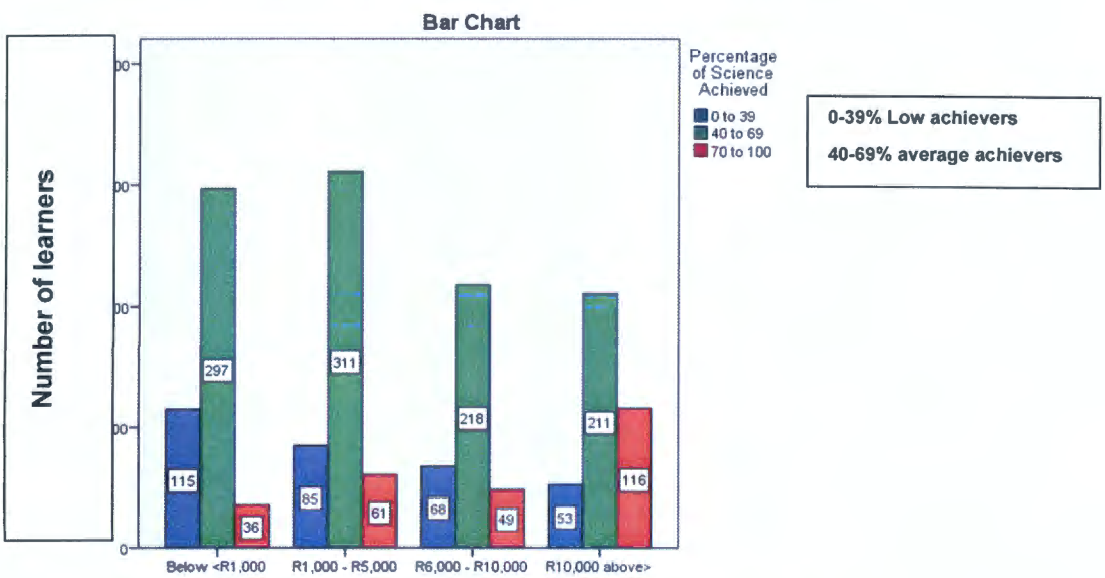


Figure 4.18 **Income per month of the breadwinner**

Figure 4.18 above indicates that there were 115 (26%) low achievers, 297 (66%) average achievers and 36 (8%) high achievers from the lower income group. Therefore, there were fewer high achievers among the group of learners from lower income backgrounds. Comparatively, 116 (31%) of the high achievers, 211 (55%) average achievers and only 53 (14%) low achievers were from higher income backgrounds. This indicates that there were more high achievers among the higher income groups and more low achievers among the lower income groups. The results of the present study suggest that the higher the income, the better the performance of the learner.

The statistical analysis of the responses to Rsearch Question 4: The ANOVA results of breadwinners' income relative to attributions

An ANOVA test of significance was performed to investigate whether there are differences in breadwinners' income (socio-economic status levels of learners) relative to attribution factors.

Table 4. 26: ANOVA test of significance breadwinners' income by attributions

Attributions	F	Sig.	Df
Ability	19.403	.000	
Effort	6.664	.000	
Interest	8.738	.000	
Task	1.660	.174	
Luck	2.853	.036	
Help	.500	.683	
Teaching methods	4.350	.005	

Table 4.26 above shows that the p-value for ability (.000), effort (.000), interest (.000), luck and teaching methods attributions (.005) are below the 0.05 level of significance. This shows that there is a significant relationship between breadwinners' income (socio-economic status level) relative to ability, effort, interest, luck and teaching methods. The ANOVA Test of significance attests to this ($p<0.05$).

On the other hand, the ANOVA results show that the p-value of task (.174) and help attributions (.683) are above $p=.05$, therefore it shows that there is no significant differences between task and help attributions relative to breadwinners' income (socio-economic status; p>.05).

Chi-Square results for breadwinners' income (socio-economic status) relative to science achievement

Table 4.27 below indicates the Chi-Square test results for income per month of the breadwinner by science achievement.

Table 4.27: Chi-Square tests income per month of the breadwinner

Chi-Square statistics	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	90.095[a]	6	.000
Likelihood Ratio	84.633	6	.000
Linear-by-Linear Association	59.869	1	.000
N of Valid Cases	1620		

0 cells (0.0%) have expected count less than 5. The minimum expected count is 54.18.)

Table 4.27 indicates that the obtained p-value for income per month of the breadwinner is .000 and is less than the 0.05 level. Therefore, the Chi-Square Test results showed that there is a statistical relationship between breadwinners' income relative to science achievement. The Chi- Square Test of significance attests to this ($p<0.05$; df = 6).

4.3.4.2 Education level of breadwinner

This section addresses the education level of the breadwinners in the family relative to attributions and achievement in science. Learners were classified as higher socio-economic (HSE) groups when the breadwinner in the family was in possession of a degree or above. On the other hand, when the learner came from a lower educational background (breadwinner - below Grade 8 level), the learner was classified as lower socio-economic (LSE) group.

Educational level of breadwinner by attributional styles of learners

Means were computed for the seven attributional factors (ability, effort, interest, task, luck, help and teaching methods) made by learners from different educational backgrounds and are indicated in Table 4.28 below.

Table 4.28: Educational background by attributions

Education level of the breadwinner	Ability	Effort	Interest	Task	Luck	Help	Teaching Attribution
Degree	2.81	2.76	2.89	2.39	1.96	1.82	2.64
Matriculated	2.71	2.70	2.87	2.44	2.04	1.86	2.65
Grade 8+	2.58	2.62	2.73	2.48	2.10	1.90	2.48
Below Grade 8	2.60	2.72	2.87	2.43	1.95	1.94	2.69
Total	2.72	2.72	2.86	2.42	2.01	1.86	2.63

The results indicated that learners from higher educational backgrounds (breadwinner possesses degree or above) made higher internal ability attributions (m=2.81) than groups who came from lower educational backgrounds (m=2.6). There were not many differences in the interest and effort attributions by learners from higher educational background (HEB) and lower educational backgrounds (LEB). Learners from a HEB made slightly higher interest (m=2.89), and effort attributions (m=2.76) than learners from LEB. Whereas, learners from LEB made slightly lower interest (m=2.87), and effort (m=2.72) attributions than learners from HEB.

Table 4.28 above also indicates that there were not many differences between learners from HEB and LEB in terms of external task and luck attributions. However, there were slight differences between help attributions by learners from HEB (m=1.82) as compared to learners from LEB (m=1.94). The figure also indicates that learners from HEB made higher teaching method attributions (2.69) than learners from LEB (m=2.64).

The influence of education level on science achievement

The achievement of science learners was investigated in terms of higher and lower educational backgrounds.

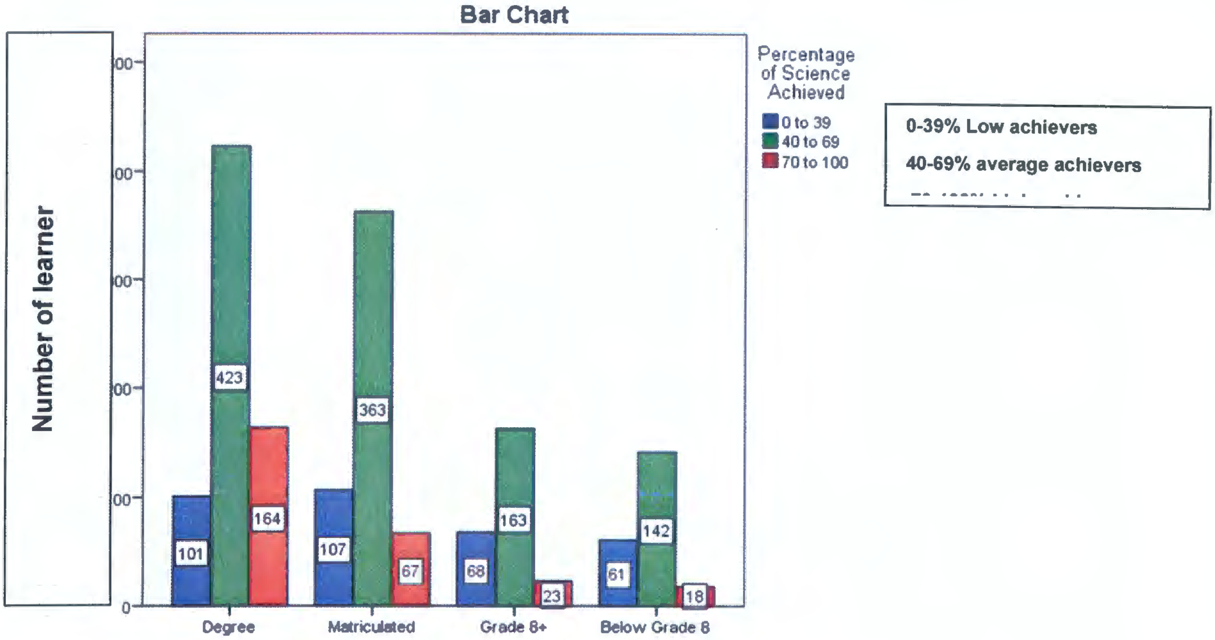


Figure 4.19 **Education levels of the breadwinner**

The results in figure 4.19 above indicates that most of the average (423 or 25%) and high (164 or 10%) achievers came from higher educational background (breadwinner in possession of a degree or higher). The table also indicates that there were fewer high achievers among learners who came from a lower educational background (breadwinner – below Grade 8 level of education).

The breadwinners' income and education levels were used to determine the socio-economic backgrounds of learners. The results indicate that there were less high achievers among the groups from the lower income bracket and from lower education levels (lower socio-economic status). On the other hand there were more high achievers among the groups from a higher income and educational background.

ANOVA results of breadwinners' education level relative to attribution

The ANOVA results for the present study was performed and yielded the results as shown in Table 4.29 below.

Table 29: ANOVA test of significance for education level by attributions

	F	Sig.	Df
Ability	7.390	.000	3
Effort	2.506	.057	3
Interest	2.131	.094	3
Task	1.122	.339	3
Luck	2.093	.099	3
Help	1.259	.287	3
Teaching Methods	2.614	.050	3

Table 4.29 above indicates that the p-values for ability (.000) and teaching methods (.050) are lower than 0.05 level. Therefore, the study shows a significant relationship between level of education relative to ability and teaching methods. The ANOVA Test of significance attests to this ($p<0.05$).

On the other hand, the p-values for effort (.057), interest (.094), task difficulty (.339), luck (.099) and help (.287) attributions are above 0.05 level of significance. Therefore, the study shows an insignificant relationship between level of education relative to effort, interest, task difficulty, and luck and help attributions. The ANOVA Test of significance attests to this ($p>0.05$).

Chi-Square results for educational level by science achievement

The relationship between educational level of breadwinners and learners' achievement in science was tested using the Chi-Square Test (see Table 4.30 below).

Table 4.30: Chi-square for educational level by science achievement

Chi-Square statistics	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	70.629[a]	6	.000
Likelihood Ratio	70.361	6	.000
Linear-by-Linear Association	57.556	1	.000
N of Valid Cases	1700		

0 cells (0.0%) have expected count less than 5. The minimum expected count is 35.36.

Table 4.30 above indicates that the obtained p-value for educational level of the breadwinner is .000 and is less than the 0.05 level. Therefore, the Chi-Square Test results showed that there is a statistical difference between breadwinners' educational level relative to science achievement. The Chi- Square Test of significance attests to this ($p<0.05$; df = 6).

4.3.4.3 Breadwinners' occupations

Table 4.31 below indicates the occupation levels of the breadwinners in the learner's environment.

Table 4.31: Occupations of breadwinners

Occupation of breadwinner	Total	%
Agriculture	133	8%
Education	317	18%
Business	272	16%
Mining	197	12%
Labourers	136	8%
Others	428	25%
Unemployed	219	13%
Total	1702	100%

Table 4.31 above shows that most (25%) of the breadwinners in the learners' families were involved in other occupations not included in the questionnaire, 19% in education. 16% in business, 12% in mining and 8% were labourers, while 13% were unemployed.

Occupation of breadwinner by attributions

Table 4.32 below indicates the occupations of breadwinners relative to attributional styles.

Table 4.32: Breadwinners' occupation level by attributions

Occupation level of breadwinner	Ability	Effort	interest	Task	Luck	Help	Teaching Attribution
Agriculture	2.80	2.82	2.87	2.47	2.12	2.12	2.69
Education	2.80	2.85	3.00	2.43	1.92	1.83	2.63
Business	2.83	2.70	2.77	2.45	1.98	1.88	2.64
Mining	2.79	2.73	2.76	2.50	2.20	2.01	2.58
Labourer	2.67	2.69	2.79	2.44	2.16	1.93	2.57
other & specify	2.65	2.67	2.92	2.38	1.95	1.73	2.70
Not employed	2.55	2.62	2.79	2.42	1.95	1.78	2.54
Total	2.72	2.72	2.86	2.43	2.01	1.86	2.63

Table 4.32 above demonstrates that the highest internal ability, effort, and interest attributions were made by learners who were from agricultural, educational and business family backgrounds. The highest external task, difficulty and luck attributions were made by learners who were from mining backgrounds. The highest help attributions were made by learners whose breadwinners were from agricultural backgrounds. Teaching methods attributions made by learners from families with agricultural and other occupations not included in the questionnaire.

Occupation of breadwinner by science achievement

Figure 4.20 below indicates the low, average and high achievers relative to the professional affiliation of the breadwinners in the family.

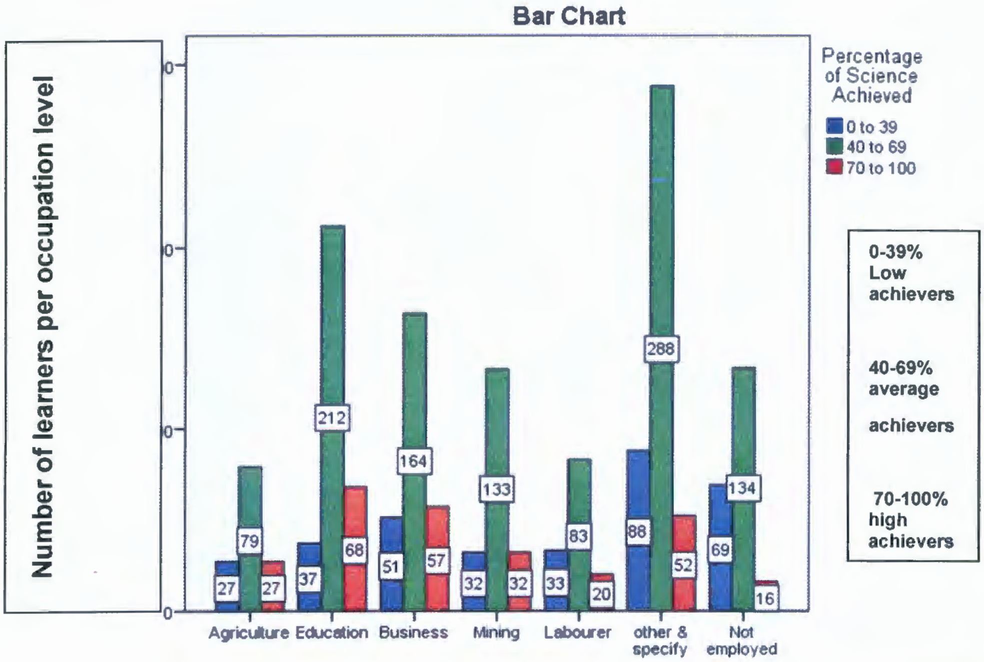


Figure 4.20 **Occupation of breadwinner by achievement in science**

Figure 4.20 above reveals that most of the high achievers were among the learners who came from an educational background where the breadwinners' occupation was in the field of education. The least high achievers and the most low achievers were among learners who came from a lower socio-economic background (breadwinners unemployed).

ANOVA results for occupation level of breadwinner relative to attributions

The ANOVA results for the present study was performed and yielded the results as shown in Table 4.33 below.

Table 4.33: ANOVA test of significance for occupational level by attributions

Attributions	F	Sig.	df
Ability	4.216	.000	6
Effort	3.087	.005	6
Interest	3.167	.004	6
Task	.710	.642	6
Luck	3.566	.002	6
Help	4.914	.000	6
Teaching Methods	1.018	.412	6

Table 4.33 above indicates that the p-values for ability (.000), effort (.005), interest (.004), luck (.002) and help attribution (.000) are below 0.05 level of significance. Therefore, the study shows a significant relationship between level of occupation relative to ability, effort, interest, luck and help attributions. The ANOVA Test of significance attests to this ($p<0.05$).

On the other hand, the p-values for task (.642) and teaching methods attributions (.412) are above 0.05 level of significance. Therefore, the study shows an insignificant relationship between breadwinners' level of occupation relative to task and teaching method attributions. The ANOVA Test of significance attests to this ($p>0.05$).

Chi-Square test of significance for breadwinners' occupation by science achievement

Breadwinners' occupational level by science achievement of learner was tested using the Chi-Square Test of significance.

Table 4.34: Chi-Square Tests results of breadwinners' occupation by science achievement

Chi-Square statistics	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	57.721	12	.000
Likelihood Ratio	59.159	12	.000
Linear-by-Linear Association	38.618	1	.000
N of Valid Cases	1702		

Table 4.34 above indicates that the obtained p-value for breadwinners' occupation is .000 and is less than the 0.05 level. Therefore, the Chi-Square Test results showed that there is a statistical difference between breadwinners' occupational level relative to science achievement. The Chi- Square Test of significance attests to this ($p<0.05$; df = 12).

4.3.4.4 Number of bedrooms in a household

Number of rooms indicated whether learners were from a lower or higher socio-economic backgrounds. Learners who had 3 to 5 bedrooms in their homes were from a higher socio-economic (HSE) group, whereas learners whose homes had 1 to 2 bedrooms were from a lower socio-economic (LSE) background (see Table 4.35).

Table 4.35: Number of rooms in a household by attributions

Number of bedrooms in the home	Ability	Effort	Interest	Task	Luck	Help	Teaching Methods
1	2.47	2.61	2.73	2.53	1.92	2.03	2.66
2	2.64	2.70	2.79	2.50	1.88	1.82	2.57
3	2.71	2.66	2.87	2.43	2.00	1.85	2.63
4	2.74	2.70	2.79	2.39	2.05	1.89	2.59
5 or more	2.83	2.86	2.95	2.34	2.21	1.92	2.78
Total	2.71	2.71	2.86	2.42	2.00	1.85	2.63

Table 4.35 above shows that learners who had 4 or more bedrooms in their home made higher ability, effort interest attributions than learners who had 2 or less bedrooms in their homes. This indicates that learners from HSE groups made higher internal ability, effort and interest attributions. The figure also demonstrates that learners who had 4 or more bedrooms made higher teaching method attributions than learners who had 2 or less bedrooms. Learners who had 4 or more bedrooms made higher external luck attributions than learners who had 2 or less bedrooms. The table indicates that learners who had 2 or less bedrooms (LSE group) made higher external task difficulty and help attributions than learners who had 4 or more rooms in the home.

Number of bedrooms in a household by science achievement

Figure 4.21 below illustrates the number of rooms per household and how it affects the learner's achievement in science.

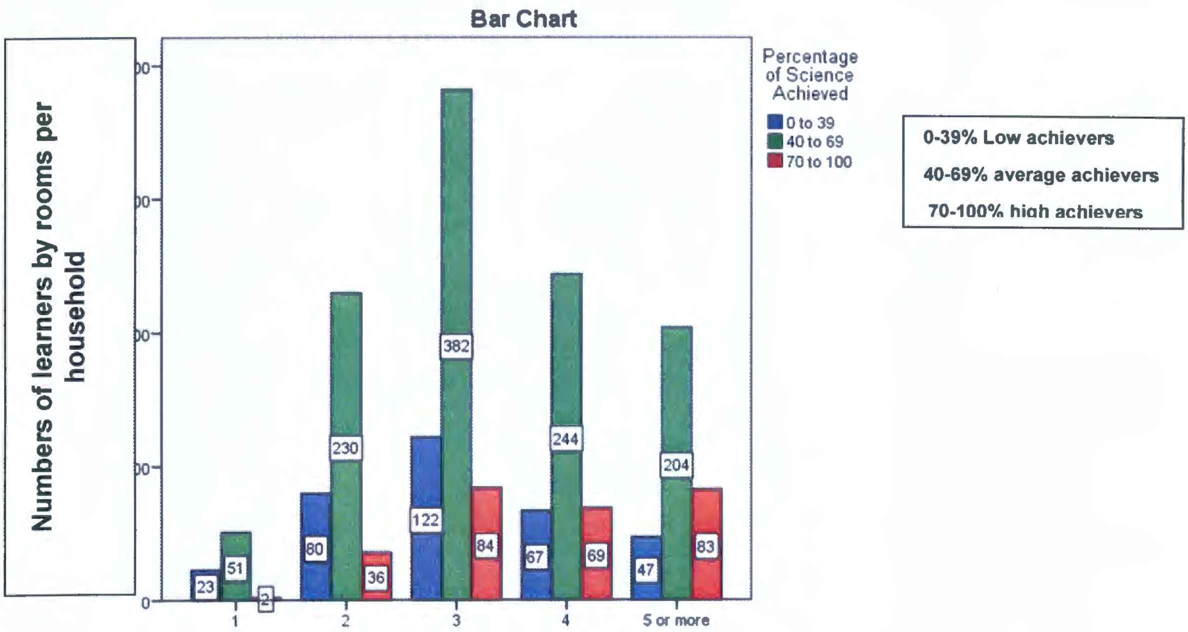


Figure 4.21 **Number of bedrooms in a household by science achievement**

Figure 4.21 above reveals that the majority of learners, irrespective of the number of rooms in a household, achieved within the average range in the science test. Furthermore, the figure shows that the majority of high achievers had 3 to 5 bedrooms in their homes (HSE). On the other hand, most of the low achievers had 2 to 3 bedrooms in their homes (LSE).

The figure also indicates that there were only 2 high achievers among learners who had only 1 bedroom in their homes (lower socio-economic group). Thus, there were almost no high achievers from the disadvantaged LSE group.

This trend was not demonstrated with the low achievers (failure group). There were fewer low achievers among the learners who had 1 to 2 bedrooms (LSE group) than among learners who had 3 to 5 bedrooms (HSE group). Thus, there were more low achievers among the HSE groups than among the LSE groups.

ANOVA test of significance for number of bedrooms in house by attribution

An ANOVA test of significance was performed and the results for number of bedrooms in a household by attributional style of learner is shown below.

Table 4.36: ANOVA test of significance for number of bedrooms in a household by attribution

Attribution	F	Sig.	df
Ability	4.554	.001	4
Effort	4.047	.003	4
Interest	2.188	.068	4
Task	2.475	.043	4
Luck	7.165	.000	4
Help	2.152	.072	4
Teaching Methods	2.797	.025	4

Table 4.36 above indicates that the p-values for ability (.001) effort (.003), task (.043), luck (.000) and teaching method (.025) are below 0.05 level. Therefore, the study shows a significant relationship between number of bedrooms in a household by ability, effort, task, luck and teaching method attributions. The ANOVA Test of significance attests to this ($p<0.05$).

The p-values for interest (.068) and help attributions (.072) are above 0.05 level. Therefore the study shows an insignificant relationship between number of bedrooms in a household by interest and help attributions.

Chi-Square Test for number of bedrooms in a household by science achievement

Question 4 was tested using the Chi-Square Test of significance on the fourth criteria to determine socio-economic level of learners (number of bedrooms in a household). Table 4.37 below indicates that the obtained p-value for number of bedrooms is .000 and is less than the 0.05 level. Therefore the Chi-Square test results show that there is a statistical difference between number of bedrooms relative to science achievement. The Chi- Square Test of significance attests to this ($p<0.05$; df = 8).

Table 4.37: Chi-Square Test of significance for number of bedrooms by attribution

Chi-Square statistics	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	47.838[a]	8	.000
Likelihood Ratio	50.683	8	.000
Linear-by-Linear Association	42.083	1	.000
N of Valid Cases	1724		

0 cells (0.0%) have expected count less than 5. The minimum expected count 12.08.)

4.3.4.5 Access to television

Table 4.38 below shows the number of learners who have access/or not to television in their homes.

Table 4.38: Access to television in the household

Television in the home	Number	%
Yes	1634	95%
No	90	5%
Total	1724	100%

Table 4.38 above indicates that 1634 (95%) of the learners had access to television in their homes. Only 90 (5%) of learners did not have access to television. Means were computed for the seven attributions relevant to television access (see Table 4.39 below).

Table 4.39: Access to television by attributions

Television in the home	Ability	Effort	Interest	Task	Luck	Help	Teaching Methods
Yes	2.72	2.71	2.86	2.42	2.00	1.85	2.63
No	2.67	2.70	2.79	2.52	2.01	1.81	2.60
Total mean	2.72	2.71	2.85	2.43	2.00	1.85	2.63

Table 4.39 above indicates that there were not much differences between the attributions made by learners who had access to television as compared to learners who had no access to television in their homes. Most of the learners made higher

internal ability, effort and interest attributions than to external task, luck, help and teaching method attributions.

ANOVA test of significance for television by attributions.

An ANOVA test of significance was computed for access to television by attributions (see Table 4.40 below).

Table 4.40: ANOVA test of significance for access to television by attributions

Attribution	F	Sig.
Ability	.402	.526
Effort	.009	.926
Interest	.501	.479
Task	1.496	.222
Luck	.005	.944
Help	.185	.667
Teaching Methods	.055	.815

Table 4.40 above indicates that the p-values for ability (.526), effort (.926), interest (.479), task (.222), luck (.944), help (.667) and teaching method attributions (.815) are above 0.05 level of significance. Therefore, the study shows an insignificant relationship between access to television relevant to all seven attribution factors investigated in the study. The study thus showed that there was no significant relationship between television access in terms of ability, effort, interest, task, luck, help and teaching method attributions. The ANOVA Test of significance attests to this ($p>0.05$).

Access to television by science achievement

Figure 4. below illustrates the number of learners who had access to television in terms of low, average and high achievers.

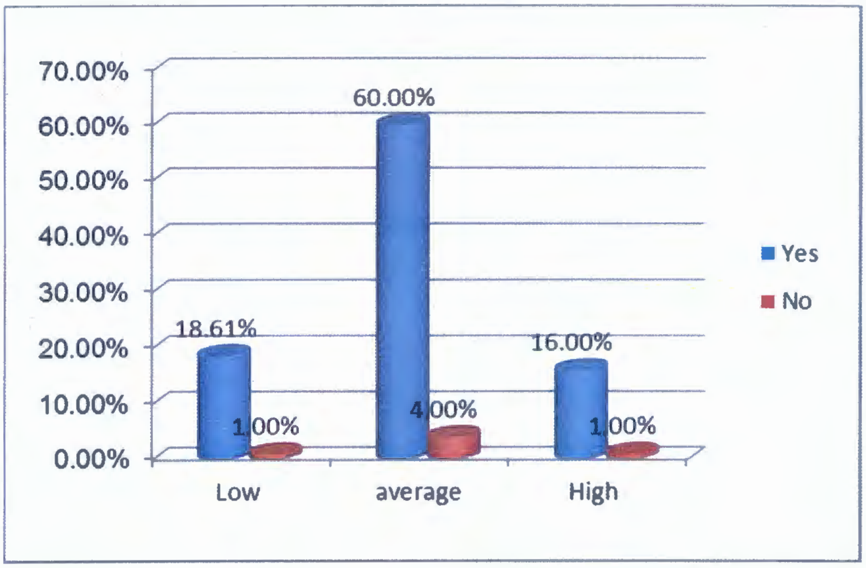


Figure 4.22 **Access to television by achievement in science**

Figure 4.22 above indicates that there were more average achievers (1044 or 60%) among learners who had televisions in their homes than the learners who did not have access to television (62 or 4%). Furthermore, there were more high achievers among learners who had access to television (269 or 16%) as compared to learners who did not have access (6 or 1%). There were also more low achievers (321 or 19%) among learners who had televisions in their homes than the learners who did not have access to television (23 or 1%).

Chi-Square test of significance for access to television by science achievement.

The Chi-Square Test of significance was applied to determine the access to television by achievement in science (see Table 4.41 below).

Table 4.41: Chi-Square test for access to television by science achievement

Chi-Square statistics	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.210[a]	2	.016
Likelihood Ratio	10.128	2	.006
Linear-by-Linear Association	6.757	1	.009
N of Valid Cases	1724		

0 cells have expected count less than 5. The minimum expected count is 14.30.)

Table 4.41 above demonstrate that the obtained p-value for access to television is .016 and is less than the 0.05 level. Therefore the Chi-Square test results show that there is a statistical difference between access to television relative to science achievement. The Chi- Square Test of significance attests to this ($p<0.05$; df = 2).

4.3.4.6 Laboratories in schools

Table 4.42 below indicates that from a total of 1708 learners, the majority (1087 or 64%) had science laboratories in their schools, whereas 621 (36%) learners did not have laboratories. This shows that about two-thirds of the schools have science laboratories. However, it is not clear whether the laboratories are well equipped or whether teachers make use of this facility for practical work.

Table 4.42: Laboratories in school

Laboratories in the school	Number	%
Yes	1087	64%
No	621	36%
Total	1708	100%

Laboratories in schools by percentage achieved in test

Figure 4.43 below demonstrates the achievement by low, average and high achievers in terms of access to laboratories.

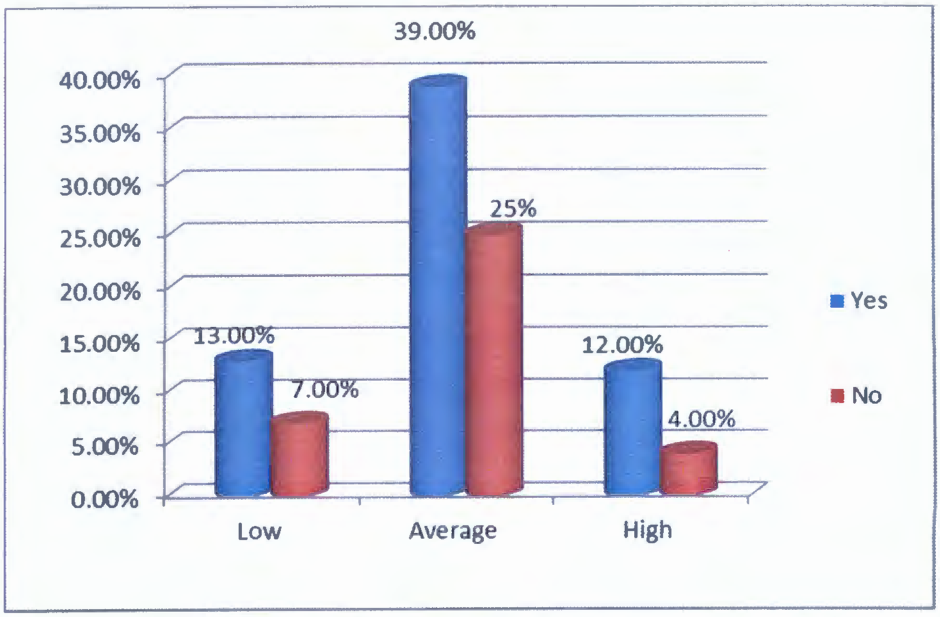


Figure 4.23 **Laboratories by percentage achieved**

Figure 4.23 above indicates that there were a greater number of average achievers (670 or 39%) among learners who had access to laboratories than those who did not have access (427 or 25%). There were more low achievers among learners who had access to laboratories (213 or 13%) than learners who did not have access (126 or 7%). It is possible that laboratories were not well equipped or teachers were not well trained to use those facilities. The figure also illustrates that there were more high achievers (204 or 12%) among learners who had laboratories in their schools than high achievers who did not have access (68 or 4%).

Chi-Square test of significance for access to laboratory by science achievement

The Chi-Square Test of significance was applied to determine the access to laboratories in the school by science achievement.

Table 4.43: Chi-Square test of significance for laboratory access relative to science achievement

Chi-Square statistics	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	18.383[a]	2	.000
Likelihood Ratio	19.251	2	.000
Linear-by-Linear Association	8.034	1	.005
N of Valid Cases	1708		

0 cells (0.0%) have expected count less than 5. The minimum expected count is 98.89.

Table 4.43 above demonstrates that the obtained p-value for access to laboratory is .000 and is less than the 0.05 level of significance. Therefore, the Chi-Square test results show that there is a statistical difference between access to laboratory relative to science achievement. The Chi- Square Test of significance attests to this ($p<0.05$; df = 2).

4.3.4.7 Community library

Table 4.44 below demonstrates that there were 635 (37%) learners who had access to a community library while there were 1077 (63%) who did not have access. Therefore, it confirms that most of the learners did not have access to libraries.

Table 4.44: Total learners with access to libraries

Library	Total	%
Yes	635	37%
No	1077	63%
Total	1712	100%

Community library by attributions

Table 4.45 below compares the attributional means of learners who had access to community libraries with the ones' who did not have access.

Table 4.45: Community libraries relative to attributions means

Community library	Ability	Effort	interest	Task	Luck	Help	Teaching Methods
Yes	2.76	2.74	2.88	2.42	2.04	1.89	2.69
No	2.71	2.71	2.85	2.42	1.97	1.83	2.59
Total mean	2.72	2.71	2.85	2.43	2.00	1.85	2.63

Although not significant, learners who had access to community libraries made slightly higher ability, effort, interest, luck, and help attributions than learners who did not have access to libraries. Learners who had access to libraries and those who did not have access to libraries found the test equally difficulty. The study also indicated that learners who had access to community libraries made higher teaching method attributions than learners who had no access to libraries.

ANOVA test for community libraries access relative to attributions

ANOVA test of significance was computed for access to libraries by attributions (see Table 4.46 below).

Table 4.46: ANOVA test of significance for community libraries by attributions

Attribution	df	F	Sig.
Ability	1	3.686	055
Effort	1	1.867	172
Interest	1	1.130	288
Task	1	156	693
Luck	1	2.286	131
Help	1	1.524	217
Teaching Methods	1	4.909	027

Table 4.46 above demonstrates that the p-value for teaching methods is (.027), which is below 0.05 level of significance. Therefore the study shows a significant relationship between access to libraries relative to teaching method attribution. The ANOVA Test of significance attests to this ($p<0.05$).

On the other hand, the table indicates that the p-values for ability (.055), effort (.172), interest (.288), task (.683), luck (.131) and help attributions (.217) are above 0.05 level of significance. Therefore, the study shows an insignificant relationship between access to libraries relative to ability effort, interest, task, luck and help attributions. The ANOVA Test of significance attests to this ($p>0.05$).

Community libraries by science achievement

Learners were divided into low average and high achievers in science (See Figure 4.26).

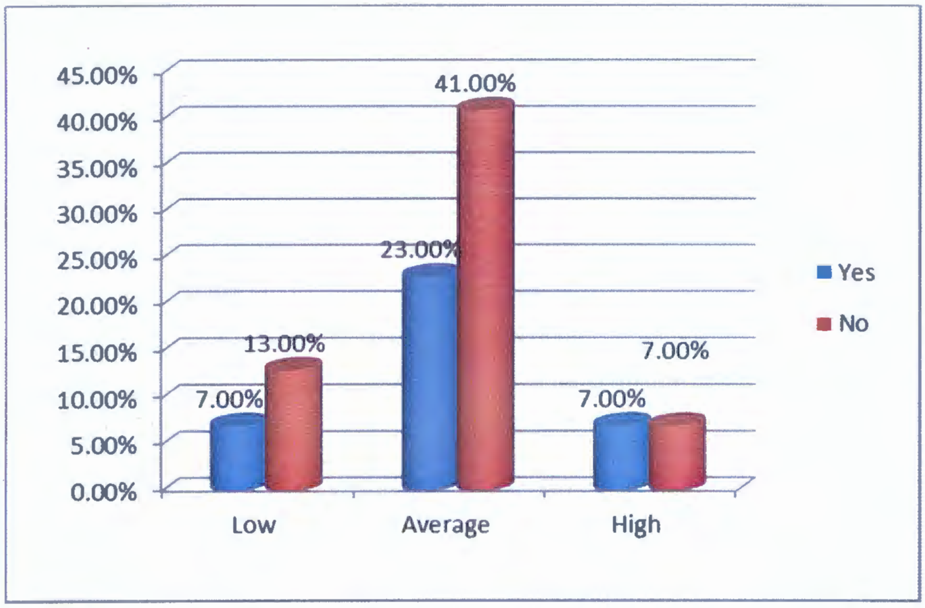


Figure 4.24 **Community library relative to achievement in science**

Figure 4.26 above revealed that there were more low achievers (218 or 13%) average achievers (707 or 41%) and high achievers (152 or 9%) among learners who did not have access to libraries as compared to those who had access to libraries. Surprisingly there were more average and high achievers among learners who did not have access to libraries. It is possible that with unavailability of books as resources, learners may have used other resources such as internet.

Chi-Square Tests for community library relative to science

The Chi-Square Test of significance was applied to determine the access to community libraries by science achievement.

Table 4.47: Chi-Square community library by science achievement

Chi-Square statistics	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5.608[a]	2	.061
Likelihood Ratio	5.517	2	.063
Linear-by-Linear Association	3.217	1	.073
N of Valid Cases	1712		

0 cells (0.0%) have expected count less than 5. The minimum expected count is 99.78.)

Table 4.47 above demonstrates that the obtained p-value for access to libraries is

.061, which is more than the 0.05 level of significance. Therefore, the Chi-Square test results show that there is no statistical difference between access to libraries relative to science achievement. The Chi- Square Test of significance attests to this ($p>0.05$; $df = 2$).

Findings for socio-economic status relative to attributions and science achievement

- Income per month of the breadwinner in the family;
- highest level of education of the breadwinner in the family;
- breadwinners occupation;
- number of bedrooms in a household;
- access to television in the learners' home;
- laboratory in school; and
- community library in the learners' area.

The influence of income per month of the breadwinner on attributions and science achievement

Results for socio-economic status indicated that learners from higher income groups (HIG) made higher ability, effort, interest and teaching method attributions than learners from lower income groups (LIG). Regarding the task difficulty, luck and help attributions, the two groups did not differ much. The results also showed that there were more high achievers among learners from higher income groups than among learners from lower income groups.

The ANOVA test of significance showed that the p-value for ability (.000), effort (.000), interest (.000), luck and teaching methods attributions (.005) are below the 0.05 level of significance. This shows that there is a significant relationship between breadwinners' income (socio-economic status level) relative to ability, effort, interest, luck and teaching methods.

On the other hand, the ANOVA results show that the p-value of task (.174) and help attributions (.683) are above $p=.05$, therefore, it shows that there is no significant differences between task and help attributions relative to breadwinners' income (socioeconomic status; $p>.05$).

The Chi-Square test of significance indicated that the obtained p-value for income per month of the breadwinner is .000 and is less than the 0.05 level. Therefore, the Chi-Square test results showed that there is a statistical relationship between breadwinners' income relative to science achievement. The Chi-Square Test of significance attests to this ($p<0.05$; df = 6).

The influence of education level on attributions and science achievement

Learners from higher educational backgrounds (HEB) made higher ability, effort, interest and teaching method attributions than learners from lower educational backgrounds (LEB). Regarding task, luck and help attributions there was not much differences between the two groups. The results also showed that there were more high achievers among learners from higher educational backgrounds than among learners from lower educational backgrounds.

ANOVA results for the relationship between level of education and attributions indicates that the p-values for ability (.000) and teaching methods (.050) are lower than 0.05 level. Therefore, the study shows a significant relationship between level of education relative to ability and teaching methods.

On the other hand, the p-values for effort (.057), interest (.094), task difficulty (.339), luck (.099) and help (.287) attributions are above 0.05 level of significance. Therefore, the study shows an insignificant relationship between level of education relative to effort, interest, task difficulty, and luck and help attributions.

The Chi-Square test of significance indicated that the obtained p-value for educational level of the breadwinner is .000 and is less than the 0.05 level. Therefore, the Chi-Square test results showed that there is a statistical difference between breadwinners' educational level relative to science achievement. The Chi-Square Test of significance attests to this ($p<0.05$; df = 6).

The influence of occupation of breadwinner on attributions and science achievement

Learners from educational and business backgrounds made higher ability, effort and interest attributions than learners from mining and other occupational backgrounds.

There were significant differences between luck, and help attributions between learners from various backgrounds. There were no significant differences between task and teaching method attributions between learners from different occupational backgrounds.

The ANOVA results indicated that the p-values for ability (.000), effort (.005), interest (.004), luck (.002) and help attribution (.000) are below 0.05 the level of significance. Therefore, the study shows a significant relationship between level of occupation relative to ability, effort, interest, luck and help attributions. The ANOVA Test of significance attests to this ($p<0.05$).

On the other hand, the p-values for task (.642) and teaching methods attributions (.412) are above 0.05 level of significance. Therefore, the study shows an insignificant relationship between breadwinners' level of occupation relative to task and teaching method attributions. The ANOVA Test of significance attests to this ($p>0.05$).

The Chi-Square test of significance indicated that the obtained p-value for breadwinners' occupation is .000 and is less than the 0.05 level. Therefore, the Chi-Square test results showed that there is a statistical difference between breadwinners' occupational level relative to science achievement. The Chi-Square Test of significance attests to this ($p<0.05$; df = 12).

The influence of number of bedrooms in a household on attributions and science achievement

Learners who had 4 or more bedrooms in their household (HSE background) made higher ability, effort and interest attributions than learners who had 2 or less bedrooms (LSE background). There were significant differences between learners from HSE environments who made higher luck and teaching method attributions than learners from LSE backgrounds. Learners from LSE backgrounds, who had 2 or less bedrooms made higher task difficulty and help attributions than learners from HSE groups who had 4 or more bedrooms in a household. There were more high achievers among learners who had 5 or more bedrooms (HSE) in their homes than learners who had 2 or less bedrooms (LSE).

The ANOVA test of significance indicated that the p-values for ability (.001) effort

(.003), task (.043), luck (.000) and teaching method (.025) are below 0.05 level. Therefore, the study shows a significant relationship between number of bedrooms in a household by ability, effort, task, luck and teaching method attributions. The ANOVA Test of significance attests to this ($p<0.05$).

The p-values for interest (.068) and help attributions (.072) are above 0.05 level. Therefore the study shows an insignificant relationship between number of bedrooms in a household by interest and help attributions.

The Chi-Square Test of significance indicated that the obtained p-value for number of bedrooms is .000 and is less than the 0.05 level. Therefore, the Chi-Square test results show that there is a statistical difference between number of bedrooms relative to science achievement. The Chi- Square Test of significance attests to this ($p<0.05$; df = 8).

The influence on access to television on attributions and science achievement of learners

There were no significant differences between learners who had access/not access to television and laboratory in terms of the seven attributions. There were more high achievers among learners who had access to TV than among learners who did not have access to TV. There were high and low achievers among learners who had laboratories and those who did not have laboratories. This may be due to learners not making use of the laboratories, or teachers not well trained to use the laboratory equipment.

ANOVA test of significance indicated that the p-values for ability (.526), effort (.926), interest (.479), task (.222), luck (.944), help, (.667) and teaching method attributions (.815) are above 0.05 level of significance. Therefore, the study shows an insignificant relationship between access to television relevant to all seven attribution factors investigated in the study. The study thus showed that there was no significant relationship between television access in terms of ability, effort, interest, task, luck, help and teaching method attributions. The ANOVA Test of significance attests to this ($p>0.05$).

The Chi-Square Test of significance demonstrated that the obtained p-value for access to television is .016 and is less than the 0.05 level. Therefore the Chi-Square

Test results show that there is a statistical difference between access to television relative to science achievement. The Chi- Square Test of significance attests to this ($p<0.05$; df = 2).

Laboratories in schools

The present study showed that about two-thirds of the schools have science laboratories. However, it is not clear whether the laboratories are well equipped or whether teachers make use of this facility for practical work.

Influence of laboratories in the school on attributions and science achievement

The present study confirmed that there were more high achievers among learners who had laboratories in their schools than high achievers who did not have access. Surprisingly, the study indicated that there were more low achievers among learners who had access to laboratories than learners who did not have access. It is possible that laboratories were not well equipped or teachers were not well trained to use those facilities.

The Chi-Square Test of significance demonstrated that the obtained p-value for access to laboratory is .000 and is less than the 0.05 level of significance. Therefore, the Chi-Square test results show that there is a statistical difference between access to laboratory relative to science achievement. The Chi-Square Test of significance attests to this ($p<0.05$; df = 2).

The influence of community libraries on attributions and science achievement

There were no significant differences between learners who had access/not access to libraries in terms of ability, effort, interest, task, luck, and help attributions. Learners who had access to community libraries made higher teaching method attributions than learners who had no access to libraries.

ANOVA test of significance demonstrated that the p-value for teaching methods is (.027), which is below 0.05 level of significance. Therefore the study shows a significant relationship between access to libraries relative to teaching method attribution. The ANOVA Test of significance attests to this ($p<0.05$).

On the other hand the table indicates that the p-values for ability (.055), effort (.172), interest (.288), task (.683), luck .131) and help attributions (.217) are above 0.05 level of significance. Therefore the study shows an insignificant relationship between access to libraries relative to ability effort, interest, task, luck and help attributions. The ANOVA Test of significance attests to this ($p>0.05$).

The Chi-Square Test of significance demonstrated that the obtained p-value for access to libraries is .061, which is more than the 0.05 level of significance. Therefore, the Chi-Square Test results show that there is no statistical difference between access to libraries relative to science achievement. The Chi-Square Test of significance attests to this ($p>0.05$; $df = 2$).

4.4 ANALYSIS OF INTERVIEWS

Ten interviews were conducted with 1 principal, 3 HODs, 1 educator, and 5 Physical Sciences learners. From the interview assessment tool, the following analysis of responses for attributions was revealed.

4.4.1 Attributions *affecting science achievement of learners: Research Question 1*

Seven attributional factors were identified in the current study as affecting to learners' science achievement: ability, effort, interest, task difficulty, luck, help and teaching methods. The summary of the interview responses are in tables.

4.4.1.1 Ability attributions affecting science achievement of learners

(a) Educators' responses regarding ability attributions of science learners

Table 4.48a shows the educators' responses regarding ability attributions of learners.

Table 4.48a: Educators' views on ability attributions of science learners

Question 1:	**Do the learners have the ability to perform well in science?**
Respondent 1	High achievers have high ability, low achievers lacked ability
Respondent 2	Learners' have mixed abilities.
Respondent 3	All learners have the ability to do science
Respondent 4	Learners have a little ability
Respondent 5	Learners have ability

Educators' perceptions regarding learners abilities in science are discussed below:

Respondent 1 revealed that high achievers have high ability, whereas low achievers lacked ability and she said:

> "*we have learners who score very good marks*"

Respondent 2 indicated that the learners have mixed abilities. High achievers are given extra work to further develop their abilities and fulfill their potentials.

Respondent 3 was of the opinion that all learners have the ability to do science. She stated the following:

> "Everybody has ability, but I don't believe that there is a spurge
> of learning or studying amongst learners today".

Respondent 4 noted that learners have a little ability. They struggled because they faced many challenges. He indicated that learners do not have ability in terms of language' to study science and he maintained:

> " ...they are not able to interpret science correctly and in a realistic way".

Respondent 5 stated that learners have the ability because she believes that science:

> "is simple'... and 'I could say we live science'... "we're staying on planet earth – anything that you do is science".

Table 4.48a above indicates that while one educator believed that learners had little ability in science, another educator felt that learners have mixed abilities. The table further shows that while two educators believed that learners had the ability to do well in science, one educator believed that high achievers had high ability and low achievers lacked ability.

Learners' responses regarding their ability in science:

Table 4.48b below indicates the learners' responses regarding ability attributions learners.

Table 4.48b: Learners' views on ability attributions in science

Question 1: Do you have the ability to perform well in science?	
Respondent 6	Ability to do well in science
Respondent 7	Developed ability
Respondent 8	Low ability in science
Respondent 9	Have high ability
Respondent 10	Ability to do well in science

The perceptions from the learners regarding their abilities in science are discussed:

Respondent 6 was of the opinion that she had the ability to do well in science.

Respondent 7 believed that she developed her abilities in science. She said:

> "The EXPO in Johannesburg helped to develop my ability in science".

Respondent 8 asserted that he had low ability because of his low poor results in the previous exam.

Respondent 9 maintained that she had high ability.

Respondent 10 was of the opinion that he had the ability to do well in science.

Table 4.48b above indicates that while one learner believed that he has low ability in science, another felt that she was still developing her ability. Furthermore, while two learners indicated that they had little ability, one learner felt that she had high ability to perform well in science.

These results were also established in the study by Addiba (2004:87) in which learners believed that they achieved high marks because of ability and effort (see 2.7.1). Other researchers also stated that internal attributions for success are the best predictors of performing well (Mudhovozi et al., 2010:587, see Section 2.7.1).

Therefore, the results show that internal *ability attributions* affect learner achievement.

4.4.1.2 Effort attributions affecting science achievement of learners

Educators' responses regarding effort attributions of science learners.

Table 4.49a indicates the educators' responses regarding effort attributions of science learners.

Table 4.49a: Educators' views on effort attributions of science learners

Question 2: Do learners spend a lot of effort on their science test preparation?	
Respondent 1	Learners put in a lot of effort
Respondent 2	Only exert effort if pressure is placed on them.
Respondent 3	Learners do put in a little effort to succeed
Respondent 4	Learners did not put in effort
Respondent 5	Learners worked hard and exerted a lot of effort for science

Educators' perceptions regarding learner's abilities in science are discussed below:

Respondent 1 was of the opinion that learners put in a lot of effort and she said:

> "learners are very competitive, especially the top learners. They work very hard that is why they get such good results".

Respondent 2 asserted that learners will only exert effort if pressure is placed on them. He had the following to say:

"Learners will make effort only if pressure is placed on them. We push them to work – they improved drastically".

Respondent 3 believed that in her experience, learners in grade 12 put in effort just to succeed in the exams and high achievers do put in effort. She noted that learners will exert more effort if educators push them to work.

Respondent 4 stated that he did not think they put in effort he said:

"I don't think science is being taken seriously by kids".

He was of the opinion that the only efforts exerted was by the educator who gave extra tuition during camps and exam time.

Respondent 5 asserted that learners worked hard and put in a lot of effort for science test preparation.

Table 4.49a above indicates that while one educator believed that learners do not exert effort in their preparation for science test, another educator felt that learners only apply effort only if pressure is placed on them. The table further shows that while one educator believed that learners do put in a little effort to succeed, two educators believed that learners exerted a lot of effort in science preparation.

Learners' responses regarding effort exerted in the science test:

Table 4.49b below indicates the interview responses of learners regarding effort exerted in the test.

Table 4.49b: Learners' views on effort attributions of science learners

Question 2: Did you spend sufficient effort on your science test preparation?	
Respondent 6	Exerted sufficient effort
Respondent 7	Did not put in sufficient effort
Respondent 8	Did not put in sufficient effort
Respondent 9	Exerted a lot of effort
Respondent 10	Spent a lot of effort

Learners' perceptions regarding their efforts spent in preparation for the science test are discussed below:

Respondent 6 was of the opinion that she exerted enough effort in preparation for the test.

Respondent 7 was not satisfied with the amount of effort she had put into preparing for the test and she said:

> "I did not study very hard".

She felt that she could have done better had she exerted more effort in test preparation.

Respondent 8 was of the opinion that he did not put in sufficient effort in preparation for the test and therefore his performance was not good. He felt that with more effort for future tests he would be able to perform better.

Respondent 9 maintained that she had exerted a lot of effort in preparation for the test. However, she believed that science needed a lot of concentration.

Respondent 10 was of the opinion that he spent a lot of effort preparing for the science test.

Table 4.49b above indicates that while two learners believed that they did not put in sufficient effort in preparation for the test, one learner indicated that she had exerted sufficient effort in test preparation. The table further shows that two learners felt that they had spent a lot of effort in their science preparation.

The findings in the current study is in agreement with Hareli and Weiner (2002b:184) who noted that failure may be ascribed to lack of effort which is subject to volitional control (see 2.8.5). The above results were also demonstrated in Addiba's study (2004:1490) in which most respondents made the highest attributions to internal effort and ability factors (see 2.7.1). High achievers attributed their success to effort, whereas low achievers made lack of effort attributions (Addiba, 2004:87).

The results are consistent with Weiner's theory which stated that high achievers make internal attributions for their achievement. The findings of the present study also correspond with findings by McClure et al., (2010:76) in which the top learners attributed their best marks to internal efforts and attained higher marks (see 2.7.1) and in which learners attributed their worst marks to lack of effort. Zewotir and Maqutu (2006:38) also stress the use of effort attributions to enhance success (see Section 2.11). The above results of attributing outcomes to controllable causes such as effort increases motivation and perseverance as suggested by McClure et al. (2010:70, see Section 2.11).

Therefore, the results show that internal *effort attributions* affect learner achievement.

4.4.1.3 Interest attributions affecting science achievement of learners

Educators' responses regarding interest attributions of science learners

Table 4.50a indicates the educators' responses regarding interest attributions of science learners.

Table 4.50a: Educators' views on interest attributions of science learners

Question 3: Do the learners find science interesting?	
Respondent 1	Learners are interested in science
Respondent 2	Learners enjoy science, especially the practical part
Respondent 3	Learners show little interest in science only to succeed and to get better jobs.
Respondent 4	Learners are not interested in science because they do not have role models to encourage interest..
Respondent 5	Learners are not interested in science

Educators' perceptions regarding learners' interests in science are discussed below.

Respondent 1 revealed that learners are interested in science and she maintains that:

> "As long as interest is there, they can cope".

She creates more interest in the course by making use of real life examples.

Respondent 2 indicated that the learners enjoy science, especially the practical experiments. They do research on the internet and that makes the subject even more interesting.

Respondent 3 was of the opinion that learners do not find science interesting. According to her they only show interest in science to succeed and to get better jobs.

Respondent 4 believed that, even though it is a science school, learners are not interested in science. He noted that educators should motivate the interest of learners by having quality resources in the school. Furthermore, he was of the opinion that learners are also not interested because they have no role models in their environment to encourage interest.

Respondent 5 believed that learners are not interested in science. She stressed:

> "We are still having a problem with learners not interested in science".
> "If they can take a little more interest they can do better".

She noted that some of the learners are forced by their parents to do science. She stressed that if learners have negative attitudes to science, it will lead to lack of interest and poor performance.

Table 4.50a above indicates that while 2 educators believed that learners show no interest in science because of lack of motivation from role models, one educator believed that learners show a little interest in science to get better jobs. The table further shows that two educators believed that learners are interested and enjoy science.

Learners' responses regarding interest in science

Table 4.50b below shows the interview responses of learners regarding interest attributions.

Table 4.50b: Learners' views on interest attributions of science learners

Question 3: Do you find science interesting?	
Respondent 6	Found science interesting but challenging and required hard work
Respondent 7	Found science interesting because learners learnt a lot from EXPO
Respondent 8	Found science interesting and enjoyed conducting experiments
Respondent 9	Enjoyed science
Respondent 10	Found science interesting and exciting

Learners' responses regarding their interests in science are discussed below:

Respondent 6 maintained that science was interesting. This is what she said:

> "Challenging but interesting, and it needs hard work".

Respondent 7 asserted that they learnt a lot from the different schools and learners at the EXPO.

Respondent 8 was excited about science. He enjoyed exploring things in the environment when experimenting.

Respondent 9 found the science course interesting. She said it would also help her to get entrance into tertiary level.

Respondent 10 indicated that he found science so interesting that he reviewed the work on a daily basis at home. He said:

> "Science is so much fun, so exciting, that's why I enjoy it"
> "exchanges information with other learners and educators"

Table 4.50b above indicates that two learners showed interest in science because of challenges involved and learning experience at EXPO. The table further indicates that three learners exhibited a lot of interest in science. They enjoyed conducting experiments and found it exciting.

The findings in the current study are in agreement with other studies which suggest that an encouragement of interest in science (Aschbacher et al., 2010:564; Anderman et. al., 2012) lead to higher achievement by learners (see 2.7.4). The results by educators are in accordance with the findings by Makgato and Mji, (2006:254) who also revealed that parental role models were not always available to encourage interest and motivation (see Section 2.7.3). Young people's interest in science declines as they progress through school (Bøe et al. 2011:21). They find that science does not suit their identities and they do not see themselves as following science careers (2.9.5). Aschbacher et al. (2010:576) indicated that learners had no support from significant people in their environment (see 2.7.6). Anderman et al. (2012:100) stressed that educators should create conducive learning environments to promote learners' personal interests, goals, adolescent motivation (see 2.7.7). The current study showed that when educators use experiments in science laboratories it increased their interest and enhanced learning. Tella (2007:150) indicated that the lack of equipment, lack of qualified teachers and poor facilities are factors which contribute to low interest and poor achievement in science and Mathematics (see 2.8.1). Barmby et al., (2008:10) noted that educators need to find ways to increase science learners in schools and to see how to increase interest in science during secondary school years (see 2.9.2).

Therefore, the qualitative results show that *interest attributions* affect learner achievement.

4.4.1.4 Task difficulty attributions affecting science achievement

Educators' responses regarding task difficulty attributions of science learners

Table 4.51a indicates the educators' responses regarding task difficulty attributions of science learners.

Table 4.51a: Educators' views on task difficulty attributions of science learners

Question 4: Do the learners find science difficult?	
Respondent 1	High achievers do not find science difficult, low achievers struggle
Respondent 2	From Grade 11 learners find science difficult
Respondent 3	From Grade 11 learners begin to find science difficult and drop out
Respondent 4	Not sufficient resources are provided. Learners do not see want to follow science as a career. Family members do not motivate learners. Learners find application of science difficult.
Respondent 5	High achievers coped well. Some learners found little difficulty in science with calculations and the application part of it.

Educators' views regarding whether learners found science difficult are discussed below.

Respondent 1 asserted that the majority of learners cope very well. High achievers do not find it difficulty and have no problems. Low achievers struggle, but with more practice they will achieve better results.

Respondent 2 maintained that some learners cannot cope because they find the course difficult. The teachers categorize them into different levels so that all learners needs are met. Learners who find difficulty with science concepts look for assistance from the teacher. learners begin to find challenges in grade 10 and 11 because more difficult concepts are introduced.

Respondent 3 said that learners drop out between grade 10 and 12 because they find science too difficult.

Respondent 4 noted that many factors contributed to the perceptions of difficulty in science. He believed that sufficient resources are not provided. According to the HOD, learners find the application part of science difficult. He said:

> "Their way of approaching it, is a very big concern".

Respondent 5 said that low achievers struggled with the application *part of physics*, whereas others found the chemistry part difficult. The learners, who expressed difficulty in the test, could not cope with calculations and formulas. Educator was of the view that high achievers coped very well and did not find the test difficult.

Table 4.51a above indicates that one educator believed that high achievers found no difficulty in science. The table further shows that while two educators were of the opinion that learners had a little difficulty with calculations and application in science, two educators believed that learners found science difficult as they progressed from Grades 10 to 12.

Learners' responses regarding task difficulty attributions

Table 4.51b shows the learners' responses regarding task difficulty attributions.

Table 4.51b: Learners' views on task difficulty in science

Question 4: Do you find the science course difficult?	
Respondent 6	Found difficulty because of fear
Respondent 7	Not difficulty if sufficient effort made
Respondent 8	Found difficult
Respondent 9	Science most difficult subject and needs a lot of concentration
Respondent 10	Science interesting and not difficult

Learners' responses regarding the difficulty they experienced in the science test:

Respondent 6 expressed feelings of fear which resulted in her finding the test difficult. She said:

> "It was fear....It was very complicated".

Respondent 7 maintained that it was not difficult if sufficient effort was spent on the task.

Respondent 8 said that he found difficulty with the complex part.

Respondent 9 said:

> "science is the most difficult subject - especially for us at a science high

school".

The student found the chemistry part most challenging. She felt that the science course needs a lot of concentration.

Respondent 10 did not find the course difficult and he found it very interesting. He maintained that he discusses the difficult concepts with his peer group and educators and that helps him to clarify some concepts related to science.

Table 4.51b above indicates that two learners found no difficulty with science because they spent sufficient effort on the preparation of the test and found science interesting. One learner maintained that he had a little difficulty with certain sections in science. On the other hand, two learners found science difficult because it involved a lot of concentration.

The results of the study are in harmony with opinions by Mere and Kwayisi (2012:172) who stated that science is a difficult course and that learners are not encouraged at home or in school to pursue science as a career (see 2.7.5). The findings are in the current study are also in agreement with Barmby, et. al., (2008:10) and Aschbacher et al., (2010:564) who are concerned about the reason why learners are finding science difficult and not following science as a career (see 2.9.2; 2.7.5; 2.7.6). The learners as well as educators in this study indicated that there is no community and parental involvement in increasing interest in following science as a career.

Therefore, the results show that learners found external *task attributions* affect learner achievement.

4.4.1.5 Luck attributions affecting science achievement

Educators' responses regarding luck attributions of science learners

Table 4.52a indicates the educators' responses regarding luck attributions of science learners

Table 4.52a: Educators' views on luck attributions of science learners

Question 5: In your opinion as a educator , do you think the learners were lucky or not in achieving their science results?	
Respondent 1	Not luck but effort and hard work
Respondent 2	Not luck but effort and hard work
Respondent 3	Not luck but effort and hard work
Respondent 4	Not lucky because results were not good
Respondent 5	Were lucky

Educators' perceptions about learners' luck attributions in science are discussed below:

Respondent 1 asserted that it was not luck but hard work and effort which lead to such good results. She said:

> "its 'their effort - its' more hard work that led to
> such wonderful results and such beautiful trophies".

Respondent 2 noted that luck was not a factor but effort was.

Respondent 3 maintained that it was not luck and she said:

> "I don't think luck plays a role." "Luck is not the right word".

She stressed that in the final exams, the reward comes from hard work.

Respondent 4 was of the opinion that learners' results were not due to luck.

Respondent 5 noted that they were lucky.

Table 4.52a above indicates that three educators believed that luck was not a contributing factor in learners' positive outcomes, but a lot of effort was spent on test preparation. The table further shows that while one educator was of the opinion that results were not due to luck or effort on the part of the learners, another educator believed that learners were lucky in achieving their results.

Learners' responses to interviews regarding luck attributions

Table 4.52b indicates the learners' responses regarding luck attributions of science learners

Table 4.52b: Learners' views on luck attributions in science

Question 5: Do you think you were lucky to achieve your science results?	
Respondent 6	Not luck because results were good
Respondent 7	Not luck but effort and hard work
Respondent 8	Luck because successful in test
Respondent 9	Luck because successful while others did not succeed
Respondent 10	Not luck but hard work and effort

Respondent 6 noted that it was not luck because her results were good. The educator also did not expect such good results.

Respondent 7 maintained that she worked hard. She was of the opinion that it was not luck and said:

> "you have to work hard to get better marks".

Respondent 8 noted that he was lucky, because he passed the science test.

Respondent 9 believed that she was lucky because she achieved 50%, whereas, her friends did not achieve that mark.

Respondent 10 believed that it was not luck. He said:

> "I worked hard to get the marks"- "spent many nights and practiced".

Table 4.52b above indicates that two learners believed that luck was not a contributing factor in their positive outcomes, but a lot of effort was spent on test preparation. The table further shows that while one learner was of the opinion that results were not due to luck or effort, two learners believed that learners were lucky in achieving their success.

The current findings are also in agreement with studies which show that some of the learners use luck attributions to explain their causes of success or failure. The findings by Hawi (2010:1127) and Weiner (2010:31) show that learners often use luck attributions for their outcomes (see 2.4).

The results of the present study are consistent with Weiner's theory that stated that low achievers had external locus of control that associated their outcome with external luck and task difficulty factors (see 2.7.1). Low achievers in the study by Addiba (2004:87) and Mudhovozi et al., (2010:589) also made use of external luck attributions (see 2.7.1; 2.5).

Therefore, the results showed that learners found external luck attributions affect learner achievement.

4.4.1.6 Help attributions affecting science achievement

Educators' responses regarding help attributions of science learners

Table 4.53a indicates the educators' responses regarding help attributions of science learners

Table 4.53a: Educators' views on help attributions of science learners

Question 6: Do the learners get help for science preparation?	
Respondent 1	Learners get help from educator s by working through question papers, although educator s are not always well qualified
Respondent 2	Learners get help from educator s through extra tuition
Respondent 3	Learners get help from educator s and parents through practical methods and resources
Respondent 4	Learners get help from educator s through extra tuition
Respondent 5	Learners do not come to educator s for assistance

Educators' perceptions about learners' help attributions in science are discussed below.

Respondent 1 asserted that educators help learners by working through question papers. She noted that some of the educators are not confident and need to upgrade their knowledge.

Respondent 2 asserted that learners came after class for assistance and extra tuition.

Respondent 3 maintained that learners get help through practical teaching methods and from either parents or educators and through the use of resources.

Respondent 4 noted that learners get help from educator s during camp and on Saturdays when educators provide extra tuition.

Respondent 5 noted that learners do not come for assistance. She said

> "we are always available for consultation".

Learners tend to come to educators for help when they encounter problems with examination papers.

Table 4.53a above indicates that four educators believed that learners received help from them for extra tuition, practicals and resources. The table further shows that one educator was of the opinion that learners did not come to them for help. The responses showed that learners got help/assistance from either parents or educators and through the use of resources.

Learners' responses regarding help attributions

Table 4.53b indicates the learners' responses regarding help/assistance in science

Table 4.53b: Learners' views on help attributions in science

Question 6: Did you get help for your science preparation?	
Respondent 6	Learners get help from educator s when they have extra tuition or during camp before exams.
Respondent 7	Learners get help from educator s and on DSTV learning programmes
Respondent 8	Learners get help from educators and practical methods
Respondent 9	Learners get help through practical methods
Respondent 10	Learners get help from educator s, revision, practical methods and peer group

Respondent 6 indicated that they get help from educators when they have extra tuition or during camp before exams.

Respondent 7 was of the opinion that the methods of teaching and viewing the learning programs on DSTV and help from educators and learners in class helped them a great deal in understanding the course material.

Respondent 8 noted that doing the practical part of the course helps them in understanding the theory. He required more help with calculations to improve his performance in science. The learning programmes and friends from other schools also helped him to prepare for test. educators provide assistance and were well committed by giving both early morning and weekend extra tuition.

Respondent 9 maintained that the practical part of the course helped them in understanding the course material.

Respondent 10 noted that he understood the work better when educators helped to do revision. He stressed that having group discussions with his peer group helped him to understand the work much better. He was provided with a lot of support and assistance from family members.

Table 4.53b above indicates that all learners received help from educators for extra tuition during camps, learning programmes, practicals, doing revision and through use of resources. The table further shows that learners also sought help from peer group, parents and other significant people for science preparation.

The results of the present study are in harmony with the study of Batool et al. (2010:456) which note that educators must encourage learners and help them to achieve. Educators should look at the perceptions of learners and use attributions theory to help more learners succeed (see Section 2.11).

Therefore, the results show that help attributions affect learner achievement.

4.4.1.7 Teaching methods attributions affecting science achievement

Educators' responses regarding teaching method contribution

Table 4.54a indicates the educators' responses regarding teaching method contribution to learners' achievement in science

Table 4.54a: Educators' views on teaching method contribution in science

Question 7: Do you think your teaching methods contribute to the results achieved by your learners?	
Respondent 1	Made good contribution to performance of learners
Respondent 2	Made good contribution through experiments
Respondent 3	Made little contribution through demonstrations and practicals if time allowed
Respondent 4	Made no contribution because of lack of resources
Respondent 5	Made contribution through demonstrations

Educators' perceptions regarding teaching method contribution in science are discussed below.

Respondent 1 was confident in saying that her teaching methods were good and resulted in good performance. She revised the work by working through question papers

Respondent 2 maintained that he was conducting individual and group experiments on weekly basis. This method of teaching assisted learners to understand better.

Respondent 3 stressed that she does her level best to use good teaching methods.

Learners prefer different teaching methods because of individual differences. She does practicals if time allows and uses demonstrations and learners use textbooks.

Respondent 4 maintained that his teaching methods did not contribute because learners still performed poorly. He could not do many practicals because of the time factor and the lack of resources.

Respondent 5 used demonstrations to help learners to understand the text and it encouraged the interest and research abilities of learners.

Table 4.54a above indicates that while one educator maintained that his teaching methods made no contribution because learners still performed poorly, another educator felt that her teaching methods made a little contribution to learners' achievement in science because she did practicals when time allowed. The table further shows that three educators were of the opinion that their teaching methods made good contribution as they used demonstrations, worked through question papers, and they did experiments in class.

Learners' responses regarding teaching method attributions

Table 4.54b indicates the learners' responses regarding teaching method contribution to their achievement in science.

Table 4.54b: Learners' views on teaching method attributions of science

Question 7: Did the teaching methods of the educator contribute to your science results?	
Respondent 6	Good contribution because of tuition during camps
Respondent 7	Teaching methods contributed and learning programmes.
Respondent 8	Good contribution because do revision in class
Respondent 9	Good contribution because educator explained concepts well
Respondent 10	Good contribution because the educators explained very well and encouraged learners to do more research

Respondents 6 maintained that teaching methods contributed because of tuition during camps. Learners camped before the exams and they got a lot of support from the principal and educators.

Respondents 7 stated that teaching methods made a contribution and also learning programmes on DSTV.

Respondent 8 noted that teaching method contributed because educators gave extra help and extra classes during the week and weekends.

Respondent 9 felt that the educators' teaching methods contributed a lot through extra tuition and the educator explained until she was sure that learners understood all the concepts in science. This encouraged learners to achieve better results in science.

Respondent 10 asserted that teaching methods were good because the educators explained the course content very well and encouraged learners to get more information through research experiments, if time allowed. This helped them to understand the science concepts and it encouraged them to do more research.

Table 4.54b above shows that all five learners believed that teaching methods made contribution to their achievement in science because of extra tuition, revision, practicals, and demonstrations done by educators.

Other studies also stressed the importance of teaching methods (Mudhovozi et al., 2010:587, see 2.4). Makgato and Mji, (2006:254) indicated that teaching strategies, parents' role in learners' education, lack of qualified teachers in South Africa and outdated teaching methods may lead to the poor achievement of learners (2.7.3). Basturk and Yavuz (2010:1942) indicated that teaching methods affect the learners' poor achievement (see 2.8.2).

Therefore the results show that teaching methods affect learner achievement.

Researchers stress that changing student attributions could help learners in educational settings to avoid further failure. Furthermore, they caution that one should be aware of factors that hinder learning so that necessary precautions may be taken (Basturk & Yavuz, 2010:1943; see Section 2.9.2). Barmby, et. al., (2008:11) showed that teaching methods, and not the curriculum, makes a difference in encouraging interest in science at high school level (see Section 2.9.2).

4.4.2 Interview results in terms of achievement motivation levels of learners related to Research Question 2

Achievement motivation is identified in the current study as affecting learners' attributions and science achievement.

The researcher conducted individual interviews with 1 principal, 3 HOD's, 1 educator teaching science, and 5 Physical Science learners to get information about learners' levels of achievement motivation.

4.4.2.1 Practical methods used in teaching to encourage achievement motivation levels of learners

The use of practical methods in teaching increased the learners' interest and achievement motivation levels. From the interview assessment tool, the following results for achievement motivation levels of learners are on display in Tables 4.55a and 4.57b

Educators' responses regarding use of practical methods.

Table 4.55a indicates the use of practical methods by educators to increase the motivation levels of learners.

Table 4.55a: Educators' use of practical methods to increase motivation

Question 8: Which practical methods are you using in presenting lessons?	
Respondent 1	Time factor a limiting factor to conduct experiments. Learners do research on internet to encourage motivation
Respondent 2	Uses experiments and internet research to encourage motivation.
Respondent 3	Teacher does practical demonstrations and internet research to encourage interest and motivation of learners.
Respondent 4	Teacher provided extra tuition to motivate learners, however, family or community members should provide motivation.
Respondent 5	Teacher made use of resources such as laboratory work, DVD'S, presentations and revision to motivate learners.

Educators' perceptions regarding practical teaching methods in science are discussed below.

Respondent 1 noted that the time factor was a problem in conducting experiments, therefore she motivated learners by doing research on internet and independent work.

Respondent 2 maintained that he uses experiments and internet research to encourage motivation of the learners. They derive internal enjoyment and this leads to higher levels of motivation.

Respondent 3 does practical demonstrations and internet research to encourage interest and motivation of learners.

Respondent 4 was of the opinion that the teacher provided extra tuition to motivate learners, however, they did not receive any motivation from family or community members. According to him, incentives for learners and teachers should be provided to lead to motivation and better achievement.

Respondent 5 noted that she made use of resources such as laboratory work, DVDs, presentations on computers and revision to motivate learners.

Table 4.55a above indicates that all 5 educator respondents teaching science believed that practical work through experiments, demonstrations, presentations, group discussion and revision led to an increase in motivation level of learners.

Learners' responses regarding use of practical methods.

Table 4.55b indicates the learners' perceptions of the use of practical methods to increase their achievement motivation levels

Table 4.55b: Learners' views on the use of practical methods

Question 8: Do you do practicals in science to increase motivation?	
Respondent 6	Learner has a negative attitude towards science, and it leads to a lack of motivation. Principal and teachers motivate learners to succeed.
Respondent 7	Learners view learning programmes on DSTV and in increases interest and motivation.
Respondent 8	Learners' view learning programmes and work on science problems with friends and it increases their motivation levels. Parents did not play a role in motivating learners but teachers motivated learners to achieve well.
Respondent 9	Learners use practicals in class and it helps them to become motivated.
Respondent 10	Learners use experiments and demonstrations, which helps to increase their motivation.

Respondent 6 believed that she has a negative attitude towards science, and it leads to a lack of motivation. During camps they were motivated by the principal and teachers and that helped to motivate them to succeed.

Respondent 7 noted that by viewing learning programmes on DSTV, they become motivated. The learner was not happy with her past performance and that showed that she is motivated to achieve. She said:

> "I know I could do better than that".

Respondent 8 stated that the practical part, viewing learning programmes and working on science problems and solutions with friends helped to motivate them. Parents did not play a role in motivating learners but teachers were well committed and motivated learners to achieve well and encouraged learners to follow science as a career.

Respondent 9 felt that the use of practicals in class helped her to become motivated.

Respondent 10 was of the opinion that when teachers used experiments, it was "exciting and fun". Experiments, demonstrations helped to increase their motivation.

Table 4.55b above indicates that 4 learners believed that practical work through experiments, demonstrations, presentations, group discussion and revision led to an increase in achievement motivation. On the other hand, 1 learner believed that the negative attitude of learners to science, lead to a lack of motivation.

The findings in the current study are in agreement with Tella (2007:150) who suggested that positive attitudes are high motivating factors which may lead to better achievement on the part of the learner (see 2.8.1). The above results are also in harmony with the findings by Weiner (2010) who revealed that understanding of achievement motivation levels among learners have a positive impact on an educator's approach in educational settings (see 2.8.3). Tella noted that that high-motivated learners perform better than low-motivated learners. It shows that successful learners have higher motivation levels than 'failure' learners (see 2.8.1).

In accordance with these findings, the Eccles achievement model stress the interest value (intrinsic motivation) which is enjoyment in performing the task. Lack of motivation on the part of learners will lead to negative attitude, no interest, poor achievement (see Section 2.8.2).

The current study showed that when educators use experiments in science laboratories, it increased interest, level of achievement motivation and academic achievement of the learner. In accordance with these findings, the Eccles achievement model stress the interest value (intrinsic motivation) which is enjoyment in performing the task (see 2.8.1). Research stressed that motivation has an impact on academic achievement of secondary school learners (Tella, 2007:150; Basturk & Yavuz, 2010:1940; see 2.8.2). Poor facilities, low interest and the lack of equipment may lead to poor achievement in science and mathematics (see 2.8.1).

Furthermore, the above findings are in agreement with researchers who indicated that individuals respond differently to perceived problems due to the need for achievement motivation levels (see 2.8.2). Kenny, Walsh-Blair, Blustein, Bempechat and Seltzer, (2010:207) indicated that high-achievement motivated individuals tend to make higher attributions to ability and effort than low-achievement motivated individuals. On the other hand, low-achievement motivated individuals make lower attributions to ability and effort. The above findings are also consistent with findings by (Bøe et al. 2011:21) who noted that many learners are motivated to choose science subjects to gain admission to tertiary level and because of high salaries in the science field (see 2.9.5).

Therefore, the results show that achievement motivation of learners affect learner achievement.

4.4.2.2 Expectations of success in future to show learners' level of motivation

Expectations of success in future by learners showed that they were well motivated.

Educators' expectations of success to show learners level of motivation

Table 4.56a indicates the Expectations of success in future by educators to show the achievement motivation levels of learners.

Table 4.56a: Educators' views on their expectations of learners' success

Question 9: What are your expectations of learners' success in the final exams?	
Respondent 1	Expect success
Respondent 2	Expect success because the low achievers are encouraged to reach higher performance.
Respondent 3	Expect success but learners' negative attitudes to science leads to lack of motivation.
Respondent 4	Expect success and focus on low achievers to become confident and motivated.
Respondent 5	Expect success and is aiming for a 70% pass rate.

The views of educators regarding their expectations of learners' success are discussed below:

Respondent 1 maintained that she expected success and with hard work they will achieve it.

Respondent 2 expects success because the learners are divided into low and high achievement groups. The low achievers are encouraged to reach higher performance.

Respondent 3 is expecting success from learners' future performance, however, because some of the learners' negative attitudes to science, they lack motivation.

Respondent 4 is expecting that learners will succeed because he is well committed and he gives extra tuition during weekends. He targets the low achievers so that they can become confident and motivated. He said:

> "this year our target is an 80% pass rate"

Respondent 5 expected learners to succeed and she was aiming for a 70% pass rate.

Table 4.56a demonstrates that all 5 educators expected success for learners in future. However, 1 educator noted that because some of the learners have negative attitudes to science which leads to a lack of motivation. The expectations of success by educators indicated high levels of achievement motivation for learners.

Learner's responses regarding their expectations of success to determine achievement motivation

Table 4.56b indicates the Expectations of success in future by learners to show their level of achievement motivation.

Table 4.56b: Learners' views on their expectations of success in test

Question 9: Do you expect to succeed in the next test?	
Respondent 6	Expected success in the next test
Respondent 7	Expect success
Respondent 8	Expect success with more effort
Respondent 9	Expect success with hard work and motivation
Respondent 10	Expect success

Learners' expectations success in test are discussed below:

Respondent 6 stated that her performance was not good in the previous test because she did not understand the question paper correctly, found it challenging and had a negative attitude towards science. However, with more effort, she believed that she expected better results in the next test. She said:

"I think my results will be high compared to the last results"

Respondent 7 expected to succeed in the test but could do better.

Respondent 8 expected success

Respondent 9 expected success because spending more time with science

Respondent 10 expect success especially from paper 2

Table 4.56b demonstrates that all 5 learners expected success in future. This indicated that expectations of success by learners indicated high levels of achievement motivation.

Motivation theorists show how motivation influences learners' effort and achievement about expectancy in future tasks and how much they value the task. The results by educators in the present study were also demonstrated in the study by Tella, (2007:150) who indicated that when learners make negative responses and do not expect success in future, it is demotivating to the teacher. Learners who are highly motivated, expect success, exert effort on a task, receive higher grades, whereas, lower motivated learners do not expect success (see 2.8.1). Tella (2007:150) noted that to predict whether a student who has failed an exam will continue or drop out, one will have to examine the subjective expectancy of future success (2.8.4).

The findings are also in accordance with Weiners' (2000:2) intra-personal theory of motivation which includes expectancy of success. Weiner (2000:4) noted that if a student fails in an exam, teachers, parents and peers judge the learner and it results in positive or negative feedback (see 2.8.4).

According to the expectancy-value theory of achievement motivation (Eccles. 2000; Eccles & Wigfield, 2000:68), motivation influences learners' ability, effort and expectancy for success (see 2.8.6). A person's effort and achievement about belief of how well they will do is determined by their belief of how much they value the activity (Eccles & Wigfield, 2000:69). Improved interest leads to improved achievement at secondary school level (2.8.1). Weiner, (2010) noted that ability attributions determine motivation. Attributing success to ability has positive motivational consequences, whereas attributing failure to lack of ability has negative consequences (Bøe, Henriksen, Lyons & Schreiner (2011:21). The abilities learners have will influence whether they will fulfil themselves and whether they expect success in future see (2.8.6).

The present study indicated that teachers and parents influence career choices. Hazari, et al., (2010:978) also noted that learners' self-perception and expectation of success in science are shaped by parents and teachers, who influence future educational choices (see 2.9.6).

Therefore, the results show that achievement motivation of learners affect learner achievement.

4.4.3 Effects of gender on attributions of learner related to Research Question 3

The interview results for gender in terms of the seven attributional factors were discussed in detail under Sections 4.4.1.1 to 4.4.1.7 in this chapter.

Table 4.57 below displays the results of males and females in terms of ability attributions:

Table 4.57: Interview results for gender relative to ability attributions

Question 1: Do you have the ability to perform well in science?		
RESPONDENT	**GENDER**	**ABILITY ATTRIBUTIONS**
Respondent 6	F	Ability to do well in science
Respondent 7	F	Developed ability
Respondent 8	M	Low ability in science
Respondent 9	F	Have high ability
Respondent 10	M	Ability to do well in science

4.4.3.1 Gender affecting ability attributions of learners

Table 4.57 above displays the results of males and females in terms of ability attributions. The interview results of each respondent regarding ability attributions are discussed in detail in Section 4.4.1.1 of this chapter.

The analysis of the interviews indicated that 3 females and 1 male believed that they have ability in science, whereas, 1 male was of the opinion that he had low ability (see Table 4.57). The interview results indicated that more females than males believed that they had ability.

The findings in the current study are in agreement with Addiba (2004) who also indicated gender differences in attribution and she found that male learners attributed their success and failure to ability (see 2.9).

In contrast to the present findings, Quinn and Lyons (2011:229) indicated that males rated their ability in science higher than did females (see 2.9.1). Eccles and Wigfield (2000:68) indicated that male and female beliefs and values differ in gender stereotypic ways by perceiving males as having higher abilities than females (see 2.8.6). Meece et al. (2006:351) also noted that the males in their study showed higher ability beliefs in science and mathematics (see 2.9.9). Batool et al. (2010:455) found that religious males use more ability attributions for success than females. The present study also conflicted with results of Rusillo and Arias, 2004:104) who revealed that males were less likely to attribute failure to lack of ability and more likely to attribute success to ability than females (see 2.9.9). The present study showed that one male attributed failure to lack of ability and one attributed success to ability. The findings of the present study also disconfirm results by Rusillo and Arias (2004:104) who maintained that males made more ability causal attributions for their academic achievement. The present study showed that females made higher ability attributions than males.

Therefore, the results show that gender affects the internal *ability attributions* of learners.

4.4.3.2 Gender relative to effort attributions

Table 4.58 below displays the results of males and females in terms of effort attributions:

Table 4.58: Interview results for gender relative to effort attributions

Question 2: Did you spend sufficient effort on your science test preparation?		
RESPONDENT	**GENDER**	**EFFORT ATTRIBUTIONS**
Respondent 6	F	Exerted sufficient effort
Respondent 7	F	Did not put in sufficient effort
Respondent 8	M	Did not put in sufficient effort
Respondent 9	F	Exerted a lot of effort
Respondent 10	M	Spent a lot of effort

Table 4.58 above displays the results of males and females in terms of effort attributions. The interview results of each respondent regarding effort attributions are discussed in detail in Section 4.4.1.2 of this chapter.

The analysis of the interviews indicated that 2 females and 1 male believed that they had exerted effort for science test preparation, whereas, 1 female and 1 male was of the opinion that they did not put in sufficient effort (see Table 4.58). The interview results indicated that more females than males believed that they had exerted effort.

The results of the current study are in accordance with the findings by Batool et al. (2010:455) who revealed that females from mainstream schools made higher effort attributions than males (see Section 2.9.9).

However, the findings in the present study are contrasting evidence by Hazari et al., (2010:978) who maintained that female physics identity appeared to be non-existent and females spent less effort on science than males. Hazari et al., (2010:978) noted that learmers' beliefs about themselves, influences the effort they will exert in science (See Section 2.9.6). The findings in the present study are also conflicting with results of McClure et al., (2010:72) who noted that females made more use of effort (unstable) attributions for success than males. The present study showed that both males and females attributed their success to effort (2.9.8). males made more ability and luck causal attributions for their academic achievement. Females attribute failures to unstable external variables like luck or internal causes such as effort to enhance their own image (Rusillo & Arias, 2004:104).

Therefore, gender affects the internal *effort attributions* of learners.

4.4.3.3 Gender relative to interest attributions

Table 4.59 below displays the results of males and females in terms of interest attributions.

Table 4.59: Interview results for gender relative to interest attributions

Question 3: Do you find science interesting?		
RESPONDENT	**GENDER**	**INTEREST ATTRIBUTIONS**
Respondent 6	F	Found science interesting but challenging and required hard work
Respondent 7	F	Found science interesting because learners learnt a lot from EXPO
2Respondent 8	M	Found science interesting and enjoyed conducting experiments
Respondent 9	F	Enjoyed science
Respondent 10	M	Found science interesting and exciting

Table 4.59 above displays the results of males and females in terms of interest attributions. The interview results of each respondent regarding interest attributions are discussed in detail in Section 4.4.1.3 of this chapter. The analysis of the interviews indicated that results showed that both male and female learners found the science course interesting (see Table 4.59). This indicates that male and female learners made equal interest attributions.

In contrast to the findings in the present study, several studies have shown that there is a decline in female learners' interest in science (Barmby et al., (2008:1085; Bøe et al., 2011:12; Hazari, Sadler, & Tai, 2008). Researchers are concerned about the under-representation of females in physics and the loss of interest in physics at an early stage. Barmby, et. al., 2008:1085) suggested that learners need to find science interesting and they should be encouraged to pursue science as a career. Bøe et al. (2011:12) noted that the physics curriculum does not take into account the interest of female learners. Hazari et al., (2008) stated that males had more childhood experiences involving science and technology (see 2.9.2 & 2.9.5).

4.4.3.4 Gender relative to task difficulty attributions

Table 4.60 demonstrates male and female learners' responses regarding task difficulty attributions.

Table 4.60: Interview results for gender relative to task attributions

Question 4: Do you find the science course difficult?		
RESPONDENT	**GENDER**	**TASK DIFFICULTY ATTRIBUTIONS**
Respondent 6	F	Found difficulty because of fear
Respondent 7	F	Not difficulty if sufficient effort made
Respondent 8	M	Found difficult
Respondent 9	F	Science most difficult subject and involved a lot of concentration
Respondent 10	M	Science interesting and not difficult

Table 4.60 above displays the results of males and females in terms of task difficulty attributions. The interview results of each respondent regarding task difficulty attributions are discussed in detail in Section 4.4.1.4 of this chapter. The analysis of the interviews indicated that 2 females and 1 male found the science test difficult, whereas, 1 female and 1 male experienced no difficulty with the science test (see Table 4.60). This demonstrates that more females than males found the science test difficult.

The findings in the present study are in agreement with results by McClure et al., (2010:72) who maintained that females ascribed their failure more to test difficulty than males. The review of literature by Bøe et al. (2011:22) also revealed that girls tend to find science more difficult than boys (see 2.9.5).

The results of the present study are conflicting with findings by Batool et al., 2010:455) who indicated that males from mainstream schools made higher task difficulty attributions than females (see 2.9.9).

Therefore, gender affects the external *task attributions* of learners.

4.4.3.5 Gender relative to luck attributions

Table 4.61 demonstrates male and female learners' responses regarding luck attributions.

Table 4.61: Interview results for gender relative to luck attributions

Question 5: Do you think you were lucky to achieve your science results?		
RESPONDENT	**GENDER**	**LUCK ATTRIBUTIONS**
Respondent 6	F	Not luck because results were good
Respondent 7	F	Not luck but effort and hard work
Respondent 8	M	Luck because successful in test
Respondent 9	F	Luck because successful while others did not succeed
Respondent 10	M	Not luck but hard work and effort

Table 4.61 above displays the results of males and females in terms of luck attributions. The interview results of male and female respondents regarding luck attributions are discussed in detail in Section 4.4.1.5 of this chapter. The analysis of the interviews indicated that 2 females and 1 male believed that they were not lucky in achieving the results, but that it was due to hard work and effort. However, 1 female and 1 male interviewee believed that they were lucky in achieving the outcome in science (see Table 4.61). This shows that fewer females made use of luck attributions in explaining their outcomes.

The present study findings agree with results by (Rusillo & Arias, 2004:104) who maintained that males made more luck causal attributions for their academic achievement. The results are also in accordance with findings by Rusillo and Arias, (2004:104) who indicated that males make luck attributions for success and failure. The results of the present study are in harmony with findings by Rusillo and Arias, (2004:104) who noted that females attribute failures to unstable external variables like luck or internal causes such as effort to enhance their own image (see 2.9.10).

The findings in the current study are in agreement with results by Mudhovozi et al., (2010:590) who demonstrated that males attributed success in academic settings to luck (see Section 2.9.10).

Therefore gender affects the external *luck attributions* of learners.

4.4.3.6 Gender relative to help attributions

Table 4.62 demonstrates male and female learners' responses regarding help attributions.

Table 4.62: Interview results for gender relative to help attributions

Question 6: Did you get help for your science preparation?		
RESPONDENT	**GENDER**	**HELP ATTRIBUTIONS**
Respondent 6	F	Learners get help from educators when they have extra tuition or during camp.
Respondent 7	F	Learners get help from educators and on DSTV learning programmes
Respondent 8	M	Learners get help from educators and practical methods
Respondent 9	F	Learners get help through practical methods
Respondent 10	M	Learners get help from educators, revision, practical methods and peers

Table 4.62 above displays the results of males and females in terms of help attributions. The interview results of male and female respondents regarding help attributions are discussed in detail in Section 4.4.1.6 of this chapter. The analysis of the interviews for external help attributions indicated that both males and females made use of *help attributions*.

Bøe et al. (2011:24) maintained that if learners required help to develop their potentials and abilities to succeed, they should choose subjects which do not conflict with their identities (see 2.9.5).

Batool et al. (2010: 454) noted that family background has to be considered with gender to see the achievement so that educators could help learners who are not achieving (see 2.10.5). Hareli and Weiner (2002b:188) noted that If a student succeeds because of help from others it results in gratitude. Gratitude expressed by learners toward their teachers may increase teachers' motivation, job satisfaction and improve teachers' attitudes towards learners (see Section 2.8.5).

4.4.3.7 Gender relative to teaching methods attributions

Table 4.63 demonstrates male and female learners' responses regarding teaching methods attributions.

Table 4.63: Interview results for gender relative to teaching method attributions

Question 7: Did the teaching methods of the educators contribute to your science results?		
RESPONDENT	**GENDER**	**TEACHING METHOD ATTRIBUTIONS**
Respondent 6	F	Good contribution because of tuition
Respondent 7	F	Teaching methods contributed.
Respondent 8	M	Good contribution because do revision in class
Respondent 9	F	Good contribution because educators explained concepts well
Respondent 10	M	Good contribution because the educators explained well and encouraged learners to do research

Table 4.63 above displays the results of males and females in terms of teaching method attributions. The interview results of male and female respondents regarding teaching method attributions is discussed in detail in Section 4.4.1.7 of this chapter. The analysis of the interviews for external teaching method attributions indicated that both males and females were of the opinion that teaching methods contributed to their outcomes.

Research by Barmby et. al. (2008:6) show that learners' interest was stimulated by practical teaching methods through lab in a lorry. The study showed that teaching methods, and not the curriculum, made a difference at high school level (see 2.9.2).

4.4.4 Effects of socio-economic status on attributions of learner related to Research Question 4

The quantitative study investigated several factors under the socio-economic status background relative to attributions and science achievement. Hence, the Research Question 4 was addressed adequately under the quantitative study.

4.5 CONCLUSION

The study revealed that successful high achievers made higher internal ability, effort and interest attributions than low achievers who failed the test. On the other hand, more low achievers believed that they had no ability, no effort, and no interest in science. The current study demonstrated that high achievers made lower task difficulty attributions which show that successful learners attributed their success to task ease. The study also showed that low achievers made higher task difficulty attributions. High achievers attributed their success to high luck and their failure to lack of luck. More high achievers perceived teaching methods as making a lot of contribution to their test score. The findings in the present study suggest that high successful learners attributed their success to good teachers.

The current study also confirmed that highly motivated learners made higher internal ability, effort and interest attributions than low motivated learners. Highly motivated learners also made higher teaching method attributions when compared to low motivated learners. Low motivated learners made higher external task difficulty, help and luck attributions than high motivated learners. Furthermore, there were more high achievers among the highly motivated group and more low achievers among the poorly motivated groups.

The quantitative findings of the current study also suggest that, although both male and females made internal attributions, females have a tendency to be more internally attributive than males in terms of ability and effort attributions. The analysis of the interviews showed that females made higher ability, effort and task difficulty attributions than males. The qualitative results also indicated that females made lower luck attributions than males and that both males and females made equal interest, help and teaching methods attributions.

Finally, the quantitative study confirmed that learners from higher socio-economic environments made higher internal ability, effort, and interest attributions than learners from lower socio-economic groups. Regarding external attributions, there was not much difference between the two groups. The results also showed that there were more high achievers among learners from higher socio-economic groups as compared to learners from lower socio-economic backgrounds.

Thus, the study revealed that attributional styles, gender, achievement, motivation level and socio-economic status of learners affect science achievement.

Chapter 5 will focus on the summary of findings, conclusions are drawn and recommendations made on issues raised.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

In this chapter the findings of the study are discussed. The effects of attributions, achievement, motivation, gender and socio-economic status on science achievement of learners are explained. The discussion also stresses the types of attributions which have a positive or negative influence on the achievement of learners in Grades 10 to 12. Conclusions are arrived at and necessary recommendations are made. Suggestions for further research are proposed.

5.2 SUMMARY OF FINDINGS

5.2.1 The effects of the types of attributions that affect the science achievement of learners: Related to Research Question 1

The quantitative study provides evidence that high successful achievers make higher ability, effort, interest, task ease, luck, help and teaching methods attributions than low achievers who failed the science test (see Figures 4.5 - 4.11). The analysis of interviews demonstrates that ability, *effort, interest*, *task difficulty*, *help* and *teaching method* attributions (see Tables 4.48a - 4.54b) affect learner achievement.

The ANOVA test of significance indicate a significant relationship between ability, effort, interest, task difficulty, luck, help and teaching method attributions relative to science achievement (see Table 4.16 and Appendix Q). Therefore, the quantitative questionnaire findings and the qualitative interview results show that attributions affect science achievement of learners.

5.2.2 The effects of achievement motivation on attributions and science achievement of learners: Related to Research Question 2

According to this research, achievement motivation levels of learners are identified as affecting the learners' attributions and achievement in science. The quantitative study confirms that highly motivated learners make higher ability, effort, interest, teaching method, lower task difficulty and help attributions than low motivated teaching method, lower task difficulty and help attributions than low motivated learners. This indicates that the highly motivated learners found the teaching methods of the teacher good and that this led to motivating them to get better results (see Figure 4.14).

The interview results indicated that experiments, demonstrations, presentations on computers as a way of teaching method was an excellent way of motivating learners to understand the course material (see Table 4.55a & Table 4.55b). Extrinsic as well as intrinsic motivation was stressed by teachers. Furthermore, laboratory resources were not available in all the schools. Teachers motivated learners by doing research on the internet and independent work. However, the negative attitude of some learners leads to a lack of motivation (see Table 4.55b).

The lack of motivation by low performing learners could lead to a cycle of no interest, no expectations of success in future, a negative attitude by learners towards science and ultimately to poor performance (Figure 5.1). Teachers have to break this cycle of poor performance by encouraging learners' motivation and interest in science.

Figure 5.1 Cycle of lack of motivation, no interest and poor achievement

The ANOVA test of significance shows that there are statistically significant differences between achievement motivation and six attributions: ability, effort, interest, task difficulty, help and teaching method attributions. However, the ANOVA results show no significant differences between achievement motivation and luck

There were more high achievers among the highly motivated groups and more low achievers among the low motivated groups. Therefore, the study shows that highly motivated learners achieve better results than poorly motivated individuals. The qualitative interviews indicated that positive attitudes of the learners are high motivating factors which result in better achievement by learners.

Therefore, the quantitative questionnaire findings and the qualitative interview results show that achievement motivation of learners affect science achievement of learners.

The Chi-Square test of significance indicates a significant relationship between achievement motivations relative to science achievement.

5.2.3 The effects of learners' gender on attributions and science achievement of learners: Related to Research Question 3

The quantitative results indicate that females demonstrate slightly higher ability, effort luck, help and teaching methods attributions than males (see Table 4.16). The analysis of the interview results indicate that females make higher ability, effort, lower luck causal attributions than males for their academic achievement. The quantitative and qualitative interviews indicate that both males and females make high interest attributions (see Table 4.16 & Table 4.59). The qualitative results show that both males and females make similar *task difficulty, help* (see Table 4.62) and *teaching methods* attributions (see Table 4.63).

The results may be due to the fact that gender inequalities in education have changed so that males and females have equal access to resources.

The ANOVA test of significance shows a significant relationship between gender relative to ability, effort, luck, help and teaching method attributions of science learners. On the other hand, the ANOVA test of significance shows that there is no statistical difference between gender relative to interest and task difficulty attributions.

The data revealed that there were no significant differences between males and females in terms of science achievement. The reason for the similarity in achievement between males and females may be due to the changing environment in education. Teachers provide equal opportunities to boys and girls in science classes. Science is no longer seen as a male dominated subject and girls are more confident in following science as a career. Therefore, the Chi-Square test results indicate that there is no statistical difference between achievement in science relative to gender.

5.2.4 Effects of socio-economic factors on attributions and science achievement of learners: Related to Research Question 4

This section deals with research Question 4 which investigated the effects of socio-economic background on the attributional styles and science achievement of learners.

Income of the breadwinner relative to attributions and science achievement of learners

Results show that learners from higher income groups (HIG) make higher ability, effort, interest and teaching method attributions than learners from lower income groups (LIG). This indicates that learners from the higher income groups found that teaching methods contributed highly to their success in the science test.

The ANOVA Test of significance indicates that there is a significant relationship between breadwinners' income (socio-economic status) relative to ability, effort, interest, luck, and teaching method attributions. The test also shows that there are no significant differences between task and help attributions relative to breadwinners' income.

There were more high achievers among the higher income groups and more low achievers among the lower income groups. Therefore, the results show that the higher the income, the better the performance of the learner. The Chi-Square test results show that there is a statistical relationship between breadwinners' income relative to science achievement.

Educational backgrounds relative to attributions and science achievement of learners

Learners from higher educational backgrounds (HEB) make higher ability attributions than learners from lower educational backgrounds (LEB). The ANOVA test of significance shows a significant relationship between ability and teaching methods relative to level of education. The ANOVA test of significance indicated that there were no significant differences in the interest, effort, task, luck and help attributions of learners relative to educational backgrounds (Table 4.36).

The results also showed that there were more high achievers among learners from higher educational backgrounds (HEB) than among learners from lower educational backgrounds (LEB). The Chi-Square test results showed that there is a statistical relationship between breadwinners' educational level relative to Science achievement.

Level of occupation relative to attributions and science achievement of learners

The ANOVA results indicated a significant relationship between ability, effort, interest, luck and help attributions (see Table 4.41) relative to level of occupation. There were no significant differences between task and teaching method attributions relative to breadwinners' level of occupation.

Most of the high achievers were among the learners from a higher occupation level. Most of the low achievers were learners from a lower occupation level where breadwinners were unemployed.

The Chi-Square test of significance indicated a statistical difference between breadwinners' occupational level relative to science achievement.

Number of bedrooms in a household relative to attributions and science achievement of learners

The results show that learners who had 3 to 5 bedrooms in their homes (higher socio-economic; HSE) background) make higher ability, effort, interest, luck, teaching method, lower task difficulty and help attributions than learners who had 1 to 2 bedrooms (lower socio-economic; LSE) group.

The ANOVA test of significance indicated a significant relationship between ability, effort, task, luck, teaching method attributions relative to number of bedrooms in a household. There was an insignificant relationship between interest and help attributions relative to number of bedrooms in a household.

The study shows that the majority of high achievers are from the HSE group. Most of the low achievers are from LSE environments. The Chi-Square test results indicate that there is a statistical difference between number of bedrooms relative to science achievement.

Access to television relative to attributions and science achievement of learners

Results indicate that 95% of the learners had access to television in their homes. The ANOVA test of significance indicated an insignificant relationship between ability, effort, interest, task, luck, help and teaching method attributions relative to television access.

The study indicated that there were more high achievers among learners who had access to television as compared to learners who did not have access.

The Chi-Square test of significance demonstrated a statistical difference between access to television relative to science achievement.

Laboratory in school relative to attributions and science achievement of learners

There were more low achievers among learners who had access to laboratories than learners who did not have access. It is possible that laboratories were not well equipped or teachers were not well trained to use those facilities (see Figure 4.23).

The Chi-Square test of significance demonstrated a statistical difference between access to laboratory relative to Science achievement.

Community library relative to attributions and science achievement of learners

There were 37% of learners who had access to community libraries. The ANOVA Test of significance study shows a significant relationship between teaching method attribution relative to library access. The study shows an insignificant relationship between ability effort, interest, task, luck and help attributions relative to library access.

The study revealed that there were more low achievers and high achievers among learners who did not have access to libraries compared to those who had access to libraries. It is possible that with unavailability of books as resources, learners may have used other resources such as internet.

The Chi-Square test of significance demonstrated no statistical difference between access to libraries relative to science achievement.

Qualitative results related to Research Question 4

The quantitative investigation regarding socio-economic status relative to attributions and achievement in science was extensive and results were satisfactory. Consequently, the research did not include interview questions related to socio-economic status.

From the general discussion with learners it was indicated that teachers from lower socio-economic regions found it difficult to access resources such as, libraries, laboratories and television. They required more laboratories and better equipment in the schools. Parents are not educated about science and are not involved in the learners' career guidance. The teacher feels that the community should show interest and encourage learners to follow science careers. The schools which have access to laboratories, allows learners to do practical work and experiments. Other schools have access to libraries, computers and radio. It helps learners to do more research and practical work to encourage interest and motivation. Therefore, the study shows that socio-economic status affects learner achievement.

5.3 CONCLUSION

Data collected was analysed mainly through quantitative methods. The qualitative interviews with a principal, Heads of Departments, a teacher and Physical Science learners helped with the triangulation process. ANOVA and Chi-Square statistical techniques were used to analyse the quantitative data.

The main areas of analysis are as follows:

In addressing Research Question 1 which investigated the effects of the types of attributions that affect the science achievement of learners the following conclusions were drawn:

The results show that attributional styles (internal *ability*, *effort, interest*, and external *task difficulty*, luck, *help* and *teaching method* attributions) affect learners' achievement.

The quantitative questionnaire findings and the qualitative interview results show that attributions affect science achievement of learners.

In addressing Research Question 2 which investigated the effects of achievement motivation on attributions and science achievement of learners the following conclusions were drawn:

The quantitative study confirms that highly motivated learners make higher ability, effort, interest, teaching method, lower task difficulty and help attributions than low motivated learners.

The study shows that highly motivated learners achieve better results than low motivated groups. The quantitative questionnaire findings and the qualitative interview results show that achievement motivation of learners affect science achievement of learners.

In addressing Research Question 3 which investigated the effects of learners' gender on attributions and science achievement of learners the following conclusions were drawn:

In terms of attributions, the quantitative results indicate a significant relationship between gender relative to ability, effort, luck, help and teaching method attributions of science learners. On the other hand, the results show no statistical difference between gender relative to interest and task difficulty attributions.

Regarding science achievement, the data revealed that there were no significant differences between males and females in terms of science achievement.

In addressing Research Question 4 which investigated the effects of socio-economic background on the attributional styles and science achievement of learners, the following conclusions were drawn:

The results show that there is a statistical relationship for some of the attributional factors relative to breadwinners' income, educational level, occupational level, number of bedrooms, access to television, laboratories and libraries (see Section 5.2.4).

The results show that there is a statistical relationship between breadwinners' income, educational level, occupational level, number of bedrooms in the home, access to television, laboratories and libraries relative to science achievement.

5.4 RECOMMENDATIONS

In the light of findings of the study, the following recommendations are made:

5.4.1 Attributions and science achievement of learners: Related to Research Question 1

- it is recommended that learners become aware of types of attributions (ability, effort, interest, task difficulty, luck, help and teaching methods) that affect science achievement of learners in Grades 10 to 12.
- An internal attributional style results in higher achievement. Therefore, it is recommended that learners be encouraged to adopt an internal attributional style by stressing ability, effort and interest attributions.
- It is recommended that science educators should stress effort attributions rather than ability attributions, as effort enhances learners' academic achievement. It is more adaptive and leads to better expectations of future performance of learner. Causes such as effort can be changed, whereas other causes such as luck and ability cannot be changed intentionally (Table 2.2).
- Teaching methods should be interesting and easy to understand to lead to better performance in science and increase the self-esteem of the learner.

5.4.2 Achievement motivation, attributions and science achievement of learners: Related to Research Question 2

- It is recommended that learners be encourage to make use of resources such as experiments in the laboratory, research on internet and use of other practical resources to increase their achievement motivation levels.
- It is recommended that science educators have to encouraging learners' motivation levels in science. This will lead to more interest, expectations of success in future, a positive attitude by learners towards science and ultimately to improved achievement.

5.4.3 Gender attributions and science achievement of learners: Related to Research Question 3

- It is recommended that both males and females be made aware of the positive influence of internal attributions on science achievement of grades 10-12 learners.
- A major crisis for science education in the North-West Province is that the number of science education enrolments at high school level is dropping. It is therefore recommended that male and female learners be motivated to follow science as a career. Science should not be seen as a male dominated career.

5.4.4 Socio-economic status, attributions and science achievement of learners: Related to Research Question 4

- Inadequate resources and the low socio-economic background of learners lead to poor achievement of learners. It is therefore recommended that more resources in terms of laboratories, libraries and internet should be provided to learners from underprivileged and lower socio-economic regions.

5.5 AREAS/SUGGESTIONS FOR FURTHER RESEARCH

Based on the findings, this study suggests the following areas for further research:

The present study was limited to two regions in the North-West Province. Further research could include learners from other regions within the North-West Province. The current investigation was restricted in terms of interviews because of time, cost and travelling expenses. This limited the generalizability of findings to all participants in the Province. Also, learners from different educational levels could be included as well as learners from tertiary level. This study was restricted to teachers, principals, Heads of Departments and learners from Grades 10 to 12. Further research should include training of teachers to become proficient in using of laboratory equipment.

The role of the school in providing resources in the library and equipment in laboratories to enhance learners' motivation and achievement in science should be addressed in future research as well.

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APPENDIX A:

LETTER OF PERMISSION FROM DIRECTOR OF POST GRADUATE STUDIES AT THE NORTH-WEST UNIVERSITY (MAFIKENG CAMPUS) TO DISTRICT MANAGER

NORTH-WEST UNIVERSITY
YUNIBESITI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT
MAFIKENG CAMPUS

Faculty of Education | School of Postgraduate Studies

09 May 2011

TO WHOM IT MAY CONCERN

This is to certify that **Mrs Shreen Gutta**, Student No.**16237498** is a doctoral (PhD) student in Guidance and Counselling at the NWU Mafikeng Campus.

Mrs Gutta needs to collect data for her research from various high schools with Grades 10-12 learners doing Mathematics in the Ngaka Modiri Molema and Dr Ruth Segomotsi Mompati areas of the North West Province

I therefore request that she be given the necessary assistance in this regard.

PROF JR DEBEILA
DIRECTOR: SCHOOL OF POSTGRADUATE STUDIES

SCHOOL OF POSTGRADUATE STUDIES
2011 -05- 09
FACULTY OF EDUCATION
DIRECTOR'S OFFICE

APPENDIX B:

LETTER FROM DISTRICT MANAGER FOR PERMISSION TO GO TO SCHOOL

education

Lefapha la Thuto
Onderwys Departement
Department of Education
NORTH WEST PROVINCE

Cnr. Thelesho Tawana & Modiri Molema
Private Bag x 10
Mmabatho 2735
Tel.: +27 (18) 384-3233
Fax: +27 (18) 384-0212/3234

MAHIKENG AREA OFFICE

Date . 09 May 2011
Enquiries : Kokong NM
Cell No : 083 632 6928

TO WHOM IT MAY CONCERN

Permission is herewith granted to Mrs Shreen Gutta, student no. 16237498to conduct research at Mafikeng Area High Schools in the North West Provinces.

Disturbing lessons and teaching time must be totally avoided. A copy of the research finding should be made available to the Area Office and Mafikeng High Schools that she will be visited.

Kokong NM
Mahikeng Area Manager

"Portrait of Excellence"
"All hands on the deck to speed up change"

NORTH-WEST UNIVERSITY
YUNIBESITI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT
MAFIKENG CAMPUS

Faculty of Education **School of Undergraduate studies**

APPENDIX C CONSENT FORM: PRINCIPAL FOR LEARNERS' INTERVIEW

Dear Principal,

The present study is investigating the attributional styles and achievement motivation levels of learners in Grade 10 – 12. The purpose is to complete the researcher's doctorate programme in Education. The study will assist learners to perform better in schools by improving the attributional style of the learners in schools and teachers will be able to support learners in all schools – rural as well as urban.

The researcher is inviting your learner to participate in an individual interview and the session will be short because of the time factor. The interview will take place at your school at a time that will be convenient for him/her. The individual session will be audio-taped and transcribed for analysis.

Your child's participation in the individual session is purely voluntary and s/he is free to withdraw at any point. The researcher will respect the respondents' identity, confidentiality and anonymity. All real names will be removed from the final transcription of data.

The researchers thank you for your cooperation and look forward to our work together.

I ____________________________ agree to participate in the research project.

- I understand the purpose of this study and know about benefits of this research project.
- I understand that my learner is not obliged to participate in this project, that s/he is free to not answer certain questions, and that s/he has the right to withdraw from the study at any point.
- I understand how confidentiality will be maintained during this research project.
- I also understand that the individual interview will be audio-taped.
- I understand the anticipated uses of data, especially with respect to publication, communication, and dissemination of results.

I have carefully studied the above and understand my participation in this agreement. I freely consent and voluntarily agree to my learners' participation in this study.

Date: ______________________________

Name (printed): ______________________________

Signature: ______________________________

NORTH-WEST UNIVERSITY
YUNIBESITI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT
MAFIKENG CAMPUS

Faculty of Education **School of Undergraduate studies**

APPENDIX D CONSENT FORM: TEACHER INTERVIEW

Dear Teacher,

The present study is investigating the attributional styles and achievement motivation levels of learners in Grade 10 – 12. The purpose is to complete the researcher's doctorate programme in Education. The study will assist learners to perform better in schools by improving the attributional style of the learners in schools and teachers will be able to support learners in all schools – rural as well as urban.

The researcher is inviting you as a teacher to participate in an individual interview. The session will be short because of the time factor. The interview will take place at your school at a time that will be convenient for you. The individual session will be audio-taped and transcribed for analysis.

Your participation in the session is purely voluntary and you are free to withdraw at any point. The researcher will respect the respondents' identity, confidentiality and anonymity. All real names will be removed from the final transcription of data.

The researchers thank you for your cooperation and look forward to our work together.

I ______________________________ agree to participate in the research project

- I understand the purpose of this study and know about benefits of this research project.
- I understand that I am not obliged to participate in this project, that I am free to refrain from answering certain questions, and that I have the right to withdraw from the study at any point.
- I understand how confidentiality will be maintained during this research project.
- I also understand that the individual interview will be audio-taped.

- I understand the anticipated uses of data, especially with respect to publication, communication, and dissemination of results.

I have carefully studied the above and understand my participation in this agreement. I freely consent and voluntarily agree to my learners' participation in this study.

Date: ______________________________

Name (printed): ______________________________

APPENDIX E CERTIFICATE OF LANGUAGE EDITING

CERTIFICATE OF LANGUAGE EDITING

The thesis titled:

CAUSAL ATTRIBUTIONS OF SUCCESS AND FAILURE BY GRADES 10-12 SCIENCE LEARNERS

by

SHREEN GUTTA

for the degree

DOCTOR IN EDUCATION

in the

FACULTY OF EDUCATION

NORTH-WEST UNIVERSITY

MAFIKENG CAMPUS

has been edited for language by

DR. NELDA MOUTON, MA, PhD (English), {NWU, Potch Campus}, PhD (Education Management)

DR NELDA MOUTON **DATE**

APPENDIX F **COVER LETTER**

I hereby give consent for my science academic test scores to be used for purpose of this research with the knowledge that the score will be handled with strict confidentiality

MARK WITH AN 'X'.

Yes	
No	

FOR OFFICE USE ONLY

1
2

The responses on your questionnaire will not in any way affect your grades.

The researcher is only interested on responses of the class for her Doctorate research study.

Name of school: ....

Student number: ....

BIOGRAPHICAL INFORMATION:

1. Gender:

Male	
Female	

1
2

2. Grade:

10	
11	
12	

1
2
3

FOR OFFICE USE ONLY

3. **Home Language**

English			1
Afrikaans			2
Setswana			3
Other			4

4. **Age:**

15 -16 years			1
17-18 years			2
19 and above			3

5. **Percentage achieved on Science Test**

0-29			1
29-39			2
39-49			3
49-59			4
59-69			5
69-79			6
80-100			7

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6. **Were you generally satisfied with your performance on the test?**

Yes			1
No			2

7. **Does the school have laboratories for learning Science**

Yes			1
No			2

APPENDIX G1 SOCIO-ECONOMIC STATUS QUESTIONNAIRE

Mark with an 'X'.

1. Number of bedrooms in my house except living or other rooms:

1	
2	
3	
4	
5or more	

1
2
3
4
5

2. Number of people in our house sharing a bedroom:

2	
3	
4	
5 or more	

1
2
3
4

3. Who is the breadwinner in your home:

Father	
Mother	
Other and specify	

1
2
3

4. **What is the occupation of the breadwinner in your family:**

Agriculture		1
Education		2
Business		3
Mining		4
Labourer		5
Other and specify		6
Not employed		7

5. **What is the income per month of the breadwinner in your family:**

Below <R1000		1
R1000-5000		2
R6000-R10000		3
R10000 above>		4

6. **What is the highest level of education the breadwinner in your family has completed:**

Degree		1
Matriculated		2
Grade 8 +		3
Below grade 8		4

7. Do you have television in your home:

Yes	
No	

1
2

8. Do you have radio in your home:

Yes	
No	

1
2

9. Do you have access to newspaper in your home:

Yes	
No	

1
2

10. Do you have a community library in your area:

Yes	
No	

1
2

APPENDIX G 2 PILOT STUDY 2 MODIFIED

PILOT STUDY 1

Pilot study 1 required the following information.

"Number of bedrooms in my house"
"Number of people in our house"
"My fathers' occupation"
"My mothers' occupation"
"My guardians' occupation"
"Your brother/sisters' occupation"
"My fathers' level of education"
"My mothers' level of education"
"My guardians' level of education"
"Your brother'/sisters' level of education"
"Do you have Television in your home"
"Do you have a radio in your house"
"Do you have access to newspaper in your home"
"Do you have a community library in your area"

MODIFIED PILOT STUDY 2

The pilot questions were modified to include categories for each question. This avoided any ambiguity when completing the questionnaire.

- Learners were asked to include occupation of the breadwinner;
- occupation categories were specified instead of a general question on the breadwinners' occupation;
- education levels were increased instead of a general question requesting the level of education of parent;
- income of the breadwinner was included in the new questionnaire to identify lower and higher socio-economic groups;
- more categories were included under home language;
- another factor to measure internal attribution was included;
- the categories on the Likert-scale was reduced from 5-point to 4-point; and

- moderate (neutral) measures for the factors on attribution were not options in the new questionnaire.

The final questions were as follows: (See Appendix G)

1. Number of bedrooms in my house except living or other rooms?
2. Number of people in our house sharing a bedroom?
3. Who is the breadwinner in your home?
4. What is the occupation of the breadwinner in your family?
5. What is the income per month of the breadwinner in your family?
6. What is the highest level of education the breadwinner in your family has completed?
7. Do you have television in your home?
8. Do you have a community library in your area?

APPENDIX H ATTRIBUTION QUESTIONNAIRE

THE FOLLOWING FACTORS ARE RELATED TO YOUR PERFORMANCE IN YOUR TEST:

RATE EACH ONE OF THE FOLLOWING FACTORS REGARDING THEIR INFLUENCE ON YOUR PERFORMANCE ON THE TEST

(a) ABILITY: Did you use a lot of ability in the performance of your test and were your test results caused by your ability level?

1	2	3	4
No Ability	Little Ability	More Ability	A lot of Ability

(b) EFFORT: Did you study hard for the test and was your test results caused by a lot of hard work?

1	2	3	4
No Effort	Little Effort	More Effort	A lot of Effort

(c) INTEREST: Do you find the Science subject interesting and was your test results caused by your interest in the subject?

1	2	3	4
No Interest	Little Interest	More Interest	A lot of Interest

(d) TASK: Did you find the test difficult and was your test results caused by a difficult test paper?

1	2	3	4
Not difficult	Little difficult	More Difficult	Extremely difficult

(e) **LUCK:** Were you lucky in the performance of the test and was your test results caused by luck?

1	2	3	4
Not lucky	Little lucky	More lucky	Very lucky

(f) **HELP:** Did you get assistance from others and were your test results caused by help from others?

1	2	3	4
No Assistance	Little Assistance	More Assistance	A lot of Assistance

(g) **TEACHING METHODS:**

Did the teachers' way of teaching style contribute to your results and was your results caused by the teaching methods?

1	2	3	4
Not contributed	Little contributed	More contributed	A lot of contribution

APPENDIX I

INSTRUCTIONS FOR APPENDIX I

This questionnaire consists of a number of items where contrasting descriptions concerning two people, viz. Person A and person B, are given.

Read the two descriptions in every item and then decide which one of the two BEST describes you.

Mark your choice with a cross in column A or B You may sometimes find that none of the two descriptions quite fit you, but you should, decide which description fits you best.

Mark only one cross for each item.

			A	B
1	A	I tend to make careless errors in my work		
	B	I am usually very accurate in my Science assignment		
2	A	I feel that every minute of the day must be used actively		
	B	I feel that I can relax a bit during my daily duties		
3	A	I prefer tasks where I must take a risk		
	B	I avoids tasks where I must take a risk		
4	A	I begin preparing myself for a task a long time beforehand		
	B	I prefer to prepare for a task a short while beforehand		
5	A	I lose heart when problems are experienced		
	B	I persevere with a task even though many problems are experienced		
6	A	I believe that my actions are correct in most situations		
	B	I doubt the correctness of my actions in most situations		
7	A	I avoid an assignment where high standards are demanded		
	B	I prefer an assignment where high standards are demanded		
8	A	I do not rest until an assignment is completed		
	B	I am not upset when an assignment is not completed		
9	A	I will accept a challenge even though I am not sure of success		
	B	I will only accept a challenge when I am fairly certain of success		
10	A	I prefer working according to a timetable		
	B	I find it difficult working according to a timetable		
11	A	I welcome periodical rest breaks while performing a difficult task		
	B	I prefer to first complete a difficult task and then a break		
12	A	I rely on my own abilities to overcome difficulties		
	B	I rely on the help of others in order to overcome difficulties		

			A	B
13	A	I view success as resulting from personal skills		
	B	I view success as partly pure luck		
14	A	I find it difficult to continue with my assignment after an interruption		
	B	I easily continue with my assignment after interruption		
15	A	I tend to give up easily		
	B	I endure until the end		
16	A	I am vague about my future plans		
	B	I have very clear future plans		
17	A	I do not accept help in the solving of a complex Science task		
	B	I readily accept help in the solving of a complex Science task		
18	A	I feel that external factors make my control of situations difficult		
	B	I usually feel in control of a situation		
19	A	I am not always sure of my plans for the following year		
	B	I mostly have clarity as to what I will be doing the following year		
20	A	I am usually discouraged by my failures		
	B	I am never discouraged by my failures		
21	A	I find it easier to leave work incomplete because I can finish it later		
	B	I do not leave work incomplete if there is enough time to complete it		
22	A	I prefer tasks with an average level of difficulty		
	B	I prefer very difficult <u>or</u> very easy tasks		
23	A	I accept resignedly if my watch loses time		
	B	I am irritated if my watch loses time		
24	A	I will be satisfied if I do well in a term assignment, even though I did not come out right on top		
	B	I want to reach the highest level in the semester assignment at all cost		
25	A	I complete the easier assignments first as I can complete them with confidence		
	B	I complete the difficult assignments first so as to get it over with		
26	A	I set standards for myself that are not too high or too low		
	B	I usually set high standards for myself		
27	A	I find it difficult to do something more than what I resolved to do		
	B	I usually get more done than what I resolved to do		
28	A	it worries me if I was late for an appointment		
	B	does not worry me if I am occasionally late for an appointment		

			A	B
29	A	I prefer goals that I can attain without much effort		
	B	I prefer goals which in which I have to exert a great amount of effort		
30	A	I feel guilty when I somewhere use my time ineffectively		
	B	I do not mind if I sometimes waste time		
31	A	I have a need to succeed		
	B	I have a need to avoid failure		
32	A	I becomes disheartened by setbacks		
	B	I regard setbacks as new challenges		
33	A	I believe that if completion of an assignment is postponed it will never get done		
	B	I feel that "tomorrow is another day" with regard to the execution of an assignment		

KEY TO MARKING APPENDIX I

			A	B	
1	A	I tend to make careless errors in my work			B
	B	I am usually very accurate in my Science assignment			
2	A	I feel that every minute of the day must be used actively			A
	B	I feel that I can relax a bit during my daily duties			
3	A	I prefer tasks where I must take a risk			A
	B	I avoids tasks where I must take a risk			
4	A	I begin preparing myself for a task a long time beforehand			A
	B	I prefer to prepare for a task a short while beforehand			
5	A	I lose heart when problems are experienced			B
	B	I persevere with a task even though many problems are experienced			
6	A	I believe that my actions are correct in most situations			A
	B	I doubt the correctness of my actions in most situations			
7	A	I avoid an assignment where high standards are demanded			B
	B	I prefer an assignment where high standards are demanded			
8	A	I do not rest until an assignment is completed			A
	B	I am not upset when an assignment is not completed			
9	A	I will accept a challenge even though I am not sure of success			A
	B	I will only accept a challenge when I am fairly certain of success			
10	A	I prefer working according to a timetable			A
	B	I find it difficult working according to a timetable			
11	A	I welcome periodical rest breaks while performing a difficult task			B
	B	I prefer to first complete a difficult task and then a break			
12	A	I rely on my own abilities to overcome difficulties			A
	B	I rely on the help of others in order to overcome difficulties			
13	A	I view success as resulting from personal skills			A
	B	I view success as partly pure luck			
14	A	I find it difficult to continue with my assignment after an interruption			B
	B	I easily continue with my assignment after interruption			
15	A	I tend to give up easily			B
	B	I endure until the end			
16	A	I am vague about my future plans			B
	B	I have very clear future plans			
17	A	I do not accept help in the solving of a complex Science task			A
	B	I readily accept help in the solving of a complex Science task			
18	A	I feel that external factors make my control of situations difficult			B
	B	I usually feel in control of a situation			

			A	B	
19	A B	I am not always sure of my plans for the following year I mostly have clarity as to what I will be doing the following year			B
20	A B	I am usually discouraged by my failures I am never discouraged by my failures			B
21	A B	I find it easier to leave work incomplete because I can finish it later I do not leave work incomplete if there is enough time to complete			B
22	A B	I prefer tasks with an average level of difficulty I prefer very difficult <u>or</u> very easy tasks			B
23	A B	I accept resignedly if my watch loses time I am irritated if my watch loses time			B
24	A B	I will be satisfied if I do well in a term assignment, even though I did not come out right on top I want to reach the highest level in the semester assignment at all costs			B
25	A B	I complete the easier assignments first as I can complete them with confidence I complete the difficult assignments first so as to get it over with			B
26	A B	I set standards for myself that are not too high or too low I usually set high standards for myself			B
27	A B	I find it difficult to do something more than what I resolved to do I usually get more done than what I resolved to do			B
28	A B	it worries me if I was late for an appointment does not worry me if I am occasionally late for an appointment			A
29	A B	I prefer goals that I can attain without much effort I prefer goals which in which I have to exert a great amount of effort			B
30	A B	I feel guilty when I somewhere use my time ineffectively I do not mind if I sometimes waste time			A
31	A B	I have a need to succeed I have a need to avoid failure			A
32	A B	I becomes disheartened by setbacks I regard setbacks as new challenges			B
33	A B	I believe that if completion of an assignment is postponed it will never get done I feel that "tomorrow is another day" with regard to the execution of an assignment			A

APPENDIX J INTERVIEW TO LEARNERS

1 Do you have the ability to perform well in science?
2 Did you spend sufficient effort on your science test preparation?
3 Do you find science interesting?
4 Do you find the science course difficult?
5 Do you think you were lucky to achieve your science results?
6 Did you get help for your science preparation?
7 Did the teaching methods of the teachers contribute to your science results?
8 Do you do practicals in science to increase motivation?
9 Do you expect to succeed in the next test?

Answers to these questions were recorded, transcribed and interpreted.

APPENDIX K INTERVIEW TO TEACHERS

1. Do the learners have the ability to perform well in science?
2. Do learners spend a lot of effort on their science test preparation?
3. Do the learners find science interesting?
4. Do the learners find science difficult?
5. In your opinion as a teacher, do you think the learners were lucky in achieving their science results?
6. Do the learners get help for science preparation?
7. Do you think your teaching methods contribute to the results achieved by your learners?
8. Which practical methods are you using in presenting lessons to motivate learners??
9. What are your expectations of learners' success in the final exams?

Answers to these questions were recorded, transcribed and interpreted.

APPENDIX L INTERVIEW WITH HOD TEACHING SCIENCE

TEACHER RESPONDENT 1

Interview Question	**Transcribed responses**	**Categorized data - Themes: ability, effort, interest, task, luck, help, teaching methods, practical methods, expectations of success (motivation)**
1. Interviewer: Do the learners have the ability to perform well in science?	Respondent: Yes, we have learners who score very good marks. But we also have learners that are struggling and lack ability. In 2011 we had 80% percent pass rate in physical science.'	High achievers have high ability, low achievers lacked ability
2 Interviewer: Do learners spend a lot of effort on their science test preparation?	Respondent: They do. You see most of the learners at our school are very competitive, especially the top learners. So because that they do go all out in preparing for their test and assignments.	Learners put in a lot of effort
3 Interviewer: Do the learners find science interesting?	Respondent: Most of them do enjoy the science courses and they do appreciate it because they will be able to cope when they go to university. And as long as the interest is there then they can cope	Learners are interested in science
4 Interviewer: Do the learners find science	Respondent: they do struggle. The strong learner	High achievers do not find science difficult, low

difficult?	has no problems, but the weak learners struggle. But we give them a lot of practice and work to do.	achievers struggle
5 Interviewer: In your opinion as an teacher, do you think the learners were lucky in achieving their science results?	Respondent: 'I can't say lucky, its' their effort - its' more hard work that let to such wonderful results and such beautiful trophies	Not luck but effort and hard work
6 Interviewer: Do the learners get help for science preparation?	Respondent: When we teach the learner we always work with past question papers. Other teachers don't make time to upgrade their knowledge and they are not confident.	Learners get help from teachers by working through question papers, although teachers are not always well qualified
7 Interviewer: Do you think your teaching methods contribute to the results achieved by your learners?	Respondent: 'I think so yes. You see as a teacher you need to be confident about your subject and the learner also must have trust in you	Made good contribution to performance of learners
8 Interviewer: Which practical methods are you using in presenting lessons to motivate learners?	Respondent: We use experiments, but the time factor is a problem. We do research on the internet as well. Learners need the text books.	Time factor a limiting factor to conduct experiments. Learners do research on internet to encourage motivation
9 Interviewer: What are your expectations of learners' success in the final exams?	Respondent: We expect a lot from this group of learners actually. I hope they won't disappoint us especially in Math and Physical Science because in the preparations exams, they did very well and that was good.	Expect success

TEACHER RESPONDENT 2

Interview Question	Transcribed responses	Categorized data - Themes: ability, effort, interest, task, luck, help, teaching methods, practical methods, expectations of success (motivation)
1. Interviewer: Do the learners have the ability to perform well in science?	Respondent: I would actually say our learners are of mixed ability. We don't have a system, we take learners only from mixed back grounds and even their abilities are also mixed abilities so it is our aim that even those who are weak - to try and push them to at least get a minimum pass in the subject.	Learners' have mixed abilities.
2 Interviewer: Do learners spend a lot of effort on their science test preparation?	Respondent: The only way they spend effort is if a teacher forces it by giving homework which involves that extra reading that's the only way. "Learners will make effort only if pressure is placed on them. We push them to work – they improved drastically".	Only exert effort if pressure is placed on them.
3 Interviewer: Do the learners find science interesting?	Respondent: Yes quite a lot especially when there is experiments involved.	Learners enjoy science, especially the practical part
4 Interviewer: Do the learners find science difficult?	Respondent: Some cannot cope because they find the course difficult. We can now	From grade 11 learners find science difficult

	categorize them and say 'these are very high achievers let them be competitive among themselves and try to get higher grades". Learners begin to find challenges in grade 10 and 11 because more difficult concepts are introduced.	
5 Interviewer: In your opinion as an teacher, do you think the learners were lucky in achieving their science results?	Respondent: luck was not a factor but effort was.	Not luck but effort and hard work
6 Interviewer: Do the learners get help for science preparation?	Respondent: Learners actually came after classes, they would actually come to request for extra lessons and extra classes for help.	Learners get help from teacher s through extra tuition
7 Interviewer: Do you think your teaching methods contribute to the results achieved by your learners?	Respondent: yes our method of teaching include experiments in groups or as individuals. With that you will never go wrong.	Made good contribution through experiments
8 Interviewer: Which practical methods are you using in presenting lessons to motivate learners?	Respondent: We do a lot of experiments and in grade 9 there are mostly demonstrations and here and there they will do individual experiments. They also have to do experiments in groups or as individuals during their normal teaching time. It makes it so interesting. They look for information on the	Uses experiments and internet research to encourage motivation.

	internet. Using Google you would find the difference. It becomes even more interesting and motivating for them	
9 Interviewer: What are your expectations of learners' success in the final exams?	Respondent: We expect success because the learners are divided into low and high achievement groups. The low achievers are encouraged to reach higher performance.	Expect success because the low achievers are encouraged to reach higher performance.

TEACHER RESPONDENT 3

Interview Question	Transcribed responses	Categorized data - Themes: ability, effort, interest, task, luck, help, teaching methods, practical methods, expectations of success (motivation)
1. Interviewer: Do the learners have the ability to perform well in science?	Respondent: I believe that most learners have the ability to pass any subject, but I don't believe that there is a spurge of learning or studying amongst learners today. So ability, yes, everybody has it.	All learners have the ability to do science
2 Interviewer: Do learners spend a lot of effort on their science test preparation?	Respondent: Some of them those who work hard do get the marks, but learners don't work hard - Learners who do well put pressure on themselves and who do more work and put more effort. Although you do get some learners that put a lot of effort in grade 12 just to pass a subject.	Learners do put in a little effort to succeed
3 Interviewer: Do the learners find science interesting?	Respondent: I'm not sure if learners take anything serious but in the end they must pass matric they must pass their grades Because they think if they have math and science then the doors are open to do	Learners show little interest in science only to succeed and to get better jobs.

	anything	
4 Interviewer: Do the learners find science difficult?	Respondent: by grade 11 they drop out of the subject. they find science difficult.	From grade 11 learners begin to find science difficult and drop out
5 Interviewer: In your opinion as an teacher, do you think the learners were lucky in achieving their science results?	Respondent: I don't think luck plays a role. Luck is not the right word. I tell them in the final exam the reward is from hard work. It is more effort than luck.	Not luck but effort and hard work
6 Interviewer: Do the learners get help for science preparation?	Respondent: learners get help through practical teaching methods. Through use of resources.	Learners get help from teacher s and parents through practical methods and resources
7 Interviewer: Do you think your teaching methods contribute to the results achieved by your learners?	Respondent: I don know - you do the best you can. You teach what you can, see and it must work for you. I always think some learners prefer one kind of teaching method and others another kind. So I do hope that the method I use is good for them. There's rarely time for practicals. I do practical work, if time allows and I prefer to do the demonstrations and use textbooks.	Made little contribution through demonstrations and practicals if time allowed
8 Interviewer: Which practical methods are you using in presenting lessons to motivate learners?	Respondent: I do practical but there's rarely time for practicals. The other thing I prefer to do demonstrations,	Teacher does practical demonstrations and internet research to encourage interest and motivation of

	internet research to encourage interest and motivation of learners.	learners.
9 Interviewer: What are your expectations of learners' success in the final exams?	Respondent: Let's speak of grade 12. I always hope that all of them will pass at least. They must just do the best they can ehm - I just hope for the best they can do personally. learners' have negative attitudes to science which leads to lack of motivation.	Expect success but learners' negative attitudes to science leads to lack of motivation.

TEACHER RESPONDENT 4

Interview Question	Transcribed responses	Categorized data - Themes: ability, effort, interest, task, luck, help, teaching methods, practical methods, expectations of success (motivation)
1. Interviewer: Do the learners have the ability to perform well in science?	Respondent: They do have the ability to do science - science is very simple – I could say we live science. We make it interesting - if you are staying on planet earth – anything that you do is science -	Learners have ability
2 Interviewer: Do learners spend a lot of effort on their science test preparation?	Respondent: They worked hard. exerted a lot of effort for science	Learners worked hard and exerted a lot of effort for science
3 Interviewer: Do the learners find science interesting?	Respondent: So there is still that bridge between the primary to the secondary level and we're still working on it. We still having a problem with them not being interested in science. Because some of them – when you have a one to one chat with them – say they were forced to come to this school by their parents. They did not want to go. learners have negative attitudes to science.	Learners are not interested in science

4 Interviewer: Do the learners find science difficult?	Respondent: They always complain that physics much more difficult than chemistry because in chemistry there is lot of theory and physics they do more calculations – and the problem with them is maths – So whenever they see numbers they complain - but I always encourage them that physics is fun – take a formula – as long as they take a formula - In numbers – But it appears that learners find calculations very difficult	High achievers coped well. Some learners found little difficulty in science with calculations and the application part of it.
5 Interviewer: In your opinion as an teacher, do you think the learners were lucky in achieving their science results?	Respondent: They were lucky. They're just lazy – They don't study - they don't care	Learners were lucky
6 Interviewer: Do the learners get help for science preparation?	Respondent: 'Aaii' - I'm not sure – I'm not sure – because we – the last classes that we had – we are always available for consultation – if they encounter some problems, they should come so that we could help them – but up to now we did not have any learner that came	Learners do not come to teachers for assistance
7 Interviewer: Do you think your teaching methods contribute to the results achieved by your learners?	Respondent: Makes contribution through use of demonstrations to help learners to understand the	Made contribution through demonstrations

	text and it encourages the interest and research abilities of learners.	
8 Interviewer: Which practical methods are you using in presenting lessons to motivate learners?	Respondent: We make use of practical demonstrations – laboratory work, DVD'S, presentations on computers and revision to motivate learners.	Teacher made use of resources such as laboratory work, DVD'S, presentations and revision to motivate learners.
9 Interviewer: What are your expectations of learners' success in the final exams?	Respondent: My expectations from learners is to get – there are about 200 learners in grade 10 – so if I can get 70%.	Expect success and is aiming for a 70% pass rate.

TEACHER RESPONDENT 5

Interview Question	**Transcribed responses**	**Categorized data - Themes: ability, effort, interest, task, luck, help, teaching methods, practical methods, expectations of success (motivation)**
1. Interviewer: Do the learners have the ability to perform well in science?	Respondent: I think our learners, do not have ability in terms of interpreting science correctly and in a realistic way".	Learners have little ability
2 Interviewer: Do learners spend a lot of effort on their science test preparation?	Respondent: I don't think so – I don't think science is being taken seriously by kids	Not sufficient effort spent on science
3 Interviewer: Do the learners find science interesting?	Respondent: This is a science school – but the building blocks of our curriculum is not scientific and the effectiveness is not there. they do not have role models to develop interest.	Learners are not interested in science because they do not have role models to encourage interest.
4 Interviewer: Do the learners find science difficult?	Respondent: The perceptions of science as difficult and the application of science is a very big concern. "Their way of approaching it, is a very big concern". You do not see adequate resources in schools. They don't see the significance of Science as a career. They don't get motivation from families.	Learners find application of science difficult. Not sufficient resources are provided. Learners do not see want to follow science as a career. Family members do not motivate learners.

5 Interviewer: In your opinion as an teacher, do you think the learners were lucky in achieving their science results?	Respondent: Not lucky because results were not good	Not lucky because results were not good
6 Interviewer: Do the learners get help for science preparation?	Respondent: Learners get help from teachers during camp and from extra tuition.	Learners get help from teachers through extra tuition
7 Interviewer: Do you think your teaching methods contribute to the results achieved by your learners?	Respondent: Ya - you know teaching methods depend on time. We do not use much of practical because of the time factor'. Dropout rate by grade 12. Poor performance	Teaching methods not contributing because of lack of resources and time
8 Interviewer: Which practical methods are you using in presenting lessons to motivate learners?	We need laboratories as resources in a science school – to contribute to the science results, so I feel very demotivated. I provide extra tuition. Learners don't see the significance of Science as a career – family members do not motivate them. Community do not motivate young Scientists.	Teacher provided extra tuition to motivate learners, however, family or community members should provide motivation. Not sufficient resources in the school. One laboratory not well equipped
9 Interviewer: What are your expectations of learners' success in the final exams?	Respondent: We expect success. We are well committed. We have grown. We target low achievers so that they can become con-fident. This year our target is 80% pass. Our learners can reach that – according to the analysis that we have. We target low achievers so that they can become confident.	Expect success and focus on low achievers to become confident and motivated.

LEARNER RESPONDENT 6 FEMALE

Interview Question	Transcribed responses	Categorized data - Themes: ability, effort, interest, task, luck, help, teaching methods, practical methods, expectations of success (motivation)
1 Interviewer: Do you have the ability to perform well in science?	Respondent: Yes I do think I have the ability to do well.	Ability to do well in science
2 Interviewer: Did you spend sufficient effort on your science test preparation? Do learners spend a lot of effort on their science test preparation?	Respondent: I put in enough effort	Exerted sufficient effort
3 Interviewer: Do you find science interesting?3 Interviewer: Did you spend sufficient effort on your science test preparation?	Respondent: Challenging but interesting but it needs hard work	Found science interesting but challenging and required hard work
4 Interviewer: Do you find the science course difficult?	Respondent: It was fear. It was very complicated. When they gave us the memorandum it was easy but when they give us the question paper, it is complicated	Found difficulty because of fear
5 Interviewer: Do you think you were lucky to achieve your science results?	Respondent: it was not luck because results were good. The teacher also did not expect such good results from us.	Not luck because results were good
6 Interviewer: Did you get help for your science	Respondent: Yes we have camped before the exams and	Learners get help from teacher when they have

preparation?	we got a lot of support from our principal and teachers. Our teachers are not part of the problem, we are the problem	extra tuition or during camp before exams.
7 Interviewer: Did the teaching methods of the teacher contribute to your science results?	Respondent: Yes the teaching methods contribute. We have extra tuition during camps before exams.	Good contribution because of tuition during camps
8 Interviewer: Do you do practicals in science to increase motivation?	Respondent: I am not committed and have a negative attitude and feel I will fail. we feel demotivated. During camps were motivated by the principal and teachers and that helped to motivate us to succeed.	Learner has a negative attitude towards science, and it leads to a lack of motivation. Principal and teachers motivate learners to succeed.
9 Interviewer: Do you expect to succeed in the next test?	Respondent: My performance was not good the in the previous test. I think i did not understand the question papers correctly. In the next test "I think my results will be high compared to the last results"	Expected success in the next test
The male/female respondents answered questions 1 to 9		

LEARNER RESPONDENT 7 FEMALE

Interview Question	Transcribed responses	Categorized data - Themes: ability, effort, interest, task, luck, help, teaching methods, practical methods, expectations of success (motivation)
1 Interviewer: Do you have the ability to perform well in science?	Respondent: Yes I do have ability. The experience that I have this far is being the part of Science EXPO in South Africa. "The EXPO in Johannesburg helped to develop my ability in science".	Developed ability
2 Interviewer: Did you spend sufficient effort on your science test preparation? Do learners spend a lot of effort on their science test preparation?	Respondent: I did not study very hard. I am not satisfied with my results. I could have done better with more effort.	Did not put in sufficient effort
3 Interviewer: Do you find science interesting?3	Respondent: I learnt a lot from the different schools and learners at the EXPO. So science is quite exciting for me	Found science interesting because learners learnt a lot from EXPO
4 Interviewer: Do you find the science course difficult?	Respondent: No, if you work hard it won't be difficult	Not difficulty if sufficient effort made
5 Interviewer: Do you think you were lucky to achieve	Respondent: It's not luck, you have to work hard to get	Not luck but effort and hard

your science results?	better and good marks	work
6 Interviewer: Did you get help for your science preparation?	Respondent help from teachers and learners in class helped a great deal in understanding the course material. and help from DSTV programmes	Learners get help from teacher s and on DSTV learning programmes
7 Interviewer: Did the teaching methods of the teacher contribute to your science results?	Respondent: Yes teaching method did contribute. and DSTV helps also.	Teaching methods contributed and learning programmes.
8 Interviewer: Do you do practicals in science to increase motivation?	Respondent: Practicals and viewing learning programmes on DSTV, we become motivated. I am not satisfied with my past performance "I know I could do better than that".	Practicals and viewing of learning programme increases motivation
9 Interviewer: Do you expect to succeed in the next test?	Respondent: expect success in the test but I the in the previous test. I think i did not understand the question papers correctly. In the next test "I think my results will be high compared to the last results"	Expect success
The male/female respondents answered questions 1 to 9		

LEARNER RESPONDENT 8 MALE

Interview Question	Transcribed responses	Categorized data - Themes: ability, effort, interest, task, luck, help, teaching methods, practical methods, expectations of success (motivation)
1 Interviewer: Do you have the ability to perform well in science?	Respondent: It was due to low ability because of poor results in previous exam.	Low ability in science
2 Interviewer: Did you spend sufficient effort on your science test preparation? Do learners spend a lot of effort on their science test preparation?	Respondent: I think the results were average but they were not really high but I didn't study hard I didn't spent enough effort for preparation of the test	Did not put in sufficient effort Exerted sufficient effort
3 Interviewer: Do you find science interesting?	Respondent: I enjoy the course, but not the complex part. When you get a chance to explore about the environment,	Found science interesting and enjoyed conducting experiments
4 Interviewer: Do you find the science course difficult?	Respondent: I found difficulty with the complex part	Found difficult
5 Interviewer: Do you think you were lucky to achieve your science results?	Respondent: lucky because I passed the science test.	Luck because successful in test
6 Interviewer: Did you get help for your science preparation?	Respondent: the practical part helped us to understand the theory. We required more help with calculations to improve	Learners get help from teachers and practical methods
7 Interviewer: Did the teaching methods of the teacher contribute to your science results?	Respondent: Yes the teaching methods contribute. Teachers gave extra help and extra classes during the	Good contribution because do revision in class and extra tuition

	week and weekends.	
8 Interviewer: Do you do practicals in science to increase motivation?	Respondent: the practical part, viewing learning programmes and working on science problems and solutions with friends helped to motivate us. Teachers were well committed and motivated us to achieve well. They encouraged us to do science.	View learning programmes and work on science problems with friends and it increases motivation levels. Parents did not play a role in motivating learners. Teachers motivated learners to achieve well
9 Interviewer: Do you expect to succeed in the next test?	Respondent: I expect to succeed	Expect success with more effort
The male/female respondents answered questions 1 to 9		

LEARNER RESPONDENT 9 FEMALE

Interview Question	Transcribed responses	Categorized data - Themes: ability, effort, interest, task, luck, help, teaching methods, practical methods, expectations of success (motivation)
1 Interviewer: Do you have the ability to perform well in science?	Respondent: Yes I have the ability to do well in science	Have high ability
2 Interviewer: Did you spend sufficient effort on your science test preparation? Do learners spend a lot of effort on their science test preparation?	Respondent Yes Mam, i spent a lot of effort because science need a lot of time and concentration	Exerted a lot of effort
3 Interviewer: Do you find science interesting?	Respondent Yes Mam, I find it interesting because when I enter the university, it will help	Enjoyed science
4 Interviewer: Do you find the science course difficult?	Respondent: And science is the most difficult subject - especially we at a Science high school – It is the most difficult subject. I find the chemistry is most challenging, It needs a lot of concentration and a lot of time	Science most difficult subject and needs a lot of concentration
5 Interviewer: Do you think you were lucky to achieve your science results?	Respondent: Yes - I was very lucky because most of the learners – they didn't achieve the 50% I have achieved.	Luck because successful while others did not succeed

6 Interviewer: Did you get help for your science preparation?	Respondent: A lot of help - our teachers and our parents help us a lot – our teachers they help us at schools. They give extra tuition before and after school. our teachers are very well committed. The practical part helped us alot	Learners get help through practical methods
7 Interviewer: Did the teaching methods of the teacher contribute to your science results?	Respondent Yes, Mam – it is contributing a lot – Our teacher uses the method of explaining to us more and more about the work so that we can understand better	Good contribution because teacher explained concepts well
8 Interviewer: Do you do practicals in science to increase motivation?	Respondent: Yes. We usually go to the laboratory to do experiments. It helps us a lot to understand the concepts and to become motivated.	Learners use practicals in class and it helps them to become motivated.
9 Interviewer: Do you expect to succeed in the next test?	Respondent: Yes Mam I expect to succeed. That's why I'm taking a lot of time to do Science	Expect success with hard work and motivation
The male/female respondents answered questions 1 to 9		

LEARNER RESPONDENT 10 MALE

Interview Question	Transcribed responses	Categorized data - Themes: ability, effort, interest, task, luck, help, teaching methods, practical methods, expectations of success (motivation)
1 Interviewer: Do you have the ability to perform well in science?	Respondent: Yes I have the ability. I understand the work when it is explained to me. I have a high ability I think I would like to believe that I have a high ability	Ability to do well in science
2 Interviewer: Did you spend sufficient effort on your science test preparation?	Respondent: I spend time with the work. When I get home work - I go home and revise the study.	Spent a lot of effort
3 Interviewer: Do you find science interesting?	Respondent: I enjoy science. This is how I enjoy work and I enjoy informing others about Science because Science is so much fun, so exciting, that's why I enjoy it . I exchange information with other learners and teachers	Found science interesting and exciting
4 Interviewer: Do you find the science course difficult?	Respondent: As time goes on its ok. I find science interesting and not difficult. I do revision after lessons and practice it and ask some questions in class, and to peers, I understand better	Science interesting and not difficult
5 Interviewer: Do you think you were lucky to achieve your science results?	Respondent: no - Luck belongs to those hard workers - I think I worked hard, I know I worked hard - yes - spent like nights and practiced. I worked hard to get the marks –	Not luck but hard work and effort

6 Interviewer: Did you get help for your science preparation?	Respondent: I do get alot of help. If I do not understand I go to my teacher. I go a learner in a higher grade for help if I need it. My family are not like a Science family - My family support my science choice very well	Learners get help from teachers and peer group
7 Interviewer: Did the teaching methods of the teacher contribute to your science results?	Respondent: Teaching methods made a good contribution because the teacher made lessons very understandable she did as much as she could - then she gave us time to go and work. Teacher encourages us to to work independently. A job well done.	Good contribution because the teachers explained very well and encouraged learners to do more research
8 Interviewer: Do you do practicals in science to increase motivation?	Respondent: We do practicals and that makes it much more fun. we become more motivated. It is very exciting because we practising and then see it. It was absolutely fabulous.	Learners use experiments and demonstrations, which helps to increase their motivation.
9 Interviewer: Do you expect to succeed in the next test?	Respondent: I expect success. When I wrote my previous paper I did very well. Paper 2 went better than that, so overall I think I got over 80, I hope.	Expect success
The male/female respondents answered questions 1 to 9		

APPENDIX M SPSS OUTPUT - ATTRIBUTION STATISTICS RELATED TO RESEARCH QUESTION ONE

(a) ABILITY * Percentage of Science Achieved

Crosstab

			Percentage of Science Achieved			Total
			0 to 39	40 to 69	70 to 100	
(a) ABILITY	1	Count	31	31	7	69
		Expected Count	13.6	44.3	11.1	69.0
		% within (a) ABILITY	44.9%	44.9%	10.1%	100.0%
	2	Count	168	422	41	631
		Expected Count	124.8	405.0	101.2	631.0
		% within (a) ABILITY	26.6%	66.9%	6.5%	100.0%
	3	Count	104	486	143	733
		Expected Count	145.0	470.4	117.6	733.0
		% within (a) ABILITY	14.2%	66.3%	19.5%	100.0%
	4	Count	36	161	84	281
		Expected Count	55.6	180.3	45.1	281.0
		% within (a) ABILITY	12.8%	57.3%	29.9%	100.0%
Total		Count	339	1100	275	1714
		Expected Count	339.0	1100.0	275.0	1714.0
		% within (a) ABILITY	19.8%	64.2%	16.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	139.201[a]	6	.000
Likelihood Ratio	138.131	6	.000
Linear-by-Linear Association	111.957	1	.000
N of Valid Cases	1714		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 11.07.

(b) EFFORT * Percentage of Science Achieved

Crosstab

			Percentage of Science Achieved			Total
			0 to 39	40 to 69	70 to 100	
(b) EFFORT	1	Count	32	32	5	69
		Expected Count	13.7	44.3	11.1	69.0
		% within (b) EFFORT	46.4%	46.4%	7.2%	100.0%
	2	Count	163	399	47	609
		Expected Count	120.6	390.9	97.5	609.0
		% within (b) EFFORT	26.8%	65.5%	7.7%	100.0%
	3	Count	115	542	135	792
		Expected Count	156.8	508.3	126.8	792.0
		% within (b) EFFORT	14.5%	68.4%	17.0%	100.0%
	4	Count	30	129	88	247
		Expected Count	48.9	158.5	39.6	247.0
		% within (b) EFFORT	12.1%	52.2%	35.6%	100.0%
Total		Count	340	1102	275	1717
		Expected Count	340.0	1102.0	275.0	1717.0
		% within (b) EFFORT	19.8%	64.2%	16.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	158.635[a]	6	.000
Likelihood Ratio	144.985	6	.000
Linear-by-Linear Association	124.143	1	.000
N of Valid Cases	1717		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 11.05.

(c) INTEREST * Percentage of Science Achieved

Crosstab

			Percentage of Science Achieved			Total
			0 to 39	40 to 69	70 to 100	
(c) INTEREST	1	Count	44	67	4	115
		Expected Count	22.8	73.8	18.4	115.0
		% within (c) INTEREST	38.3%	58.3%	3.5%	100.0%
	2	Count	110	284	41	435
		Expected Count	86.3	279.1	69.6	435.0
		% within (c) INTEREST	25.3%	65.3%	9.4%	100.0%
	3	Count	151	495	117	763
		Expected Count	151.4	489.6	122.1	763.0
		% within (c) INTEREST	19.8%	64.9%	15.3%	100.0%
	4	Count	36	257	113	406
		Expected Count	80.5	260.5	65.0	406.0
		% within (c) INTEREST	8.9%	63.3%	27.8%	100.0%
Total		Count	341	1103	275	1719
		Expected Count	341.0	1103.0	275.0	1719.0
		% within (c) INTEREST	19.8%	64.2%	16.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	110.409[a]	6	.000
Likelihood Ratio	113.007	6	.000
Linear-by-Linear Association	103.589	1	.000
N of Valid Cases	1719		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 18.40.

(d) TASK * Percentage of Science Achieved

Crosstab

			Percentage of Science Achieved			Total
			0 to 39	40 to 69	70 to 100	
(d) TASK	1	Count	17	58	41	116
		Expected Count	23.0	74.4	18.5	116.0
		% within (d) TASK	14.7%	50.0%	35.3%	100.0%
	2	Count	161	603	167	931
		Expected Count	184.7	597.5	148.8	931.0
		% within (d) TASK	17.3%	64.8%	17.9%	100.0%
	3	Count	92	341	46	479
		Expected Count	95.0	307.4	76.6	479.0
		% within (d) TASK	19.2%	71.2%	9.6%	100.0%
	4	Count	70	98	20	188
		Expected Count	37.3	120.7	30.1	188.0
		% within (d) TASK	37.2%	52.1%	10.6%	100.0%
Total		Count	340	1100	274	1714
		Expected Count	340.0	1100.0	274.0	1714.0
		% within (d) TASK	19.8%	64.2%	16.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	89.977[a]	6	.000
Likelihood Ratio	80.181	6	.000
Linear-by-Linear Association	54.578	1	.000
N of Valid Cases	1714		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 18.54.

(e) LUCK * Percentage of Science Achieved

Crosstab

			Percentage of Science Achieved			Total
			0 to 39	40 to 69	70 to 100	
(e) LUCK	1	Count	137	331	88	556
		Expected Count	110.2	356.9	88.8	556.0
		% within (e) LUCK	24.6%	59.5%	15.8%	100.0%
	2	Count	144	474	102	720
		Expected Count	142.7	462.2	115.0	720.0
		% within (e) LUCK	20.0%	65.8%	14.2%	100.0%
	3	Count	40	223	47	310
		Expected Count	61.5	199.0	49.5	310.0
		% within (e) LUCK	12.9%	71.9%	15.2%	100.0%
	4	Count	19	73	37	129
		Expected Count	25.6	82.8	20.6	129.0
		% within (e) LUCK	14.7%	56.6%	28.7%	100.0%
Total		Count	340	1101	274	1715
		Expected Count	340.0	1101.0	274.0	1715.0
		% within (e) LUCK	19.8%	64.2%	16.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	36.583[a]	6	.000
Likelihood Ratio	34.877	6	.000
Linear-by-Linear Association	17.341	1	.000
N of Valid Cases	1715		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 20.61.

(f) HELP * Percentage of Science Achieved

Crosstab

			Percentage of Science Achieved			Total
			0 to 39	40 to 69	70 to 100	
(f) HELP	1	Count	162	463	99	724
		Expected Count	143.5	465.2	115.2	724.0
		% within (f) HELP	22.4%	64.0%	13.7%	100.0%
	2	Count	115	399	99	613
		Expected Count	121.5	393.9	97.6	613.0
		% within (f) HELP	18.8%	65.1%	16.2%	100.0%
	3	Count	52	186	45	283
		Expected Count	56.1	181.8	45.0	283.0
		% within (f) HELP	18.4%	65.7%	15.9%	100.0%
	4	Count	11	54	30	95
		Expected Count	18.8	61.0	15.1	95.0
		% within (f) HELP	11.6%	56.8%	31.6%	100.0%
Total		Count	340	1102	273	1715
		Expected Count	340.0	1102.0	273.0	1715.0
		% within (f) HELP	19.8%	64.3%	15.9%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	24.218[a]	6	.000
Likelihood Ratio	21.572	6	.001
Linear-by-Linear Association	14.742	1	.000
N of Valid Cases	1715		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 15.12.

(g) TEACHING METHODS * Percentage of Science Achieved

Crosstab

			Percentage of Science Achieved		
			0 to 39	40 to 69	70 to 100
(g) TEACHING METHODS	1	Count	70	112	17
		Expected Count	39.6	127.6	31.8
		% within (g) TEACHING METHODS	35.2%	56.3%	8.5%
	2	Count	142	386	78
		Expected Count	120.6	388.6	96.9
		% within (g) TEACHING METHODS	23.4%	63.7%	12.9%
	3	Count	87	378	83
		Expected Count	109.0	351.4	87.6
		% within (g) TEACHING METHODS	15.9%	69.0%	15.1%
	4	Count	42	223	96
		Expected Count	71.8	231.5	57.7
		% within (g) TEACHING METHODS	11.6%	61.8%	26.6%
Total		Count	341	1099	274
		Expected Count	341.0	1099.0	274.0
		% within (g) TEACHING METHODS	19.9%	64.1%	16.0%

Crosstab

			Total
(g) TEACHING METHODS	1	Count	199
		Expected Count	199.0
		% within (g) TEACHING METHODS	100.0%
	2	Count	606
		Expected Count	606.0
		% within (g) TEACHING METHODS	100.0%
	3	Count	548
		Expected Count	548.0
		% within (g) TEACHING METHODS	100.0%
	4	Count	361
		Expected Count	361.0
		% within (g) TEACHING METHODS	100.0%
Total		Count	1714
		Expected Count	1714.0
		% within (g) TEACHING METHODS	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	84.473[a]	6	.000
Likelihood Ratio	79.859	6	.000
Linear-by-Linear Association	72.694	1	.000
N of Valid Cases	1714		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 31.81.

APPENDIX N SPSS OUTPUT – ACHIEVEMENT MOTIVATION STATISTICS RELATED TO RESEARCH QUESTION 2

Achievement Motivation Score * Percentage of Science Achieved Cross tabulation

			Percentage of Science Achieved		
			0 to 39	40 to 69	70 to 100
Achievement Motivation Score	Low	Count	19	46	8
		Expected Count	14.5	46.9	11.6
		% within Achievement Motivation Score	26.0%	63.0%	11.0%
	Medium	Count	226	641	151
		Expected Count	202.4	654.2	161.4
		% within Achievement Motivation Score	22.2%	63.0%	14.8%
	High	Count	100	428	116
		Expected Count	128.1	413.9	102.1
		% within Achievement Motivation Score	15.5%	66.5%	18.0%
Total		Count	345	1115	275
		Expected Count	345.0	1115.0	275.0
		% within Achievement Motivation Score	19.9%	64.3%	15.9%

Achievement Motivation Score * Percentage of Science Achieved Cross tabulation

			Total
Achievement Motivation Score	Low	Count	73
		Expected Count	73.0
		% within Achievement Motivation Score	100.0%
	Medium	Count	1018
		Expected Count	1018.0
		% within Achievement Motivation Score	100.0%
	High	Count	644
		Expected Count	644.0
		% within Achievement Motivation Score	100.0%
Total		Count	1735
		Expected Count	1735.0
		% within Achievement Motivation Score	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	14.711[a]	4	.005
Likelihood Ratio	15.058	4	.005
Linear-by-Linear Association	13.296	1	.000
N of Valid Cases	1735		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 11.57.

APPENDIX O SPSS OUTPUT – GENDER STATISTICS RELATED TO RESEARCH QUESTION 3

1. Gender * Percentage of Science Achieved

Crosstab

			Percentage of Science Achieved			Total
			0 to 39	40 to 69	70 to 100	
1. Gender	Male	Count	182	582	141	905
		Expected Count	180.6	582.6	141.8	905.0
		% within 1. Gender	20.1%	64.3%	15.6%	100.0%
	Female	Count	163	531	130	824
		Expected Count	164.4	530.4	129.2	824.0
		% within 1. Gender	19.8%	64.4%	15.8%	100.0%
Total		Count	345	1113	271	1729
		Expected Count	345.0	1113.0	271.0	1729.0
		% within 1. Gender	20.0%	64.4%	15.7%	100.0%

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.035[a]	2	.983
Likelihood Ratio	.035	2	.983
Linear-by-Linear Association	.034	1	.855
N of Valid Cases	1729		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 129.15.

2. Grade * Percentage of Science Achieved

Crosstab

			Percentage of Science Achieved			Total
			0 to 39	40 to 69	70 to 100	
2. Grade	Grade 10	Count	153	473	86	712
		Expected Count	141.6	457.6	112.9	712.0
		% within 2. Grade	21.5%	66.4%	12.1%	100.0%
	Grade 11	Count	98	372	85	555
		Expected Count	110.4	356.7	88.0	555.0
		% within 2. Grade	17.7%	67.0%	15.3%	100.0%
	Grade 12	Count	94	270	104	468
		Expected Count	93.1	300.8	74.2	468.0
		% within 2. Grade	20.1%	57.7%	22.2%	100.0%
Total		Count	345	1115	275	1735
		Expected Count	345.0	1115.0	275.0	1735.0
		% within 2. Grade	19.9%	64.3%	15.9%	100.0%

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	25.119[a]	4	.000
Likelihood Ratio	24.481	4	.000
Linear-by-Linear Association	11.060	1	.001
N of Valid Cases	1735		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 74.18.

Crosstab

			Percentage of Science Achieved		
			0 to 39	40 to 69	70 to 100
3. Home Language	English	Count	22	79	35
		Expected Count	27.2	87.4	21.4
		% within 3. Home Language	16.2%	58.1%	25.7%
	Afrikaans	Count	10	23	6
		Expected Count	7.8	25.1	6.1
		% within 3. Home Language	25.6%	59.0%	15.4%
	Setswana	Count	294	923	204
		Expected Count	284.2	913.4	223.4
		% within 3. Home Language	20.7%	65.0%	14.4%
	OTHER	Count	15	71	23
		Expected Count	21.8	70.1	17.1
		% within 3. Home Language	13.8%	65.1%	21.1%
Total		Count	341	1096	268
		Expected Count	341.0	1096.0	268.0
		% within 3. Home Language	20.0%	64.3%	15.7%

Crosstab

			Total
3. Home Language	English	Count	136
		Expected Count	136.0
		% within 3. Home Language	100.0%
	Afrikaans	Count	39
		Expected Count	39.0
		% within 3. Home Language	100.0%
	Setswana	Count	1421
		Expected Count	1421.0
		% within 3. Home Language	100.0%
	OTHER	Count	109
		Expected Count	109.0
		% within 3. Home Language	100.0%
Total		Count	1705
		Expected Count	1705.0
		% within 3. Home Language	100.0%

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	17.540[a]	6	.007
Likelihood Ratio	16.289	6	.012
Linear-by-Linear Association	2.159	1	.142
N of Valid Cases	1705		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 6.13.

APPENDIX P SPSS OUTPUT – SOCIO-ECONOMIC STATUS STATISTICS RELATED TO RESEARCH QUESTION 4

7. Does the school have laboratories for learning Science * Percentage of Science Achieved

Crosstab

			Percentage of Science Achieved		
			0 to 39	40 to 69	70 to 100
7. Does the school have laboratories for learning Science	Yes	Count	213	670	204
		Expected Count	215.7	698.1	173.1
		% within 7. Does the school have laboratories for learning Science	19.6%	61.6%	18.8%
	No	Count	126	427	68
		Expected Count	123.3	398.9	98.9
		% within 7. Does the school have laboratories for learning Science	20.3%	68.8%	11.0%
Total		Count	339	1097	272
		Expected Count	339.0	1097.0	272.0
		% within 7. Does the school have laboratories for learning Science	19.8%	64.2%	15.9%

Crosstab

			Total
7. Does the school have laboratories for learning Science	Yes	Count	1087
		Expected Count	1087.0
		% within 7. Does the school have laboratories for learning Science	100.0%
	No	Count	621
		Expected Count	621.0
		% within 7. Does the school have laboratories for learning Science	100.0%
Total		Count	1708
		Expected Count	1708.0
		% within 7. Does the school have laboratories for learning Science	100.0%

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	18.383[a]	2	.000
Likelihood Ratio	19.251	2	.000
Linear-by-Linear Association	8.034	1	.005
N of Valid Cases	1708		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 98.89.

1. Number of bedrooms in my house except living or other rooms * Percentage of Science Achieved

Crosstab

			Percentage of Science Achieved		
			0 to 39	40 to 69	70 to 100
1. Number of bedrooms in my house except living or other rooms	1	Count	23	51	2
		Expected Count	14.9	49.0	12.1
		% within 1. Number of bedrooms in my house except living or other rooms	30.3%	67.1%	2.6%
	2	Count	80	230	36
		Expected Count	68.0	223.0	55.0
		% within 1. Number of bedrooms in my house except living or other rooms	23.1%	66.5%	10.4%
	3	Count	122	382	84
		Expected Count	115.6	378.9	93.5
		% within 1. Number of bedrooms in my house except living or other rooms	20.7%	65.0%	14.3%
	4	Count	67	244	69
		Expected Count	74.7	244.9	60.4
		% within 1. Number of bedrooms in my house except living or other rooms	17.6%	64.2%	18.2%
	5 or more	Count	47	204	83
		Expected Count	65.7	215.2	53.1
		% within 1. Number of bedrooms in my house except living or other rooms	14.1%	61.1%	24.9%
Total		Count	339	1111	274
		Expected Count	339.0	1111.0	274.0
		% within 1. Number of bedrooms in my house except living or other rooms	19.7%	64.4%	15.9%

Crosstab

			Total
1. Number of bedrooms in my house except living or other rooms	1	Count	76
		Expected Count	76.0
		% within 1. Number of bedrooms in my house except living or other rooms	100.0%
	2	Count	346
		Expected Count	346.0
		% within 1. Number of bedrooms in my house except living or other rooms	100.0%
	3	Count	588
		Expected Count	588.0
		% within 1. Number of bedrooms in my house except living or other rooms	100.0%
	4	Count	380
		Expected Count	380.0
		% within 1. Number of bedrooms in my house except living or other rooms	100.0%
	5 or more	Count	334
		Expected Count	334.0
		% within 1. Number of bedrooms in my house except living or other rooms	100.0%
Total		Count	1724
		Expected Count	1724.0
		% within 1. Number of bedrooms in my house except living or other rooms	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	47.838[a]	8	.000
Likelihood Ratio	50.683	8	.000
Linear-by-Linear Association	42.083	1	.000
N of Valid Cases	1724		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 12.08.

4. What is the occupation of the breadwinner in your home * Percentage of Science Achieved

Crosstab

			Percentage of Science Achieved		
			0 to 39	40 to 69	70 to 100
4. What is the occupation of the breadwinner in your home	Agriculture	Count	27	79	27
		Expected Count	26.3	85.4	21.3
		% within 4. What is the occupation of the breadwinner in your home	20.3%	59.4%	20.3%
	Education	Count	37	212	68
		Expected Count	62.8	203.6	50.7
		% within 4. What is the occupation of the breadwinner in your home	11.7%	66.9%	21.5%
	Business	Count	51	164	57
		Expected Count	53.9	174.7	43.5
		% within 4. What is the occupation of the breadwinner in your home	18.8%	60.3%	21.0%
	Mining	Count	32	133	32
		Expected Count	39.0	126.5	31.5
		% within 4. What is the occupation of the breadwinner in your home	16.2%	67.5%	16.2%
	Labourer	Count	33	83	20
		Expected Count	26.9	87.3	21.7
		% within 4. What is the occupation of the breadwinner in your home	24.3%	61.0%	14.7%
	other & specify	Count	88	288	52
		Expected Count	84.7	274.9	68.4
		% within 4. What is the occupation of the breadwinner in your home	20.6%	67.3%	12.1%
	Not employed	Count	69	134	16

Crosstab

			Total
4. What is the occupation of the breadwinner in your home	Agriculture	Count	133
		Expected Count	133.0
		% within 4. What is the occupation of the breadwinner in your home	100.0%
	Education	Count	317
		Expected Count	317.0
		% within 4. What is the occupation of the breadwinner in your home	100.0%
	Business	Count	272
		Expected Count	272.0
		% within 4. What is the occupation of the breadwinner in your home	100.0%
	Mining	Count	197
		Expected Count	197.0
		% within 4. What is the occupation of the breadwinner in your home	100.0%
	Labourer	Count	136
		Expected Count	136.0
		% within 4. What is the occupation of the breadwinner in your home	100.0%
	other & specify	Count	428
		Expected Count	428.0
		% within 4. What is the occupation of the breadwinner in your home	100.0%
	Not employed	Count	219

Crosstab

			Percentage of Science Achieved		
			0 to 39	40 to 69	70 to 100
4. What is the occupation of the breadwinner in your home	Not employed	Expected Count	43.4	140.6	35.0
		% within 4. What is the occupation of the breadwinner in your home	31.5%	61.2%	7.3%
Total		Count	337	1093	272
		Expected Count	337.0	1093.0	272.0
		% within 4. What is the occupation of the breadwinner in your home	19.8%	64.2%	16.0%

Crosstab

			Total
4. What is the occupation of the breadwinner in your home	Not employed	Expected Count	219.0
		% within 4. What is the occupation of the breadwinner in your home	100.0%
Total		Count	1702
		Expected Count	1702.0
		% within 4. What is the occupation of the breadwinner in your home	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	57.721[a]	12	.000
Likelihood Ratio	59.159	12	.000
Linear-by-Linear Association	38.618	1	.000
N of Valid Cases	1702		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 21.25.

5. What is the income per month of the breadwinner in your home * Percentage of Science Achieved

Crosstab

			Percentage of Science Achieved	
			0 to 39	40 to 69
5. What is the income per month of the breadwinner in your home	Below <R1,000	Count	115	297
		Expected Count	88.8	286.8
		% within 5. What is the income per month of the breadwinner in your home	25.7%	66.3%
	R1,000 - R5,000	Count	85	311
		Expected Count	90.6	292.5
		% within 5. What is the income per month of the breadwinner in your home	18.6%	68.1%
	R6,000 - R10,000	Count	68	218
		Expected Count	66.4	214.4
		% within 5. What is the income per month of the breadwinner in your home	20.3%	65.1%
	R10,000 above>	Count	53	211
		Expected Count	75.3	243.2
		% within 5. What is the income per month of the breadwinner in your home	13.9%	55.5%
Total		Count	321	1037
		Expected Count	321.0	1037.0
		% within 5. What is the income per month of the breadwinner in your home	19.8%	64.0%

Crosstab

			Percentage of Science Achieved	Total
			70 to 100	
5. What is the income per month of the breadwinner in your home	Below <R1,000	Count	36	448
		Expected Count	72.5	448.0
		% within 5. What is the income per month of the breadwinner in your home	8.0%	100.0%
	R1,000 - R5,000	Count	61	457
		Expected Count	73.9	457.0
		% within 5. What is the income per month of the breadwinner in your home	13.3%	100.0%
	R6,000 - R10,000	Count	49	335
		Expected Count	54.2	335.0
		% within 5. What is the income per month of the breadwinner in your home	14.6%	100.0%
	R10,000 above>	Count	116	380
		Expected Count	61.5	380.0
		% within 5. What is the income per month of the breadwinner in your home	30.5%	100.0%
Total		Count	262	1620
		Expected Count	262.0	1620.0
		% within 5. What is the income per month of the breadwinner in your home	16.2%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	90.095[a]	6	.000
Likelihood Ratio	84.633	6	.000
Linear-by-Linear Association	59.869	1	.000
N of Valid Cases	1620		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 54.18.

6. What is the highest level of education the breadwinner in your family has completed * Percentage of Science Achieved

Crosstab

			Percentage of Science Achieved	
			0 to 39	40 to 69
6. What is the highest level of education the breadwinner in your family has completed	Degree	Count	101	423
		Expected Count	136.4	441.5
		% within 6. What is the highest level of education the breadwinner in your family has completed	14.7%	61.5%
	Matriculated	Count	107	363
		Expected Count	106.5	344.6
		% within 6. What is the highest level of education the breadwinner in your family has completed	19.9%	67.6%
	Grade 8+	Count	68	163
		Expected Count	50.4	163.0
		% within 6. What is the highest level of education the breadwinner in your family has completed	26.8%	64.2%
	Below Grade 8	Count	61	142
		Expected Count	43.8	141.8
		% within 6. What is the highest level of education the breadwinner in your family has completed	27.6%	64.3%
Total		Count	337	1091
		Expected Count	337.0	1091.0
		% within 6. What is the highest level of education the breadwinner in your family has completed	19.8%	64.2%

Crosstab

			Percentage of Science Achieved 70 to 100	Total
6. What is the highest level of education the breadwinner in your family has completed	Degree	Count	164	688
		Expected Count	110.1	688.0
		% within 6. What is the highest level of education the breadwinner in your family has completed	23.8%	100.0%
	Matriculated	Count	67	537
		Expected Count	85.9	537.0
		% within 6. What is the highest level of education the breadwinner in your family has completed	12.5%	100.0%
	Grade 8+	Count	23	254
		Expected Count	40.6	254.0
		% within 6. What is the highest level of education the breadwinner in your family has completed	9.1%	100.0%
	Below Grade 8	Count	18	221
		Expected Count	35.4	221.0
		% within 6. What is the highest level of education the breadwinner in your family has completed	8.1%	100.0%
Total		Count	272	1700
		Expected Count	272.0	1700.0
		% within 6. What is the highest level of education the breadwinner in your family has completed	16.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	70.629[a]	6	.000
Likelihood Ratio	70.361	6	.000
Linear-by-Linear Association	57.556	1	.000
N of Valid Cases	1700		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 35.36.

7. Do you have television in your home * Percentage of Science Achieved

Crosstab

			Percentage of Science Achieved		
			0 to 39	40 to 69	70 to 100
7. Do you have television in your home	Yes	Count	321	1044	269
		Expected Count	326.0	1048.3	259.7
		% within 7. Do you have television in your home	19.6%	63.9%	16.5%
	No	Count	23	62	5
		Expected Count	18.0	57.7	14.3
		% within 7. Do you have television in your home	25.6%	68.9%	5.6%
Total		Count	344	1106	274
		Expected Count	344.0	1106.0	274.0
		% within 7. Do you have television in your home	20.0%	64.2%	15.9%

Crosstab

			Total
7. Do you have television in your home	Yes	Count	1634
		Expected Count	1634.0
		% within 7. Do you have television in your home	100.0%
	No	Count	90
		Expected Count	90.0
		% within 7. Do you have television in your home	100.0%
Total		Count	1724
		Expected Count	1724.0
		% within 7. Do you have television in your home	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.210[a]	2	.016
Likelihood Ratio	10.128	2	.006
Linear-by-Linear Association	6.757	1	.009
N of Valid Cases	1724		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 14.30.

Crosstab

			Total
10. Do you have a community library in your area:	Yes	Count	635
		Expected Count	635.0
		% within 10. Do you have a community library in your area:	100.0%
	No	Count	1077
		Expected Count	1077.0
		% within 10. Do you have a community library in your area:	100.0%
Total		Count	1712
		Expected Count	1712.0
		% within 10. Do you have a community library in your area:	100.0%

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5.608[a]	2	.061
Likelihood Ratio	5.517	2	.063
Linear-by-Linear Association	3.217	1	.073
N of Valid Cases	1712		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 99.78.

APPENDIX Q ANOVA RESULTS FOR ATTRIBUTIONS RELATIVE TO ACHIEVEMENT IN SCIENCE

(a) ABILITY (b) EFFORT (c) INTEREST (d) TASK (e) LUCK (f) HELP (g) TEACHING METHODS * 5. Percentage achieved on Science Test

Report

5. Percentage achieved on Science Test		(a) ABILITY	(b) EFFORT	(c) INTEREST	(d) TASK
00- 29	Mean	2.44	2.26	2.28	2.92
	N	86	87	87	87
	Std. Deviation	.989	.933	.996	.967
29-39	Mean	2.42	2.47	2.61	2.53
	N	253	253	254	253
	Std. Deviation	.729	.716	.776	.804
39-49	Mean	2.46	2.46	2.67	2.45
	N	393	392	395	395
	Std. Deviation	.703	.689	.864	.750
49-59	Mean	2.76	2.72	2.89	2.48
	N	414	416	414	412
	Std. Deviation	.749	.687	.829	.723
59-69	Mean	2.97	2.98	3.05	2.35
	N	293	294	294	293
	Std. Deviation	.694	.663	.786	.699
69-79	Mean	3.08	3.07	3.22	2.19
	N	214	214	214	213
	Std. Deviation	.700	.715	.721	.715
80-100	Mean	3.18	3.25	3.28	2.08
	N	61	61	61	61
	Std. Deviation	.866	.830	.859	.918
Total	Mean	2.72	2.71	2.85	2.43
	N	1714	1717	1719	1714
	Std. Deviation	.783	.758	.857	.775

Report

5. Percentage achieved on Science Test		(e) LUCK	(f) HELP	(g) TEACHING METHODS
00- 29	Mean	1.54	1.57	2.15
	N	87	87	87
	Std. Deviation	.696	.757	1.040
29-39	Mean	1.92	1.80	2.35
	N	253	253	254
	Std. Deviation	.872	.852	.888
39-49	Mean	1.98	1.78	2.47
	N	394	392	391
	Std. Deviation	.842	.832	.894
49-59	Mean	2.06	1.81	2.68
	N	414	415	413
	Std. Deviation	.875	.825	.916
59-69	Mean	2.06	1.98	2.83
	N	293	295	295
	Std. Deviation	.921	.974	.905
69-79	Mean	2.13	2.04	2.92
	N	213	212	213
	Std. Deviation	.952	.940	.892
80-100	Mean	2.08	1.95	3.00
	N	61	61	61
	Std. Deviation	1.201	1.132	1.095
Total	Mean	2.01	1.85	2.62
	N	1715	1715	1714
	Std. Deviation	.898	.888	.943

ANOVA Table

			Sum of Squares	df	Mean Square
(a) ABILITY * 5. Percentage achieved on Science Test	Between Groups	(Combined)	116.561	6	19.427
	Within Groups		932.498	1707	.546
	Total		1049.060	1713	
(b) EFFORT * 5. Percentage achieved on Science Test	Between Groups	(Combined)	121.852	6	20.309
	Within Groups		864.545	1710	.506
	Total		986.397	1716	
(c) INTEREST * 5. Percentage achieved on Science Test	Between Groups	(Combined)	110.118	6	18.353
	Within Groups		1151.859	1712	.673
	Total		1261.977	1718	
(d) TASK * 5. Percentage achieved on Science Test	Between Groups	(Combined)	46.473	6	7.745
	Within Groups		981.903	1707	.575
	Total		1028.376	1713	
(e) LUCK * 5. Percentage achieved on Science Test	Between Groups	(Combined)	26.814	6	4.469
	Within Groups		1355.102	1708	.793
	Total		1381.916	1714	
(f) HELP * 5. Percentage achieved on Science Test	Between Groups	(Combined)	23.365	6	3.894
	Within Groups		1326.900	1708	.777
	Total		1350.265	1714	
(g) TEACHING METHODS * 5. Percentage achieved on Science Test	Between Groups	(Combined)	90.274	6	15.046
	Within Groups		1431.508	1707	.839
	Total		1521.781	1713	

ANOVA Table

			F	Sig.
(a) ABILITY * 5. Percentage achieved on Science Test	Between Groups	(Combined)	35.562	.000
	Within Groups			
	Total			
(b) EFFORT * 5. Percentage achieved on Science Test	Between Groups	(Combined)	40.169	.000
	Within Groups			
	Total			
(c) INTEREST * 5. Percentage achieved on Science Test	Between Groups	(Combined)	27.278	.000
	Within Groups			
	Total			
(d) TASK * 5. Percentage achieved on Science Test	Between Groups	(Combined)	13.465	.000
	Within Groups			
	Total			
(e) LUCK * 5. Percentage achieved on Science Test	Between Groups	(Combined)	5.633	.000
	Within Groups			
	Total			
(f) HELP * 5. Percentage achieved on Science Test	Between Groups	(Combined)	5.013	.000
	Within Groups			
	Total			
(g) TEACHING METHODS * 5. Percentage achieved on Science Test	Between Groups	(Combined)	17.941	.000
	Within Groups			
	Total			

APPENDIX R ANOVA RESULTS OF ATTRIBUTIONS RELATIVE TO ACHIEVEMENT MOTIVATION

Report

Achievement Motivation Score		(a) ABILITY	(b) EFFORT	(c) INTEREST	(d) TASK	(e) LUCK
Low	Mean	2.59	2.49	2.50	2.64	2.09
	N	69	68	68	67	67
	Std. Deviation	.734	.702	.702	.792	.866
Medium	Mean	2.66	2.63	2.69	2.50	2.01
	N	1020	1026	1027	1026	1024
	Std. Deviation	.815	.772	.879	.793	.875
High	Mean	2.82	2.86	3.15	2.28	1.99
	N	655	654	655	654	657
	Std. Deviation	.727	.723	.753	.714	.931
Total	Mean	2.71	2.71	2.85	2.43	2.00
	N	1744	1748	1750	1747	1748
	Std. Deviation	.784	.760	.859	.772	.896

Report

Achievement Motivation Score		(f) HELP	(g) TEACHING METHODS
Low	Mean	1.87	2.42
	N	67	66
	Std. Deviation	.886	.805
Medium	Mean	1.94	2.49
	N	1023	1027
	Std. Deviation	.901	.928
High	Mean	1.71	2.86
	N	656	651
	Std. Deviation	.851	.936
Total	Mean	1.85	2.63
	N	1746	1744
	Std. Deviation	.888	.943

ANOVA Table

			Sum of Squares	df	Mean Square
(a) ABILITY * Achievement Motivation Score	Between Groups	(Combined)	11.357	2	5.678
	Within Groups		1058.868	1741	.608
	Total		1070.224	1743	
(b) EFFORT * Achievement Motivation Score	Between Groups	(Combined)	24.346	2	12.173
	Within Groups		986.020	1745	.565
	Total		1010.366	1747	
(c) INTEREST * Achievement Motivation Score	Between Groups	(Combined)	92.482	2	46.241
	Within Groups		1196.889	1747	.685
	Total		1289.371	1749	
(d) TASK * Achievement Motivation Score	Between Groups	(Combined)	22.434	2	11.217
	Within Groups		1018.567	1744	.584
	Total		1041.002	1746	
(e) LUCK * Achievement Motivation Score	Between Groups	(Combined)	.639	2	.320
	Within Groups		1401.340	1745	.803
	Total		1401.979	1747	
(f) HELP * Achievement Motivation Score	Between Groups	(Combined)	20.955	2	10.477
	Within Groups		1355.510	1743	.778
	Total		1376.465	1745	
(g) TEACHING METHODS * Achievement Motivation Score	Between Groups	(Combined)	55.645	2	27.823
	Within Groups		1493.840	1741	.858
	Total		1549.486	1743	

ANOVA Table

			F	Sig.
(a) ABILITY * Achievement Motivation Score	Between Groups	(Combined)	9.336	.000
	Within Groups			
	Total			
(b) EFFORT * Achievement Motivation Score	Between Groups	(Combined)	21.543	.000
	Within Groups			
	Total			
(c) INTEREST * Achievement Motivation Score	Between Groups	(Combined)	67.494	.000
	Within Groups			
	Total			
(d) TASK * Achievement Motivation Score	Between Groups	(Combined)	19.206	.000
	Within Groups			
	Total			
(e) LUCK * Achievement Motivation Score	Between Groups	(Combined)	.398	.672
	Within Groups			
	Total			
(f) HELP * Achievement Motivation Score	Between Groups	(Combined)	13.472	.000
	Within Groups			
	Total			
(g) TEACHING METHODS * Achievement Motivation Score	Between Groups	(Combined)	32.426	.000
	Within Groups			
	Total			

APPENDIX S ANOVA RESULTS FOR ATTRIBUTIONS RELATIVE TO GENDER

(a) ABILITY (b) EFFORT (c) INTEREST (d) TASK (e) LUCK (f) HELP (g) TEACHING METHODS * 1. Gender

Report

1. Gender		(a) ABILITY	(b) EFFORT	(c) INTEREST	(d) TASK	(e) LUCK	(f) HELP
Male	Mean	2.67	2.65	2.85	2.44	1.96	1.80
	N	908	908	910	911	910	908
	Std. Deviation	.783	.747	.839	.795	.876	.887
Female	Mean	2.76	2.77	2.85	2.40	2.06	1.91
	N	830	834	834	830	832	832
	Std. Deviation	.779	.768	.879	.747	.912	.882
Total	Mean	2.71	2.71	2.85	2.43	2.00	1.85
	N	1738	1742	1744	1741	1742	1740
	Std. Deviation	.782	.760	.858	.772	.895	.886

Report

1. Gender		(g) TEACHING METHODS
Male	Mean	2.58
	N	906
	Std. Deviation	.948
Female	Mean	2.68
	N	832
	Std. Deviation	.936
Total	Mean	2.63
	N	1738
	Std. Deviation	.943

ANOVA Table

			Sum of Squares	df	Mean Square
(a) ABILITY * 1. Gender	Between Groups	(Combined)	3.738	1	3.738
	Within Groups		1058.843	1736	.610
	Total		1062.581	1737	
(b) EFFORT * 1. Gender	Between Groups	(Combined)	7.257	1	7.257
	Within Groups		997.432	1740	.573
	Total		1004.689	1741	
(c) INTEREST * 1. Gender	Between Groups	(Combined)	.003	1	.003
	Within Groups		1284.533	1742	.737
	Total		1284.536	1743	
(d) TASK * 1. Gender	Between Groups	(Combined)	.649	1	.649
	Within Groups		1036.819	1739	.596
	Total		1037.468	1740	
(e) LUCK * 1. Gender	Between Groups	(Combined)	4.281	1	4.281
	Within Groups		1389.698	1740	.799
	Total		1393.979	1741	
(f) HELP * 1. Gender	Between Groups	(Combined)	5.158	1	5.158
	Within Groups		1359.992	1738	.783
	Total		1365.149	1739	
(g) TEACHING METHODS * 1. Gender	Between Groups	(Combined)	4.595	1	4.595
	Within Groups		1540.561	1736	.887
	Total		1545.156	1737	

ANOVA Table

			F	Sig.
(a) ABILITY * 1. Gender	Between Groups	(Combined)	6.128	.013
	Within Groups			
	Total			
(b) EFFORT * 1. Gender	Between Groups	(Combined)	12.660	.000
	Within Groups			
	Total			
(c) INTEREST * 1. Gender	Between Groups	(Combined)	.004	.949
	Within Groups			
	Total			
(d) TASK * 1. Gender	Between Groups	(Combined)	1.088	.297
	Within Groups			
	Total			
(e) LUCK * 1. Gender	Between Groups	(Combined)	5.360	.021
	Within Groups			
	Total			
(f) HELP * 1. Gender	Between Groups	(Combined)	6.591	.010
	Within Groups			
	Total			
(g) TEACHING METHODS * 1. Gender	Between Groups	(Combined)	5.178	.023
	Within Groups			
	Total			

APPENDIX T ANOVA RESULTS FOR ATTRIBUTIONS RELATIVE TO SOCIO-ECONOMIC STATUS

(a) ABILITY (b) EFFORT (c) INTEREST (d) TASK (e) LUCK (f) HELP (g) TEACHING METHODS * 1. Number of bedrooms in my house except living or other room

Report

1. Number of bedrooms in my house except living or other rooms		(a) ABILITY	(b) EFFORT	(c) INTEREST
1	Mean	2.47	2.61	2.73
	N	76	77	77
	Std. Deviation	.808	.781	.883
2	Mean	2.64	2.69	2.84
	N	349	350	348
	Std. Deviation	.806	.731	.858
3	Mean	2.71	2.66	2.87
	N	593	596	599
	Std. Deviation	.774	.744	.856
4	Mean	2.74	2.70	2.79
	N	381	382	381
	Std. Deviation	.718	.728	.858
5 or more	Mean	2.83	2.86	2.95
	N	334	332	333
	Std. Deviation	.829	.839	.856
Total	Mean	2.71	2.71	2.86
	N	1733	1737	1738
	Std. Deviation	.784	.761	.859

Report

1. Number of bedrooms in my house except living or other rooms		(d) TASK	(e) LUCK	(f) HELP	(g) TEACHING METHODS
1	Mean	2.53	1.92	2.03	2.66
	N	76	76	74	76
	Std. Deviation	.824	.860	.921	.857
2	Mean	2.50	1.88	1.82	2.57
	N	349	350	349	350
	Std. Deviation	.826	.830	.836	.911
3	Mean	2.43	1.94	1.79	2.60
	N	596	597	599	599
	Std. Deviation	.698	.871	.846	.957
4	Mean	2.39	2.05	1.89	2.59
	N	380	379	379	378
	Std. Deviation	.745	.871	.896	.891
5 or more	Mean	2.34	2.21	1.92	2.78
	N	334	334	333	330
	Std. Deviation	.844	1.009	.993	1.017
Total	Mean	2.42	2.00	1.85	2.63
	N	1735	1736	1734	1733
	Std. Deviation	.771	.897	.889	.944

ANOVA Table

			Sum of Squares	df	Mean Square
(a) ABILITY * 1. Number of bedrooms in my house except living or other rooms	Between Groups	(Combined)	11.113	4	2.778
	Within Groups		1054.070	1728	.610
	Total		1065.183	1732	
(b) EFFORT * 1. Number of bedrooms in my house except living or other rooms	Between Groups	(Combined)	9.321	4	2.330
	Within Groups		997.176	1732	.576
	Total		1006.497	1736	
(c) INTEREST * 1. Number of bedrooms in my house except living or other rooms	Between Groups	(Combined)	6.446	4	1.612
	Within Groups		1276.305	1733	.736
	Total		1282.751	1737	
(d) TASK * 1. Number of bedrooms in my house except living or other rooms	Between Groups	(Combined)	5.868	4	1.467
	Within Groups		1025.455	1730	.593
	Total		1031.323	1734	
(e) LUCK * 1. Number of bedrooms in my house except living or other rooms	Between Groups	(Combined)	22.737	4	5.684
	Within Groups		1373.243	1731	.793
	Total		1395.979	1735	
(f) HELP * 1. Number of bedrooms in my house except living or other rooms	Between Groups	(Combined)	6.787	4	1.697
	Within Groups		1363.419	1729	.789
	Total		1370.205	1733	
(g) TEACHING METHODS * 1. Number of bedrooms in my house except living or other rooms	Between Groups	(Combined)	9.921	4	2.480
	Within Groups		1532.246	1728	.887
	Total		1542.167	1732	

ANOVA Table

			F	Sig.
(a) ABILITY * 1. Number of bedrooms in my house except living or other rooms	Between Groups	(Combined)	4.554	.001
	Within Groups			
	Total			
(b) EFFORT * 1. Number of bedrooms in my house except living or other rooms	Between Groups	(Combined)	4.047	.003
	Within Groups			
	Total			
(c) INTEREST * 1. Number of bedrooms in my house except living or other rooms	Between Groups	(Combined)	2.188	.068
	Within Groups			
	Total			
(d) TASK * 1. Number of bedrooms in my house except living or other rooms	Between Groups	(Combined)	2.475	.043
	Within Groups			
	Total			
(e) LUCK * 1. Number of bedrooms in my house except living or other rooms	Between Groups	(Combined)	7.165	.000
	Within Groups			
	Total			
(f) HELP * 1. Number of bedrooms in my house except living or other rooms	Between Groups	(Combined)	2.152	.072
	Within Groups			
	Total			
(g) TEACHING METHODS * 1. Number of bedrooms in my house except living or other rooms	Between Groups	(Combined)	2.797	.025
	Within Groups			
	Total			

(a) ABILITY (b) EFFORT (c) INTEREST (d) TASK (e) LUCK (f) HELP (g) TEACHING METHODS * 2. Number of people in our house sharing a bedroom

Report

2. Number of people in our house sharing a bedroom		(a) ABILITY	(b) EFFORT	(c) INTEREST
1	Mean	2.69	2.69	2.86
	N	1058	1063	1064
	Std. Deviation	.782	.763	.863
2	Mean	2.78	2.75	2.85
	N	287	286	289
	Std. Deviation	.791	.743	.854
3	Mean	2.81	2.81	2.89
	N	182	181	179
	Std. Deviation	.840	.794	.854
4	Mean	2.73	2.82	2.77
	N	131	132	132
	Std. Deviation	.763	.739	.806
Total	Mean	2.72	2.72	2.86
	N	1658	1662	1664
	Std. Deviation	.789	.762	.856

Report

2. Number of people in our house sharing a bedroom		(d) TASK	(e) LUCK	(f) HELP	(g) TEACHING METHODS
1	Mean	2.42	1.92	1.75	2.60
	N	1063	1065	1065	1063
	Std. Deviation	.772	.877	.853	.959
2	Mean	2.40	2.25	2.05	2.68
	N	286	288	286	285
	Std. Deviation	.737	.912	.895	.911
3	Mean	2.57	2.25	2.07	2.74
	N	179	179	177	179
	Std. Deviation	.834	.935	.963	.889
4	Mean	2.39	1.98	2.14	2.60
	N	132	130	132	131
	Std. Deviation	.788	.863	.926	.866
Total	Mean	2.43	2.02	1.86	2.63
	N	1660	1662	1660	1658
	Std. Deviation	.775	.900	.892	.937

ANOVA Table

			Sum of Squares	df	Mean Square
(a) ABILITY * 2. Number of people in our house sharing a bedroom	Between Groups	(Combined)	3.530	3	1.177
	Within Groups		1028.401	1654	.622
	Total		1031.931	1657	
(b) EFFORT * 2. Number of people in our house sharing a bedroom	Between Groups	(Combined)	4.127	3	1.376
	Within Groups		960.556	1658	.579
	Total		964.684	1661	
(c) INTEREST * 2. Number of people in our house sharing a bedroom	Between Groups	(Combined)	1.162	3	.387
	Within Groups		1216.083	1660	.733
	Total		1217.245	1663	
(d) TASK * 2. Number of people in our house sharing a bedroom	Between Groups	(Combined)	4.111	3	1.370
	Within Groups		992.642	1656	.599
	Total		996.754	1659	
(e) LUCK * 2. Number of people in our house sharing a bedroom	Between Groups	(Combined)	36.053	3	12.018
	Within Groups		1308.369	1658	.789
	Total		1344.422	1661	
(f) HELP * 2. Number of people in our house sharing a bedroom	Between Groups	(Combined)	41.587	3	13.862
	Within Groups		1278.916	1656	.772
	Total		1320.503	1659	
(g) TEACHING METHODS * 2. Number of people in our house sharing a bedroom	Between Groups	(Combined)	3.784	3	1.261
	Within Groups		1450.836	1654	.877
	Total		1454.620	1657	

ANOVA Table

			F	Sig.
(a) ABILITY * 2. Number of people in our house sharing a bedroom	Between Groups	(Combined)	1.892	.129
	Within Groups			
	Total			
(b) EFFORT * 2. Number of people in our house sharing a bedroom	Between Groups	(Combined)	2.375	.068
	Within Groups			
	Total			
(c) INTEREST * 2. Number of people in our house sharing a bedroom	Between Groups	(Combined)	.529	.663
	Within Groups			
	Total			
(d) TASK * 2. Number of people in our house sharing a bedroom	Between Groups	(Combined)	2.286	.077
	Within Groups			
	Total			
(e) LUCK * 2. Number of people in our house sharing a bedroom	Between Groups	(Combined)	15.229	.000
	Within Groups			
	Total			
(f) HELP * 2. Number of people in our house sharing a bedroom	Between Groups	(Combined)	17.950	.000
	Within Groups			
	Total			
(g) TEACHING METHODS * 2. Number of people in our house sharing a bedroom	Between Groups	(Combined)	1.438	.230
	Within Groups			
	Total			

(a) ABILITY (b) EFFORT (c) INTEREST (d) TASK (e) LUCK (f) HELP (g) TEACHING METHODS * 4. What is the occupation of the breadwinner in your home?

Report

4. What is the occupation of the breadwinner in your home		(a) ABILITY	(b) EFFORT	(c) INTEREST
Agriculture	Mean	2.80	2.82	2.87
	N	138	140	140
	Std. Deviation	.862	.825	.864
Education	Mean	2.80	2.85	3.00
	N	319	318	321
	Std. Deviation	.789	.751	.846
Business	Mean	2.83	2.70	2.77
	N	277	277	275
	Std. Deviation	.825	.826	.941
Mining	Mean	2.79	2.73	2.76
	N	196	195	195
	Std. Deviation	.794	.808	.884
Labourer	Mean	2.67	2.69	2.79
	N	135	135	135
	Std. Deviation	.712	.748	.805
other & specify	Mean	2.65	2.67	2.92
	N	425	428	429
	Std. Deviation	.731	.679	.789
Not employed	Mean	2.55	2.62	2.79
	N	220	221	220
	Std. Deviation	.766	.727	.834
Total	Mean	2.72	2.72	2.86
	N	1710	1714	1715
	Std. Deviation	.783	.759	.853

Report

4. What is the occupation of the breadwinner in your home		(d) TASK	(e) LUCK	(f) HELP	(g) TEACHING METHODS
Agriculture	Mean	2.47	2.12	2.12	2.69
	N	140	140	139	140
	Std. Deviation	.885	1.014	.941	.996
Education	Mean	2.43	1.92	1.83	2.63
	N	316	320	319	318
	Std. Deviation	.819	.876	.842	.957
Business	Mean	2.45	1.98	1.88	2.64
	N	275	273	275	275
	Std. Deviation	.797	.925	.882	.935
Mining	Mean	2.50	2.20	2.01	2.58
	N	197	196	195	194
	Std. Deviation	.773	.943	.955	.948
Labourer	Mean	2.44	2.16	1.93	2.57
	N	135	135	134	135
	Std. Deviation	.759	.908	.873	.910
other & specify	Mean	2.38	1.95	1.73	2.70
	N	429	429	429	429
	Std. Deviation	.711	.832	.895	.912
Not employed	Mean	2.42	1.95	1.78	2.54
	N	220	220	221	220
	Std. Deviation	.714	.842	.848	.952
Total	Mean	2.43	2.01	1.86	2.63
	N	1712	1713	1712	1711
	Std. Deviation	.772	.895	.893	.940

ANOVA Table

			Sum of Squares	df	Mean Square
(a) ABILITY * 4. What is the occupation of the breadwinner in your home	Between Groups	(Combined)	15.348	6	2.558
	Within Groups		1033.263	1703	.607
	Total		1048.611	1709	
(b) EFFORT * 4. What is the occupation of the breadwinner in your home	Between Groups	(Combined)	10.596	6	1.766
	Within Groups		976.541	1707	.572
	Total		987.137	1713	
(c) INTEREST * 4. What is the occupation of the breadwinner in your home	Between Groups	(Combined)	13.713	6	2.286
	Within Groups		1232.535	1708	.722
	Total		1246.248	1714	
(d) TASK * 4. What is the occupation of the breadwinner in your home	Between Groups	(Combined)	2.540	6	.423
	Within Groups		1016.908	1705	.596
	Total		1019.448	1711	
(e) LUCK * 4. What is the occupation of the breadwinner in your home	Between Groups	(Combined)	17.006	6	2.834
	Within Groups		1355.863	1706	.795
	Total		1372.869	1712	
(f) HELP * 4. What is the occupation of the breadwinner in your home	Between Groups	(Combined)	23.173	6	3.862
	Within Groups		1340.191	1705	.786
	Total		1363.364	1711	
(g) TEACHING METHODS * 4. What is the occupation of the breadwinner in your home	Between Groups	(Combined)	5.400	6	.900
	Within Groups		1506.630	1704	.884
	Total		1512.030	1710	

ANOVA Table

			F	Sig.
(a) ABILITY * 4. What is the occupation of the breadwinner in your home	Between Groups	(Combined)	4.216	.000
	Within Groups			
	Total			
(b) EFFORT * 4. What is the occupation of the breadwinner in your home	Between Groups	(Combined)	3.087	.005
	Within Groups			
	Total			
(c) INTEREST * 4. What is the occupation of the breadwinner in your home	Between Groups	(Combined)	3.167	.004
	Within Groups			
	Total			
(d) TASK * 4. What is the occupation of the breadwinner in your home	Between Groups	(Combined)	.710	.642
	Within Groups			
	Total			
(e) LUCK * 4. What is the occupation of the breadwinner in your home	Between Groups	(Combined)	3.566	.002
	Within Groups			
	Total			
(f) HELP * 4. What is the occupation of the breadwinner in your home	Between Groups	(Combined)	4.914	.000
	Within Groups			
	Total			
(g) TEACHING METHODS * 4. What is the occupation of the breadwinner in your home	Between Groups	(Combined)	1.018	.412
	Within Groups			
	Total			

(a) ABILITY (b) EFFORT (c) INTEREST (d) TASK (e) LUCK (f) HELP (g) TEACHING METHODS * 5. What is the income per month of the breadwinner in your home?

Report

5. What is the income per month of the breadwinner in your home		(a) ABILITY	(b) EFFORT	(c) INTEREST
	Mean	2.60	2.62	2.72
Below <R1,000	N	452	455	454
	Std. Deviation	.746	.738	.853
	Mean	2.64	2.70	2.84
R1,000 - R5,000	N	455	455	456
	Std. Deviation	.732	.736	.839
	Mean	2.77	2.78	2.95
R6,000 - R10,000	N	339	338	338
	Std. Deviation	.826	.763	.803
	Mean	2.97	2.84	2.99
R10,000 above>	N	381	383	384
	Std. Deviation	.789	.803	.870
	Mean	2.73	2.73	2.86
Total	N	1627	1631	1632
	Std. Deviation	.783	.762	.849

Report

5. What is the income per month of the breadwinner in your home		(d) TASK	(e) LUCK	(f) HELP	(g) TEACHING METHODS
	Mean	2.47	2.02	1.90	2.53
Below <R1,000	N	453	453	449	451
	Std. Deviation	.785	.866	.882	.927
	Mean	2.38	2.10	1.90	2.66
R1,000 - R5,000	N	455	455	455	455
	Std. Deviation	.704	.875	.876	.922
	Mean	2.49	1.91	1.85	2.61
R6,000 - R10,000	N	339	338	338	338
	Std. Deviation	.808	.886	.855	.945
	Mean	2.43	2.00	1.84	2.76
R10,000 above>	N	380	382	384	381
	Std. Deviation	.830	.968	.963	.979
	Mean	2.44	2.02	1.88	2.63
Total	N	1627	1628	1626	1625
	Std. Deviation	.780	.899	.894	.945

ANOVA Table

			Sum of Squares	df	Mean Square
(a) ABILITY * 5. What is the income per month of the breadwinner in your home	Between Groups	(Combined)	34.471	3	11.490
	Within Groups		961.154	1623	.592
	Total		995.625	1626	
(b) EFFORT * 5. What is the income per month of the breadwinner in your home	Between Groups	(Combined)	11.503	3	3.834
	Within Groups		936.084	1627	.575
	Total		947.587	1630	
(c) INTEREST * 5. What is the income per month of the breadwinner in your home	Between Groups	(Combined)	18.632	3	6.211
	Within Groups		1157.169	1628	.711
	Total		1175.801	1631	
(d) TASK * 5. What is the income per month of the breadwinner in your home	Between Groups	(Combined)	3.024	3	1.008
	Within Groups		985.763	1623	.607
	Total		988.787	1626	
(e) LUCK * 5. What is the income per month of the breadwinner in your home	Between Groups	(Combined)	6.892	3	2.297
	Within Groups		1307.592	1624	.805
	Total		1314.483	1627	
(f) HELP * 5. What is the income per month of the breadwinner in your home	Between Groups	(Combined)	1.200	3	.400
	Within Groups		1298.953	1622	.801
	Total		1300.153	1625	
(g) TEACHING METHODS * 5. What is the income per month of the breadwinner in your home	Between Groups	(Combined)	11.572	3	3.857
	Within Groups		1437.299	1621	.887
	Total		1448.870	1624	

ANOVA Table

			F	Sig.
(a) ABILITY * 5. What is the income per month of the breadwinner in your home	Between Groups	(Combined)	19.403	.000
	Within Groups			
	Total			
(b) EFFORT * 5. What is the income per month of the breadwinner in your home	Between Groups	(Combined)	6.664	.000
	Within Groups			
	Total			
(c) INTEREST * 5. What is the income per month of the breadwinner in your home	Between Groups	(Combined)	8.738	.000
	Within Groups			
	Total			
(d) TASK * 5. What is the income per month of the breadwinner in your home	Between Groups	(Combined)	1.660	.174
	Within Groups			
	Total			
(e) LUCK * 5. What is the income per month of the breadwinner in your home	Between Groups	(Combined)	2.853	.036
	Within Groups			
	Total			
(f) HELP * 5. What is the income per month of the breadwinner in your home	Between Groups	(Combined)	.500	.683
	Within Groups			
	Total			
(g) TEACHING METHODS * 5. What is the income per month of the breadwinner in your home	Between Groups	(Combined)	4.350	.005
	Within Groups			
	Total			

(a) ABILITY (b) EFFORT (c) INTEREST (d) TASK (e) LUCK (f) HELP (g) TEACHING METHODS * 6. What is the highest level of education the breadwinner in your family has completed?

Report

6. What is the highest level of education the breadwinner in your family has completed		(a) ABILITY	(b) EFFORT	(c) INTEREST
Degree	Mean	2.81	2.76	2.89
	N	696	700	701
	Std. Deviation	.827	.799	.905
Matriculated	Mean	2.71	2.70	2.87
	N	537	535	537
	Std. Deviation	.755	.725	.837
Grade 8+	Mean	2.58	2.62	2.73
	N	255	256	256
	Std. Deviation	.737	.726	.782
Below Grade 8	Mean	2.60	2.72	2.87
	N	222	223	222
	Std. Deviation	.741	.739	.820
Total	Mean	2.72	2.72	2.86
	N	1710	1714	1716
	Std. Deviation	.785	.759	.856

Report

6. What is the highest level of education the breadwinner in your family has completed		(d) TASK	(e) LUCK	(f) HELP	(g) TEACHING METHODS
Degree	Mean	2.39	1.96	1.82	2.64
	N	699	701	697	696
	Std. Deviation	.796	.923	.881	.982
Matriculated	Mean	2.44	2.04	1.86	2.65
	N	536	535	537	537
	Std. Deviation	.774	.875	.908	.914
Grade 8+	Mean	2.48	2.10	1.90	2.48
	N	255	256	256	255
	Std. Deviation	.752	.839	.889	.913
Below Grade 8	Mean	2.43	1.95	1.94	2.69
	N	222	221	221	221
	Std. Deviation	.713	.908	.877	.922
Total	Mean	2.42	2.01	1.86	2.63
	N	1712	1713	1711	1709
	Std. Deviation	.772	.895	.890	.945

ANOVA Table

			Sum of Squares	df	Mean Square
(a) ABILITY * 6. What is the highest level of education the breadwinner in your family has completed	Between Groups	(Combined)	13.520	3	4.507
	Within Groups		1040.354	1706	.610
	Total		1053.874	1709	
(b) EFFORT * 6. What is the highest level of education the breadwinner in your family has completed	Between Groups	(Combined)	4.320	3	1.440
	Within Groups		982.739	1710	.575
	Total		987.060	1713	
(c) INTEREST * 6. What is the highest level of education the breadwinner in your family has completed	Between Groups	(Combined)	4.681	3	1.560
	Within Groups		1253.340	1712	.732
	Total		1258.020	1715	
(d) TASK * 6. What is the highest level of education the breadwinner in your family has completed	Between Groups	(Combined)	2.007	3	.669
	Within Groups		1018.273	1708	.596
	Total		1020.280	1711	
(e) LUCK * 6. What is the highest level of education the breadwinner in your family has completed	Between Groups	(Combined)	5.018	3	1.673
	Within Groups		1365.912	1709	.799
	Total		1370.929	1712	
(f) HELP * 6. What is the highest level of education the breadwinner in your family has completed	Between Groups	(Combined)	2.993	3	.998
	Within Groups		1352.925	1707	.793
	Total		1355.918	1710	
(g) TEACHING METHODS * 6. What is the highest level of education the breadwinner in your family has completed	Between Groups	(Combined)	6.980	3	2.327
	Within Groups		1517.348	1705	.890
	Total		1524.328	1708	

ANOVA Table

			F	Sig.
(a) ABILITY * 6. What is the highest level of education the breadwinner in your family has completed	Between Groups	(Combined)	7.390	.000
	Within Groups			
	Total			
(b) EFFORT * 6. What is the highest level of education the breadwinner in your family has completed	Between Groups	(Combined)	2.506	.057
	Within Groups			
	Total			
(c) INTEREST * 6. What is the highest level of education the breadwinner in your family has completed	Between Groups	(Combined)	2.131	.094
	Within Groups			
	Total			
(d) TASK * 6. What is the highest level of education the breadwinner in your family has completed	Between Groups	(Combined)	1.122	.339
	Within Groups			
	Total			
(e) LUCK * 6. What is the highest level of education the breadwinner in your family has completed	Between Groups	(Combined)	2.093	.099
	Within Groups			
	Total			
(f) HELP * 6. What is the highest level of education the breadwinner in your family has completed	Between Groups	(Combined)	1.259	.287
	Within Groups			
	Total			
(g) TEACHING METHODS * 6. What is the highest level of education the breadwinner in your family has completed	Between Groups	(Combined)	2.614	.050
	Within Groups			
	Total			

(a) ABILITY (b) EFFORT (c) INTEREST (d) TASK (e) LUCK (f) HELP (g) TEACHING METHODS * 7. Do you have television in your home?

Report

7. Do you have television in your home		(a) ABILITY	(b) EFFORT	(c) INTEREST	(d) TASK	(e) LUCK
Yes	Mean	2.72	2.71	2.86	2.42	2.00
	N	1648	1650	1652	1650	1650
	Std. Deviation	.782	.758	.853	.771	.899
No	Mean	2.67	2.70	2.79	2.52	2.01
	N	90	91	91	90	91
	Std. Deviation	.779	.823	.937	.796	.850
Total	Mean	2.72	2.71	2.85	2.43	2.00
	N	1738	1741	1743	1740	1741
	Std. Deviation	.781	.761	.857	.772	.896

Report

7. Do you have television in your home		(f) HELP	(g) TEACHING METHODS
Yes	Mean	1.85	2.63
	N	1648	1646
	Std. Deviation	.889	.944
No	Mean	1.81	2.60
	N	91	91
	Std. Deviation	.881	.917
Total	Mean	1.85	2.63
	N	1739	1737
	Std. Deviation	.889	.943

ANOVA Table

			Sum of Squares	df	Mean Square
(a) ABILITY * 7. Do you have television in your home	Between Groups	(Combined)	.245	1	.245
	Within Groups		1060.043	1736	.611
	Total		1060.288	1737	
(b) EFFORT * 7. Do you have television in your home	Between Groups	(Combined)	.005	1	.005
	Within Groups		1008.093	1739	.580
	Total		1008.098	1740	
(c) INTEREST * 7. Do you have television in your home	Between Groups	(Combined)	.368	1	.368
	Within Groups		1280.032	1741	.735
	Total		1280.400	1742	
(d) TASK * 7. Do you have television in your home	Between Groups	(Combined)	.892	1	.892
	Within Groups		1036.396	1738	.596
	Total		1037.287	1739	
(e) LUCK * 7. Do you have television in your home	Between Groups	(Combined)	.004	1	.004
	Within Groups		1397.959	1739	.804
	Total		1397.963	1740	
(f) HELP * 7. Do you have television in your home	Between Groups	(Combined)	.146	1	.146
	Within Groups		1372.873	1737	.790
	Total		1373.019	1738	
(g) TEACHING METHODS * 7. Do you have television in your home	Between Groups	(Combined)	.049	1	.049
	Within Groups		1542.210	1735	.889
	Total		1542.259	1736	

ANOVA Table

			F	Sig.
(a) ABILITY * 7. Do you have television in your home	Between Groups	(Combined)	.402	.526
	Within Groups			
	Total			
(b) EFFORT * 7. Do you have television in your home	Between Groups	(Combined)	.009	.926
	Within Groups			
	Total			
(c) INTEREST * 7. Do you have television in your home	Between Groups	(Combined)	.501	.479
	Within Groups			
	Total			
(d) TASK * 7. Do you have television in your home	Between Groups	(Combined)	1.496	.222
	Within Groups			
	Total			
(e) LUCK * 7. Do you have television in your home	Between Groups	(Combined)	.005	.944
	Within Groups			
	Total			
(f) HELP * 7. Do you have television in your home	Between Groups	(Combined)	.185	.667
	Within Groups			
	Total			
(g) TEACHING METHODS * 7. Do you have television in your home	Between Groups	(Combined)	.055	.815
	Within Groups			
	Total			

(a) ABILITY (b) EFFORT (c) INTEREST (d) TASK (e) LUCK (f) HELP (g) TEACHING METHODS * 10. Do you have a community library in your area?

Report

10. Do you have a community library in your area:		(a) ABILITY	(b) EFFORT	(c) INTEREST	(d) TASK
Yes	Mean	2.76	2.74	2.88	2.42
	N	639	644	643	643
	Std. Deviation	.810	.806	.899	.784
No	Mean	2.69	2.69	2.84	2.43
	N	1088	1086	1089	1085
	Std. Deviation	.766	.731	.830	.764
Total	Mean	2.71	2.71	2.85	2.42
	N	1727	1730	1732	1728
	Std. Deviation	.783	.760	.856	.771

Report

10. Do you have a community library in your area:		(e) LUCK	(f) HELP	(g) TEACHING METHODS
Yes	Mean	2.04	1.89	2.69
	N	643	644	642
	Std. Deviation	.933	.887	.957
No	Mean	1.97	1.83	2.59
	N	1086	1087	1086
	Std. Deviation	.867	.885	.932
Total	Mean	2.00	1.85	2.63
	N	1729	1731	1728
	Std. Deviation	.893	.886	.942

ANOVA Table

			Sum of Squares	df	Mean Square
(a) ABILITY * 10. Do you have a community library in your area:	Between Groups	(Combined)	2.258	1	2.258
	Within Groups		1056.863	1725	.613
	Total		1059.121	1726	
(b) EFFORT * 10. Do you have a community library in your area:	Between Groups	(Combined)	1.078	1	1.078
	Within Groups		997.255	1728	.577
	Total		998.333	1729	
(c) INTEREST * 10. Do you have a community library in your area:	Between Groups	(Combined)	.828	1	.828
	Within Groups		1267.923	1730	.733
	Total		1268.751	1731	
(d) TASK * 10. Do you have a community library in your area:	Between Groups	(Combined)	.093	1	.093
	Within Groups		1026.127	1726	.595
	Total		1026.220	1727	
(e) LUCK * 10. Do you have a community library in your area:	Between Groups	(Combined)	1.821	1	1.821
	Within Groups		1375.174	1727	.796
	Total		1376.995	1728	
(f) HELP * 10. Do you have a community library in your area:	Between Groups	(Combined)	1.195	1	1.195
	Within Groups		1356.351	1729	.784
	Total		1357.546	1730	
(g) TEACHING METHODS * 10. Do you have a community library in your area:	Between Groups	(Combined)	4.350	1	4.350
	Within Groups		1529.386	1726	.886
	Total		1533.736	1727	

ANOVA Table

			F	Sig.
(a) ABILITY * 10. Do you have a community library in your area:	Between Groups	(Combined)	3.686	.055
	Within Groups			
	Total			
(b) EFFORT * 10. Do you have a community library in your area:	Between Groups	(Combined)	1.867	.172
	Within Groups			
	Total			
(c) INTEREST * 10. Do you have a community library in your area:	Between Groups	(Combined)	1.130	.288
	Within Groups			
	Total			
(d) TASK * 10. Do you have a community library in your area:	Between Groups	(Combined)	.156	.693
	Within Groups			
	Total			
(e) LUCK * 10. Do you have a community library in your area:	Between Groups	(Combined)	2.286	.131
	Within Groups			
	Total			
(f) HELP * 10. Do you have a community library in your area:	Between Groups	(Combined)	1.524	.217
	Within Groups			
	Total			
(g) TEACHING METHODS * 10. Do you have a community library in your area:	Between Groups	(Combined)	4.909	.027
	Within Groups			
	Total			