THE RELATIONSHIP BETWEEN STUDENT ACADEMIC ACHIEVEMENT AND STUDENT LEARNING STYLES IN A MULTICULTURAL SENIOR SCHOOL

by

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submitted in accordance with the requirements for the degree of

DOCTOR OF EDUCATION

In the subject

PSYCHOLOGY OF EDUCATION

at the

UNIVERSITY OF SOUTH AFRICA

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December 2015

DECLARATION

Student number: **6600581**

I declare that THE RELATIONSHIP BETWEEN STUDENT ACADEMIC ACHIEVEMENT AND STUDENT LEARNING STYLES IN A MULTICULTURAL SENIOR SCHOOL is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

SIGNATURE

15 December 2015

DATE

ACKNOWLEDGEMENTS

I would like to express my gratitude to the following people who were a great help in the completion of this thesis:

- Professor Salomé Schulze for her excellent supervision,
- The Headmaster and the Board of the International School of South Africa for allowing me to conduct the empirical research at the school,
- All the students who participated in the empirical research,
- Dr Liezel Korf for her work on the statistics,
- Professor Eleanor Lemmer for editing the thesis,
- My father who has always been an inspiration, and
- My husband and my son who gave me great support throughout the whole process.

SUMMARY

Since 1994 South African classrooms have become more culturally diverse. In order to teach effectively in such an environment, teachers need to use strategies which meet the needs of all the students. One way of addressing this challenge is to consider learning styles theory. Teachers need to understand how individual students of all cultures learn, and which specific learning styles are significantly related to academic achievement. In order to investigate this relationship, a study was conducted at an independent multicultural senior school in the North West Province of South Africa. The aim of the research was to gather information on the learning style preferences of the students at the school; the relationship between the students' academic achievements in English and mathematics and their learning style; and finally, the relationship between the students' nationality, gender, form and age and their learning styles as well as their academic achievements in English and mathematics. A mixed methods research design was used. Data was collected by means of a structured questionnaire that was completed by a sample of 240 students of different forms, genders and nationalities. This was followed by individual interviews with ten top achieving students.

The study found that the predominant learning style amongst the students in the school was individual learning. This particular learning style was also most significantly related to academic achievements in English and mathematics. The study further determined that nationality did not significantly influence students' learning styles but gender and age did. Female students were found to be more inclined to be individual learners. Younger students were also found to be auditory learners to a greater extent than older students. Regarding the studying of English and mathematics, it was found that female students generally used auditory learning styles whilst male students preferred kinaesthetic learning styles. Lastly, the study found that the average achievements in mathematics deteriorated as the students got older and the worst performing form was the Form 6s. To this end, various suggestions were made as to how learning styles

could be considered to improve learning. Recommendations for further study were highlighted along with the limitations of this research.

KEY WORDS

Learning
Learning styles
Learning theories
Academic achievement
VARK model
Multicultural independent school
North West Province, South Africa
Mixed methods inquiry

TABLE OF CONTENTS

CHAPTER 2: LEARNING AND LEARNING STYLES

CHAPTER 4: THE RESEARCH DESIGN AND DATA COLLECTION

APPENDICES

LIST OF ABBREVIATIONS

A	Auditory
AC	Abstract conceptualisation
AE	Abstract experimentation
CS	Conditioned Stimulus
CE	Concrete experimentation
FET	Further Education and Training
GET	General Education Training
GLM	General Linear Modelling
GSD	Gregorc Style Delineator
HET	Higher Education and Training
ILS	Index of Learning Styles
K	Kinaesthetic
LSI	Learning Style Inventory
LSQ	Learning Style Questionnaire
MBTI	Myers-Briggs Type Indicator
NQF	National Qualifications Framework
PEPS	Productivity Environmental Preference Survey
R	Read/write
RO	Reflective observation
SPSS	Statistical Package for the Social Sciences
SRL	Self-regulated learning
UCR	Unconditioned response
UCS	Unconditioned stimulus
V	Visual
VAK	Visual, Auditory, Kinaesthetic Learning Style
VARK	Visual, Auditory, Read/write, Kinaesthetic Learning Styles
ZPD	Zone of Proximal Development

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION AND OVERVIEW

> As early as 1980, Scott Thomson, executive director of NASSP, said, "the ability to map learning styles is the most promising development in curriculum and instruction in a generation. It is the most scientific way we know to individualise instruction". Almost three decades ago, he was right on target (Dunn, Honigsfeld, Doolan, Bostrom, Russo, Schiering, Suh & Tenedero 2009:139).

1.1 INTRODUCTION AND BACKGROUND

Individualism, according to Scott (2010:5), is the dominant value system in Western cultures and, as such, affects the conduct of every aspect of human endeavour including education. According to Duman (2010:2078) and Scott (2010:5), one of the best ways of conceiving individualism is through a thorough understanding of learning style models. Psychologists and teachers[1] alike have found that such models are able to explain the differences found in students' academic achievements and receptivity to various forms of instruction (Schunk 2012:478; Sousa 2011:58). Using learning style models in the classroom can therefore ensure that learning opportunities are more individualised and therefore more personalised as teaching and learning is tailored to suit individual needs (Allcock & Hulme 2010:67; Olson & Hergenhahn 2013:9-10; Orhun 2007:322; Sparks 2006:520).

Since the 1950s the effects of globalisation on the educational environment have resulted in a growing body of research into learning styles and strategies. Much support can now be found in the literature for the consideration of learning styles in school

[1] The school where the research took place uses the term 'teacher' to refer to an educator.

teaching (Cagiltay 2008:415). Many researchers have highlighted the positive influences learning styles can have on education in general. Allcock and Hulme (2010:70) highlight two such positive influences. They firstly state that learning style models enable the identification and addressing of individual learning needs. The second influence is that learning style models also create awareness amongst both students and teachers of the wide range of learning and teaching methods that are available for use.

There are many other studies in the relevant literature which report the positive effects of considering learning styles in teaching and learning. Many educational theorists and researchers view learning styles as an important factor in the learning process. They agree that incorporating them into teaching has the potential to facilitate effective learning for students (Graf, Kinshuk & Liu 2009:3). It is also believed that both the academic achievement and the self-confidence of students increases when course content is designed and based on the learning styles of the students (Reid 2005:14, 52; Sadeghi, Kasim, Tan & Abdullah 2012:116). If students know their own learning styles and apply them to the learning process, these students should learn both more easily and more rapidly. There is therefore a high degree of probability that the students will be more successful in the learning process as learning would be encouraged and students would be engaged and motivated (Bennett 2013:144; Daghani & Akkoyunlu 2012:123; Graf *et al*. 2009:3; Prashnig 2006:3; Reid 2005:129). Making students aware of their learning styles, and showing them their individual strengths and weaknesses, can also help students to understand why learning is sometimes difficult for them (Graf *et al*. 2009:3). Furthermore, knowledge of learning styles can also equip students for life-long learning (Bostrom 2012:11; Reid 2005:64).

Another positive influence identified in the literature is that if students are expected to learn, retain complex information, become academically successful, be motivated to learn and to approach learning appropriately, identification of and responsiveness to

their learning style preferences is necessary. This is especially true when the teachers' teaching styles do not match the learning styles of the students (Allcock & Hulme 2010:67; Hlawaty 2009:24; Romanelli, Bird & Ryan 2009:2). Educational researchers and theorists also generally agree that students learn in different ways. Therefore, it is important to consider the students' particular learning styles so as to help them learn more easily and effectively (Bostrom 2012:11; Kinshuk, Liu & Graf 2009:740).

Other authors have also highlighted the many positive effects that can be gained by considering learning styles in the classroom. Several authors (Dunn, Honigsfeld, Doolan, Bostrom, Russo, Schiering, Suh & Tenedero 2009:137-138), state that teachers, once aware of the concept of 'learning style', become more self-motivated to reflect on their particular philosophy of education. These particular authors also add that teacher awareness is often sensitised to the point that it increases self-directed and autonomous learning. Students start to accept responsibility for their own learning regardless of their teachers' teaching style. The delivery of subject matter is therefore more value driven and personal and social justice and equity are promoted.

Several authors (Breckler, Teoh & Role 2011:26; Duman 2010:2078; Wang, Wang, Wang & Huang 2006:208) also highlight various other positive effects which can be gained by considering learning styles in the classroom. All these authors indicate that students' learning styles are a significant factor, and in some cases, one of the most important factors that affect academic performance. According to Wang *et al.* (2006:208), knowledge of learning styles can help improve instructional planning and implementation and ultimately enhance student learning. Orhun (2007:323, 331) supports this view by adding that when students are taught by means of approaches that complement their learning styles, and when they become aware of their own learning styles, their academic achievements significantly increase. Other authors (Cagiltay 2008:422; Cutolo & Rochford 2007:2) corroborate the views stated above. They maintain that once students know their individual learning styles, and adapt certain

learning styles depending on which teaching methods they meet during their education, their academic performance may improve.

Understanding the learning styles of students is also beneficial in other ways. It helps teachers know their students, and helps them to understand how their students take in and interact with information. If students are aware of their learning styles, they can also better communicate what they need in order to process the information. An awareness of learning styles can help teachers to be more flexible in the ways they present information and design courses and learning objects (Mestre 2010:814).

Throughout the world learning styles have become an increasingly relevant pedagogic concept. This has been because the diversity of students engaged in education has continued to expand. The students who make up the student body at schools nowadays come from various ethnic and cultural backgrounds, from a multitude of training programmes and institutions, and all have differing learning styles. Coupled with this increase in diversification has been an expansion in the type of instructional media used in classroom teaching. These changes and advances in technology have led many teachers to reconsider the traditional uniform instruction methods. The importance of considering students' learning styles in the design and delivery of course content is now being stressed (Romanelli *et al.* 2009:1).

In South Africa it has also become necessary to address the issue of learning styles in classroom teaching. This is due to the increasing cultural diversity found in these classrooms. In order to teach effectively in such an environment, teachers need to use strategies that meet the needs of all the students. However, with such culturally diverse classrooms, teachers need to understand how individual students of all cultural and racial groups learn, and which specific learning styles are significantly related to academic achievement. These are difficult questions to answer but do need to be addressed.

In this study an attempt will therefore be made to address the issues highlighted above. The learning styles of students who attend an independent, multiracial and multicultural school in the North West Province of South Africa will be examined. This particular school offers an internationally recognised curriculum and thus attracts students from all over Africa. The school has both day scholars and boarders. The majority of the boarders come from countries to the north of South Africa namely Nigeria, the Ivory Coast, the Democratic Republic of Congo, Malawi, Botswana, Rwanda, Tanzania, Zimbabwe and Zambia. Most of these students speak English as well as their mother tongue. At least half of the student body is South African and are day scholars. The teaching staff at the school is as cosmopolitan as the students. There are South Africans (with all racial groups represented), Zimbabweans, Zambians and British citizens employed.

The above mentioned school operates in a highly competitive market. As a result, the school has become very grade-oriented and the teachers are expected to achieve the highest results in external examinations. This puts a huge amount of pressure on the teachers to get the best out of each and every student. The staff has found this very difficult to achieve especially as the students are accepted into the school irrespective of their academic potential. The question therefore arises as to how one, as a teacher, can achieve high academic standards from such mixed ability students. One way, as proposed in the literature, is to consider the learning styles of the students in classroom teaching.

In the next section of this chapter the main research questions and various sub-questions of the study will be stated.

1.2 THE PROBLEM STATEMENT AND RESEARCH QUESTIONS

One way, as suggested in the literature, to improve the academic performance of students is to identify their preferred or dominant learning styles. Once this has been done, teachers can adapt their teaching to include these particular learning styles. This should maximise learning in the classroom and improve the students' academic success remembering that classrooms should be places in which students learn rather than places in which teachers teach (Cohen, Manion, Morrison & Wyse 2010:181; Naimie, Siraj, Ahmed Abuzaid & Shagholi 2010:83; Peterson, Carne & Freear 2011:163-164; Rayner 2007:24). Therefore, the main aim of the study is to investigate and explain the relationship between learning styles and academic achievement.

The study also attempts to address a number of sub-problems. One of these sub-problems relates to the diversity of nationalities found in South African classrooms. If South African teachers want to improve their students' academic achievements, the teachers need to know whether a particular nationality is predisposed to a certain type of learning style. As there appears to be limited research and studies on how learning styles and the students' nationalities are connected, this issue will also be examined in the study.

In light of the above, the main research question of the study is: *What is the relationship between students' academic achievement and students' learning style in a multicultural senior school?*

The following sub-questions emanate from the main research question:

- What are the learning style preferences of the students in the sample?
- What is the relationship between students' academic achievements in English and mathematics and their learning styles?

- How are students' learning styles and their academic achievements in mathematics and English influenced by age, form[2], nationality and gender?
- How does a group of students learn mathematics, English and subjects that involve a lot of learning material?

The reason why English and mathematics are used is that they are studied by the majority of the students in the school and are the two most common subjects.

The first three sub-questions will be answered quantitatively, and the fourth question will be investigated qualitatively and the findings integrated into the answers to the previous questions. Only when these questions have been answered, will the research question that asks about the relationship between students' achievement and their learning styles in a multicultural senior[3] school, be answered.

In the next section the aims of the research will be highlighted.

1.3 AIMS OF THE RESEARCH

The main aim of the research is to answer the general research question in section 1.2. To this end, the specific aims of the study are twofold. The first aim of the study is to do a literature review to investigate:

- the generic theories on the concept of learning and learning styles, and
- the factors that impact on learning, academic achievement and learning styles.

Thus, the starting point of the research will be the literature review. As indicated above, this will firstly be undertaken to explore the concept of learning, how learning styles can influence learning and academic achievement, and the effect that nationality, gender

[2] The school where the research took place uses the term 'form' instead of 'grade'.
[3] The term 'senior' was used in the research to refer to those students in the Senior Phase of the GET Band plus those students in the FET Phase (see section 1.5.3 where the term is defined).

and age may have on learning styles. The literature study will concentrate on a wide variety of information sources such as books, scientific periodicals and articles from scholarly journals and the internet.

The second aim of the study is to do an empirical investigation to determine the different learning styles of students who attend a multicultural senior school. The role played by nationality, as well as the gender, age and form of the students in influencing these learning styles will be investigated. The relationship between learning styles and academic achievement (in English and mathematics) will also be explored.

A brief overview of the research design and data collection methods which will be used to achieve the aims of the empirical investigation is given in the next section.

1.4 AN OVERVIEW OF THE RESEARCH DESIGN AND DATA COLLECTION METHODS

According to McCaig (2010:30), a research design is an overarching strategy for unearthing useful answers to problems. The research problem will be investigated empirically by means of a mixed methods research design (a combination of qualitative and quantitative methods), in line with a philosophy of pragmatism. The mixed methods approach is deemed most suitable for this research as the data will be more valid due to the triangulation of methods (Krathwohl 2009:285). The mixed methods approach will be implemented in two phases with data from the first, quantitative approach, being utilised in the qualitative approach which follows.

In the quantitative research phase students[4] who are enrolled at an independent school located in Mafikeng (North West Province) will be used. This school was selected

[4] The term ‘student’ and not ‘learner’ will be used in the discussion of the empirical inquiry so as to be in line with international academic literature in which the term ‘student’ is most often used. In addition, the

because there is a diverse composition of students at the school. All students in Form 2 (Grade 9) through to Upper 6th (post-matric) who do both English and mathematics will be included in the questionnaire process. Several different nationalities are represented by these students.

The students will be required to complete a questionnaire. The questionnaire will essentially seek to determine the particular learning style of the student as well as other biographical data such as gender, form, age and nationality. The data from the questionnaires will be captured with the aid of spread sheet software (Microsoft Excel). The data will be analysed by means of the Statistical Package for the Social Sciences (SPSS).

The above phase will be followed by the qualitative research phase which will comprise of face-to-face interviews. In these interviews certain issues which are pertinent to the study will be investigated and discussed in more detail with selected students. The top students who achieve in both English and mathematics will be chosen. Both male and female students from Form 2 (Grades 9) through to Upper 6th (post-matric) from an array of different cultural groups will be represented. Transcripts from these interviews will be analysed manually. Data from the interviews will then be considered along test results from Term 1 and 2.

The questions of reliability and validity will be considered in the research design. According to several authors (Neuman 2006:188,190; Wellington & Szczerbinski 2007:43) reliability and validity are central issues in all forms of measurement and are widely used to discuss the quality of the research. Including both qualitative and

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research was conducted at an independent school where the term ‘student’ is generally the term which is used.

quantitative research methods will increase the validity of the study (see Chapter Four for more detail).

The central concepts of the study will be defined and explained in the next section.

1.5 DEFINITION OF CONCEPTS

The central concepts of this study were learning, learning styles, the senior phase, adolescents and multicultural education. These concepts will be defined and briefly explained in this section as they are more fully explored in the next two chapters.

1.5.1 Learning

When people ask what schools are for, a common reply is 'to help children learn'. During the last 10 years learning has become a key topic, not only for professionals and students in the areas of psychology and education, but also in political and economic contexts (Santrock 2008:226). One reason for this is that the world has become highly globalised and competitive resulting in people equating education with jobs and wealth (Illeris 2009:1). Expectations are being placed on the education systems to develop the necessary skills, attitudes and aptitudes that enhance collaboration, teamwork, problem solving and creativity. Change and innovation have become the new status quo. However, this has proved difficult to achieve as 19th-century teaching techniques are still being used in 20th-century classrooms whilst trying to engage 21st-century students. Such demands require a new and better way of approaching educational issues such as learning (Slade & Griffith 2013:23).

What exactly is learning? The term 'learning' has proved extremely difficult to define even though it is one of the most important topics in present-day psychology (Gray & Macblain 2012:106; Hergenhahn & Olson 2005:3; Illeris 2009:1; Jenlink & Austin

2013:88; Saljo 2009:202). For more than 2000 years philosophers, academics and educators have attempted to explain and define learning (Gray & Macblain 2012:2) but what has resulted is no generally accepted definition of the concept (Ertmer & Newby 2013:45; Illeris 2009:1). The definitions that authors suggest currently are considerably more complex than the ones found in textbooks from earlier decades when learning was traditionally understood mainly as the acquisition of knowledge and skills. Today the concept of learning covers a much larger field including emotional, social and societal dimensions (Illeris 2009:1; Saljo 2009:203).Therefore, in order to derive a definition of the term 'learning', it is necessary to firstly investigate how each of the three main learning theories (behavioural, cognitive and constructivist) define this term.

From a behavioural perspective, learning is defined as comprehension, knowledge and understanding which are gained through practice or experience. Learning therefore results in a relatively permanent change in observable behaviour which is persistent, measurable and specified and allows an individual to formulate a new or revise a prior mental construct. Learning cannot be attributed to temporary body states such as illness, fatigue or drugs (Gross 2010:159; Morrison 2006:92; O'Donnell, Reeve & Smith 2012:153; Olson & Hergenhahn 2013:1-2, 6; Shaffer & Kipp 2014:155; Sternberg & Williams 2010:236; Suaalii & Bhattacharya 2007:106). Learning is therefore accomplished when a proper response is demonstrated following the presentation of a specific environmental stimulus (Ertmer & Newby 2013:48).

From a cognitivist perspective, learning is as an active process 'involving the acquisition or reorganisation of the cognitive structures through which humans process and store information' (Yilmaz 2011:205). Learning is concerned not so much with what students do, but with what they know and how they come to acquire it. The student is also viewed by cognitivists as a very active participant in the learning process (Ertmer & Newby 2013:51; O'Donnell *et al*. 2012:153).

Constructivism is one of the newest and currently most popular theories with regard to learning. From a constructivist perspective, learning is viewed as a process in which new information is assimilated into students' prior stock of knowledge (that is the knowledge individuals would have accumulated during their lives). Since individuals have a different store of knowledge, each person would ultimately assimilate a different interpretation of new information - one that fits in with, and makes sense of, the knowledge base the individual already has in place (Cooper 2013:290). In short, constructivism is a theory that equates learning with creating meaning (Ertmer & Newby 2013:55). Learning is therefore seen to be the active construction of knowledge and is an on-going lifelong process in accordance with existing schemes of thought (Howe & Lisi 2014:219; Morrison 2006:103; Suaalii & Bhattacharya 2007:101).

After considering the definitions above, the following interpretation of learning will be used in the study: In line with constructivist views of learning, learning is the act of actively constructing knowledge, which can involve new knowledge or the revision of prior mental constructs.

1.5.2 Learning styles

Learning styles, according to Ku and Chang (2011:266), are an ongoing issue of great importance to educational research. Over the last several decades at least 71 different learning styles have been documented and are frequently encountered at levels ranging from kindergarten to graduate school (Olson & Hergenhahn 2013:412; Pashler, McDaniel, Rohrer & Bjork 2009:117).

What exactly are learning styles? According to Wu (2014:113), Kinshuk *et al*. (2009:740) and Scott (2010:6) the area of learning styles is complex and as such there is no clear definition of learning styles or a comprehensive model which describes the most important learning style preferences. Yilmaz-Soylu and Akkoyunlu (2009:43) state

that this is due to the fact that different theorists define learning style by focusing on different aspects of learning such as the way and method students may process, comprehend and organise information, and students' responses to environmental stimuli.

Despite this confusion, many authors have attempted to define this difficult concept. Several authors state that learning styles are the way individuals begin to concentrate on, process, internalise, retain and recall new and difficult information (Brown, Terry & Kelsey 2013: 207; Daghani & Akkoyunlu 2012:123; Dunn *et al*. 2009:136; Given 2000:3 & 89; Ku & Chang 2011:266; Good, Ramos & D'Amore 2013:82; O'Neill-Blackwell 2012:xix; Pashler *et al*. 2009:105-107; Schunk 2012:478). To this, Pashler *et al.* (2009:105-107) add that because students learn information in different ways, it is necessary to determine what is most likely to trigger their concentration, how this concentration will be maintained and how students will respond to their natural processing style in order to produce long term memory and retention. These different aspects of learning styles constitute a particular student's learning style (Given 2000:89). Learning styles are not synonymous with ability as ability refers to capacities to learn and execute skills. Learning styles are more habitual ways of processing and using information (Schunk 2012:478).

Other authors give a broader definition of what learning styles are. They state that learning styles are a student's individual preferences, needs for learning conditions or modes of learning (Cavas 2010:47; Howe & Lisi 2014:398; Sadeghi *et al*. 2012:117; Sternberg & Williams 2010:146-147). A very broad definition of the term is given by Bostrom (2012:13) who states that learning styles are a collective term for theories on how people learn best (assuming that everyone can learn, albeit in different ways, and on different levels). Bhatti and Bart (2013:1) define learning styles as characteristic ways of perceiving and processing information. Şengül, Katranci and Bozkuş (2013:3) state that learning styles are the methods students use to collect, organise, think and

interpret information. Cavas (2010:47) further adds that it is commonly believed that learning styles are not really concerned with *what* students learn, but rather with *how* they prefer to learn. According to all these definitions, no learning style is better than another (Castro & Peck 2005:402).

Another definition of learning styles is given by Eggen and Kauchak (2013:145). They define learning styles as a student's personal approach to thinking and problem-solving. To this they add that the terms 'learning style', 'cognitive style', 'thinking style' and 'problem-solving style' are often used interchangeably, thus adding to confusion in this area when seeking an acceptable and encompassing definition.

Dunn and Griggs (2007:viii) as well as Morrison (2006:394) are more specific in their definition of learning styles. They state that learning styles are comprised of environmental, emotional, sociological, physiological and psychological elements that enable individuals to receive, store and then use the knowledge or skills to which they have been exposed. According to these authors, learning styles can range from straightforward preferences for physical surroundings to more fundamental differences that may be rooted in culture or personality. In the case of physical surroundings, different students have different preferences for aspects of the classroom environment such as lighting, hard or soft seating furnishings or background noise. A teacher can thus offer a variety of study and learning conditions within a single classroom.

After considering the definitions above, the following definition of the term 'learning style' will be used in this study: A learning style is the personal approach that an individual student uses when concentrating on, processing, internalising, problem solving, retaining and recalling new and difficult information.

1.5.3 The Senior Phase

South Africa's National Qualifications Framework (NQF) recognises three broad bands of education, namely the General Education and Training (GET) Band, the Further Education and Training (FET) Band and the Higher Education and Training (HET) Band. The GET Band is made up of three phases namely Foundation (Grades R to 3), Intermediate (Grades 4 to 6) and Senior Phase (Grades 7 to 9). The FET phase consists of all learning and training programmes from NQF levels two to four or the equivalent of Grade 10 to 12 in the school system. This phase directly follows the GET Band and precedes the HET phase. Education within the FET phase is compulsory and is provided by senior secondary schools and technical colleges, non-governmental organisations, private providers, colleges, training centres and community colleges. At the FET level students receive career oriented education, and are prepared for the HET Band, careers and self-employment (Lemmer 2002:37; Sosibo & Nomlomo 2014:74). The focus of this research will be on those students in the Senior Phase of the GET Band (specifically Grade 9) plus those students in the FET Phase (Grades 10 to 12).

1.5.4 Adolescents

Students in the Senior Phase of the GET Band (Grade 9) and those in the FET phase (Grades 10 to 12) (see section 1.5.3) could be considered adolescents. The term 'adolescence' means 'to grow up into maturity' (Han 2014:2384). Papalia, Olds and Feldman (2006:412) state that the adolescent stage lasts from about the age of 10 or 11 until the late teens or early twenties. Rice and Dolgin (2008:2) divide the adolescent period into three different stages namely early adolescence (11 to 14 years), middle (15 to 17 years) and late adolescence (18 years and over). However, it is difficult to link a chronological age to this term because of cultural differences, historical circumstances and socio-economic situations (Santrock 2001:17). Adolescence can be a difficult time for all concerned as it can facilitate an identity crisis. It is, however, a necessary stage

as it allows the individual to develop the prerequisites needed for physiological growth, mental maturation and social responsibility in order to experience and pass through the crisis of identity (Erikson in Han 2014:2384).

The terms ‘adolescent’ and ‘student’ will be used in the following chapters when referring to a FET phase student.

After considering the definitions above, the following interpretation of the term ‘adolescent’ will be used in the study: An adolescent is a person who is in the middle to late adolescence and ranges in age from 15 to 18 years and over.

1.5.5 Multicultural education

Multicultural education, according to Nieto (2009:80), is “an idea, an educational reform movement, and a process whose major goal is to change the structure of educational institutions so that male and female students, exceptional students, and students who are members of diverse racial, ethnic, language, and cultural groups will have an equal chance to achieve academically in school”. According to Nieto (2009:80) this definition has remained remarkably stable over time.

An important goal of multicultural education is equal opportunity for all students (Santrock 2008:157). Multicultural education is able to increase this educational equity by allowing individuals from diverse backgrounds to have an equal opportunity to achieve academically at school (Tiedt & Tiedt 2010:25; Woolfolk 2007:161). Multicultural education is therefore education that values diversity and regularly includes the perspectives of a variety of cultural groups. Multicultural education incorporates content, concepts, principles, theories and paradigms from history, the social and behavioural sciences and from ethnic and women studies (Banks 2003:x).

After considering the definitions above, the following interpretation of what is meant by ‘multicultural education’ will be used in this study: Multicultural education teaches students from diverse ethnic, cultural and racial backgrounds how to live and work together harmoniously.

In the next section the division of the chapters of the thesis, is indicated.

1.6 THE DIVISION OF CHAPTERS

This thesis consists of the following six chapters:

- Chapter One is an introductory chapter which provides an orientation to the study. The research has been justified, the research problems have been stated, a brief overview of the research design has been given, and the most important concepts of the study have been defined.

- Chapter Two explores the theories on the concept of ‘learning’ and ‘learning styles’.

- Chapter Three looks at the factors that impact learning, learning styles and academic achievement thereby aligning the literature review with the topic of the research.

- Chapter Four clarifies the research design and the research methodologies to be used. A description and discussion of the methods and techniques that will be used to collect and analyse the data are given. Reasons why certain research methods are used as the main methods for data collection are explained.

- In Chapter Five the findings of the empirical research are presented. The findings are also interpreted and discussed in light of the theoretical framework of the study.

- Chapter Six deals with the conclusions and the recommendations of the research. The limitations of the study as well as its contribution will also be highlighted.

1.7 CONCLUSION

The aim of this chapter was to provide an introduction to the study. The central theme of the research, namely the relationship between learning style and academic achievement, was introduced. A brief discussion of the research methods to be used was given. This was followed by an explanation of the key concepts used in the research. The chapter ended with a brief summary of how the chapters in the study are divided.

In the next chapter the conceptual framework of the study will be presented.

CHAPTER 2

LEARNING AND LEARNING STYLES

Do you find it easy to read maps, or find your way around a new city, or back to a place previously visited? Can you visualise the kitchen area from a builder's plan for a new house? If you can, you may be able to improve your strategies for learning by using visual techniques. If not, you may be using inappropriate visual techniques of study (e.g. mind maps). You may also be harming your chances of academic success (Fleming 1995:308).

2.1 INTRODUCTION

The second chapter of the study starts with a brief discussion of the brain and how this is connected to learning. The chapter then moves on to examine various learning theories, more specifically behavioural, cognitive and constructivist learning theories. This is followed with a discussion of the various learning styles which students may adopt. The chapter then ends with a brief discussion of the various criticisms which have been levelled against the concept of learning styles.

2.2 THE BRAIN AND LEARNING

The brain is composed of a right and a left hemisphere. These two hemispheres usually work together in order for the individual to understand the world (Ormrod 2014:9). The two hemispheres are said to communicate with each other via bundles of nerve fibres which cross from one side of the body to another. When a person is involved in complex tasks such as learning to speak an additional language, learning the music or lyrics of a

song or drawing a mind map, both hemispheres in the brain are used (Dymoke 2011:52; Ormrod 2014:9).

It is believed that the left and right hemispheres of the brain employ different strategies while receiving and processing diverse information. Each hemisphere is neuron or nerve cell rich and enables special functions (cognitive, affective and physical activities) to happen. Neither of these hemispheres is superior to the other even though they have different specialised functions. The hemispheres spontaneously determine the time spent on thinking about a particular issue (Duman 2010:2078).

Within the brain, two essential components are needed for learning namely the long-term memory and the short-term memory (often called the working memory) (Clark, Kirschner & Sweller 2012:8).The long-term memory is a large mental warehouse of the things that people know. The working memory, on the other hand, is a limited mental space by means of which individuals think. In order to learn effectively, there has to be an efficient relationship between the long-term memory and the working memory in conjunction with the cognitive processes that support learning. The long-term memory is viewed as the central, dominant structure of human cognition as everything that humans see, hear and think about is dependent on and influenced by their long-term memories (Clark *et al*. 2012:9).

In addition to the above, some researchers believe that the whole brain supports learning (Dymoke 2011:52; Ormrod 2014:9). However, every brain is unique, all brains are capable of learning and the capacity of the brain to store information is unlimited (Duman 2010:2078; Reid 2005:144-145). One implication of accepting the uniqueness of the human brain is that all individuals have their own optimal approach to or style of learning (Olson & Hergenhahn 2013:412). In order to maximise productive student learning, teachers must understand the processes that underlie learning namely the

various learning theories (Ormrod 2014:30). These learning theories will be discussed in the next section.

2.3 LEARNING THEORIES

Teachers provide students with learning experiences in the classroom. In order for students to learn particular behaviours and knowledge effectively, teachers need to provide the kinds of experiences that will facilitate this learning. Because the types of experiences which foster the learning of behaviours may be different from those that foster the learning of knowledge, various learning theories have been developed (O'Donnell *et al*. 2012:153). These learning theories help to explain how, when and where learning occurs and how best to support student learning. Learning theories can also guide teachers in the development of programmes for students which will support and enhance their learning (Morrison 2006:92-93).

There are many contrasting and complementary learning theories - in fact, up to 50 theories have been identified (Dennick 2012:618; Dymoke 2011:48; O'Donnell *et al*. 2012:153; Reid 2005:4). However, a thorough perusal of the perspectives posited by learning theorists such as Skinner (1968), Piaget (1970), Vygotsky (1978), Bandura (1977) and Bruner (1966) reveals that no single theorist has offered a complete explanation of the way students learn as no theory to date seems to be able to explain the complexities of the learning process fully and satisfactory (Dymoke 2011:48; Gray & Macblain 2012:123). Each of the learning theories put forth by the theorists mentioned above aims to explain some aspect of learning. Many of these learning theories overlap and each one of these theories has its own strengths and weaknesses. As such, teachers and students typically draw on several different learning theories in order to enhance effective learning in the classroom (Gray & Macblain 2012:123).

In the next section of this chapter the following learning theories will be discussed namely behavioural, cognitivist and constructivist. These are considered to be the three most important learning theories. The educational implications of each of these three learning theories will also be discussed.

2.3.1 Behavioural theories

Early research on learning relied heavily on asking people to describe what they were thinking. In the early 1900s some psychologists argued that such self-reflections were highly subjective and not necessarily accurate. Beginning with the work of Pavlov, the Russian psychologist, and Thorndike, the American psychologist, a more objective approach to the study of learning emerged (Ormrod 2014:34). Using techniques borrowed from the physical sciences, researchers began conducting experiments to understand how both people and animals learn (Slavin 2009:129). It was assumed that humans and animals learn in similar ways (equipotentiality) and principles that were derived from research on animals like rats and pigeons could be applied to human learning (Ormrod 2014:34-35). These researchers were later known as behavioural theorists, and their goal was to promote the scientific study of human behaviour (Bryant, Vincent, Shaqlaih & Moss 2013:91).

Several researchers have indicated that behaviourism is essentially a theory that explains learning in terms of observable behaviours and how these behaviours are influenced by stimuli from the environment (Eggen & Kauchak 2013:292; Ertmer & Newby 2013:48; Ormrod 2014:34-35). Behaviourism therefore focuses on how stimuli can elicit responses and how, if the responses are rewarded, they can become habitual or learned; or, if the responses are punished, they can be eliminated or changed. Learning, according to behaviourists, therefore results from individuals' experiences with stimuli and the effects which follow (Isman 2011:137; Ormrod 2014:34-35).

In an educational setting, the behavioural theory can be illustrated with the following example. If a student who is normally passive gives an active response that is rewarded with something pleasant, for example with a smile or a sweet, that student will be more likely to repeat the response as a desirable consequence has been elicited (Oakes, Lipton, Anderson & Stillman 2013:163). This example therefore highlights the key features of behaviourism namely:

- the reinforcement of appropriate behaviours by means of rewards,
- the creation of environments that enable and condition students to respond in what are deemed appropriate ways,
- the role of consequences, and
- learning through repetition (Dymoke 2011:48; Slavin 2009:131).

In this theory no reference is made to cognitive functions as the focus is solely on observable behaviour (Gray & Macblain 2012:4).

In the next section three of the main behavioural theorists, namely Pavlov (classical conditioning), Thorndike (instrumental conditioning) and Skinner (operant conditioning) will be discussed in relation to how they view learning.

2.3.1.1 Classical conditioning

In the early 1900s the Russian physiologist, Ivan Pavlov (in Gray & Macblain 2012:4; Ormrod 2014:36; Slavin 2009:129), conducted experiments related to the salivation of dogs in anticipation of being fed. Pavlov's assistants fed meat powder to dogs and measured the amount of saliva these dogs produced. Pavlov noticed that after a few of these experiences, the dogs would salivate just at the sight of the assistants. Further research revealed that the dogs had made an association between the technicians (neutral stimulus) and food (stimulus) and this caused their drooling response. The phenomenon Pavlov observed is now commonly known as classical conditioning.

Classical conditioning involves the pairing of a previously neutral stimulus with an unconditioned stimulus in order to evoke a conditioned response (Slavin 2009:130). A neutral stimulus or conditioned stimulus (CS) is a stimulus to which the organism does not respond in any noticeable way. An unconditioned stimulus (UCS) is one that does lead to a response and when an organism responds to the stimulus unconditionally, without having to learn to do so, it is called an unconditioned response (UCR) (Ormrod 2014:37; Shaffer & Kipp 2014:156). The term 'unconditioned' means that the organism learns to pair the stimulus and the response in a way that is automatic and involuntary (O'Donnell *et al*. 2012:155).

Classical conditioning can be used to understand how people learn a variety of involuntary responses, especially responses associated with emotion. Fear of failure is an example of a response that may be classically conditioned (Ormrod 2014:38-39). An example of this is a student who fails a mathematics test (UCS) may associate all mathematics tests with failure so the mathematics tests become a CS. Pavlov defined an UCS as a reinforcer (Hergenhahn & Olson 2005:4). The mathematics tests become associated with failure and a conditioned response (a learned physiological or emotional response) is therefore produced (Eggen & Kauchak 2013:293).

2.3.1.2 Instrumental conditioning

In 1898 Edward Thorndike (in Hergenhahn & Olson 2005:57) introduced a theory of learning which emphasised the role of experience in the strengthening and weakening of stimulus-response connections. Thorndike conducted an experiment with a hungry cat in a cage from where the cat could see a fish. After a period of trial and error, the cat figured out how to open the door of the cage in order to get to the fish. The cat became quicker and quicker at opening this door. By observing the cat's behaviour, Thorndike concluded that learning consists of trial-and-error behaviour. Some behaviours are gradually strengthened; others are weakened as a result of the consequences that

various behaviours bring about. In short, Thorndike found that responses to a situation that are followed by satisfaction are strengthened (the cat opening the cage gets the fish) whilst responses that are followed by discomfort, are weakened (Gray & Macblain 2012:35; Ormrod 2014:52-53). Thorndike referred to this as the Law of Effect (Gross 2010:163; Hergenhahn & Olson 2005:61; O'Donnell *et al*. 2012:156).

Not all of Thorndike's ideas have stood the test of time (Ormrod 2014:53). Thorndike believed that the majority of learning was acquired through trial and error which later theorists found to be too simplistic. It was also believed that Thorndike was more concerned with explaining the laws of learning than in understanding how thinking, motivation and intentions affect behaviour (Gray & Macblain 2012:35-36).

2.3.1.3 Operant conditioning

One of the best known learning theorists in the behaviourist tradition is B.F. Skinner (in Dymoke 2011:48). In accordance with Thorndike, Skinner proposed that organisms acquire behaviours that are followed by pleasant consequences (Gray & Macblain 2012:5; Ormrod 2014:54). Skinner's laboratory experiments in the 1960s used small animals under controlled conditions. These animals were provided with rewards (or reinforcers) for any response which was near to the desired outcome. Gradually the desired behaviour was brought closer to what was required through the controlled use of stimulus-response associations. Skinner referred to this as the principle of operant conditioning (Dymoke 2011:48-49; Ormrod 2014:54). In short, operant conditioning involves behaviour that is followed by a reinforcer which strengthens the probability of that behaviour reoccurring. Positive and negative reinforcement (in the form of pleasant or unpleasant stimulus) and punishment are also used (Bryant *et al*. 2013:92).

An important element of operant conditioning is a reinforcer which is a stimulus or event that influences the frequency of the response that follows (Hergenhahn & Olson

2005:80; Ormrod 2014:54-55; Slavin 2009:132). Examples of reinforcers used in the classroom are stickers, sweets or approving smiles (O'Donnell *et al*. 2012:156). Skinner identified two types of reinforcers namely positive and negative reinforcers (Gray & Macblain 2012:5; Hergenhahn & Olson 2005:91). Positive reinforcement involves presenting a pleasurable stimulus such as food or praise after the response. Negative reinforcement involves the removal or avoidance of a stimulus. An example could be a parent who may excuse a child from chores (such as washing dishes) if he or she studies during this time (Gross 2010:164; Ormrod 2014:60; Slavin 2009:133).

2.3.1.4 Educational implications of the behavioural theory

For almost 50 years behaviourism has remained a dominant force in education (Gray & Macblain 2012:4, 43; Oakes *et al*. 2013:163). Some of the basic principles of behavioural learning theories (especially the explanation of human behaviour, the changing of behaviour and the consequences of behaviour) still influence approaches to classroom behaviour management (Dymoke 2011:49; Slavin 2009:150). As a philosophy, behaviourism is also very simple as it embodies the notion that behaviour can be explained as a reaction to a response such as rewards and punishment (Bryant *et al.* 2013:94).

Skinner's principle of operant conditioning has proven useful as a powerful explanation of why humans act as they do. Virtually any behaviour (desirable and undesirable) can be learned or modified through operant conditioning. In a classroom setting, disruptive behaviours often get teachers and classmates' attention when more productive behaviours do not (Ormrod 2014:54-55). This explains why students often carry on with disruptive behaviour.

The role of stimulus-response associations is also important. In order to learn and succeed, students need to encounter academic subject matter in a positive climate and

associate it with pleasant emotions. When students associate academic subject matter with good feelings, they are more likely to pursue it of their own accord. However, learning can only be confirmed as taking place when there has been a behavioural change such as higher test scores, improved athletic performance or better study habits (Ormrod 2014:46-48).

Regardless of the positive aspects mentioned above, behaviourism has been criticised by several authors. Slavin (2009:150) pointed out that behaviourism is limited in scope. It focuses almost exclusively on observable behaviour and ignores invisible learning processes such as concept formation and problem solving. Therefore, validating behaviourism is not easy. There are also various forms of behaviourism which all have different viewpoints. However, Bryant *et al*. (2013:96) note that behaviourism has been validated, but such validation is limited in context and scope. With behaviourism, no attempt is made to determine the structure of students' knowledge or to assess which mental processes are important for them to use. Students are characterised as being reactive to conditions in the environment as opposed to taking an active role in discovering the environment (Ertmer & Newby 2013:48). This encourages a controlled approach to learning where students assume a passive role. It also presents a limited view of how people learn as it does not embrace the different situations in which learning can take place, or how people learn from new or one-off experiences without reinforcement (Dymoke 2011:49). In addition, much of the experimentation was done on animals and then generalised to humans. However, humans are different from animals in their thinking and people are not animals who can be confined to boxes as suggested by Skinner. Behaviourism also does not explain why people act in certain ways and why people act differently even if they have had the same experiences (Bryant *et al.* 2013:98).

Much scientific research on learning has revealed alternative perspectives to learning such as cognitivist and constructivist theories (Oakes *et al*. 2013:163). Cognitive theory,

which is a direct outgrowth of behavioural learning (Slavin 2009:150), will be discussed next.

2.3.2 Cognitive theory

In the late 1950s learning theory began to move away from the use of behavioural models to an approach that relied on learning theories and models from the cognitive sciences. Psychologists and educators began to de-emphasise a concern with overt, observable behaviour and stressed instead more complex cognitive processes such as thinking, problem solving, language use, concept formation and information processing (Ertmer & Newby 2013:50; Paciotti 2013:105). This shift from a behavioural orientation to a cognitive orientation led to the development of the cognitive theory of learning (Ertmer & Newby 2013:51).

Cognitive theories stress the acquisition of knowledge, internal mental structures (the students' learning processes) and the processes involved in learning specific tasks (the issue of how information is received, organised, stored and retrieved by the mind) (Ertmer & Newby 2013:51; Reid 2005:9). Cognitive theorists regard learning as being less concerned with what students do, and more with what students know and how students come to acquire it. Students are viewed as very active participants in the learning process (Ertmer & Newby 2013:51).

People can learn a great deal from observing others. In the classroom, students learn many academic skills (such as reading and writing) by watching and imitating what their teachers and classmates do. Such learning by observation and modelling is the focus of the social cognitive theory. This perspective was originally called the social learning theory as it stated that a great deal of human learning involves watching and interacting with other people. In its earliest form this perspective was based largely on behaviourist principles. Currently it includes many cognitivist elements as humans need to encode,

retain and retrieve knowledge of a model's behaviour in order to perform that model's behaviour (O'Donnell *et al.* 2012:268, 286; Ormrod 2014:117; Slavin 2009:146).

According to the cognitive theorists, reinforcement and punishment have little effect on learning and behaviour unless people have a mental awareness of *why* they are being reinforced or punished. Such theorists also believe that attention and retention (memory) are important to incorporate into explanations of how learning occurs (Gray & Macblain 2012:91; Ormrod 2014:118-119, 122).

Three key areas of social cognitive theory namely modelling, vicarious reinforcement and self-regulated learning will be discussed in the next section.

2.3.2.1 Modelling

One of the key social cognitivists, Bandura (in Gray & Macblain 2012:91) noted that the Skinnerian emphasis on the effects of the consequences of behaviour largely ignored the phenomena of modelling (Ormrod 2014:125; Slavin 2009:146-147). Bandura believed that much of human learning is not shaped by its consequences, but is more efficiently learned directly from a model. An example of such would be a physical education teacher who demonstrates jumping jacks and then the students imitate the teacher (Slavin 2009:146-147). Academic skills are also learned more effectively when a model demonstrates not only how to do a task, but also how to think about a task. An example of this is when a teacher models the thinking processes involved in long division (Ormrod 2014:129).

Bandura suggested that four conditions are necessary for an individual to successfully model the behaviour of someone (referred to as observational learning). These conditions are attention, retention, motor reproduction and motivation. In order to imitate a model accurately, a student must first pay attention to the model and especially the

significant aspects of the model's behaviour. After paying attention, the student then needs to remember the behaviour that has been observed (retention), and be able to replicate the behaviour (motor reproduction). Finally, the students need to want to (or be motivated) to demonstrate what they have learned (Ormrod 2014:130, 133; Slavin 2009:146).

2.3.2.2 Vicarious reinforcement

Another important concept of the social cognitive theory is vicarious reinforcement. Bandura (in Gray & Macblain 2012:6) believed that behaviour can be shaped and maintained by reinforcement. He extended this theory to include an important aspect of indirect reinforcement namely vicarious reinforcement. Vicarious reinforcement occurs when an observer sees a model receiving positive reinforcement for exhibiting certain behaviours and then decides to emulate that exact behaviour (O'Donnell *et al.* 2012:257). An example of vicarious reinforcement is when a student watches other students gain popularity amongst the girls by playing a guitar so that student also learns to play the guitar (Ormrod 2014:120).

2.3.2.3 Self-regulated learning

Self-regulation is another important concept of the social cognitive theory. Models and theories of self-regulated learning (SRL) emerged in the 1980s in an effort to try and describe the attributes of academically successful students. According to SRL, students become active participants in the process of monitoring their own learning and controlling their cognition, motivation and behaviour towards successfully completing academic goals. Some key self-regulatory processes that affect learning outcomes include goal setting and time management, self-monitoring and reflection, modification of learning strategies, regulation of feedback, help seeking, and resource oriented learning (Rowe & Rafferty 2013:591; Slavin 2009:148).

Self-regulatory processes can be organized into four stages namely planning and goal setting, self-monitoring, controlling, and reflecting. Within each of these stages, self-regulation processes are structured into the following areas - cognition, motivation, behaviour and context. The self-regulating processes begin in the planning stage with activities like goal setting and recognition of prior knowledge. The cognitive area recognizes the resources and strategies that are helpful in addressing the task. Metacognitive awareness recognizes the difficulty of the task and identifies the knowledge and skills needed for addressing the task. Motivational beliefs influence student behaviour towards the task such as planning time and effort (Rowe & Rafferty 2013:591).

After the planning stage, the self-regulating process moves on to the self-monitoring stage. In this stage students become aware of their own state of cognition and motivation and use of time and effort. Processes in this stage include self-observation of comprehension and competency, as well as an increased awareness of the goals that will subsequently direct behaviours and understanding of how performance will be evaluated. In the controlling stage the students use motivational strategies as well as those strategies related to accomplishing academic tasks. The final stage of reflecting includes evaluations that students make about the overall assessment of the task (Rowe & Rafferty 2013:591).

Educational researchers had found that students who self-regulate their learning activities perform better than students who do not (Rowe & Rafferty 2013:591). Such students are able to facilitate the development of their behavioural skills and habits that will further assist them in learning effectively in other contexts. They are also able to apply appropriate learning strategies in order to improve their academic outcomes (Veloo, Hong & Lee 2015:3).

2.3.2.4 Educational implications of the cognitivist theory

Cognitivism is a rapidly developing field. Newer research validates much of what is known about cognitivism namely that humans have the innate faculty to construct knowledge through building and adjusting schemata as they continue to interact with their environment (Paciotti 2013:110). However, there have been criticisms of cognitivism. One such criticism is that cognitivism has failed to provide a detailed account of the mental activities it purports to study (Paciotti 2013:112).

Since the 1960s psychologists and other specialists have learned a great deal about how children learn. All of them agree that learning is not simply responding to stimuli (as proposed by the behaviourists), but is an active experience. Teachers cannot simply *give* students knowledge - students need to construct knowledge in their own minds. In short, students need to *create* meaning as opposed to *acquiring* it (Ertmer & Newby 2013:55; Oakes *et al*. 2013:166; Slavin 2009:231). Such ideas have led to the development of a third theory of learning namely constructivism which will be discussed next.

2.3.3 Constructivist theories

The meaning and understanding of knowledge is gained in a process that depends on existing knowledge and experience, students' cognitive operations and the learning activities that students engage in (Dennick 2012:618; Isman 2011:138). Theories of learning based on these ideas are called constructivist theories (Slavin 2009:231). Constructivism is not a single theory of learning but includes a number of different theories all of which view students as active participants in constructing understanding (O'Donnell *et al.* 2012:268). These learning theories have come to dominate current thinking in education and have been embraced by nearly every educational reform

initiative within the last two decades (Ertmer & Newby 2013:55; Hartle, Baviskar & Smith 2012:31; Slavin 2009:239).

Only when students realise that their prior knowledge is insufficient or inappropriate to understand something, will they become motivated to modify their constructs. The realisation that their current constructs do not match their needs is called cognitive dissonance and can be identified by the wrinkled brows of students indicating confusion. When students are presented with information or puzzles that their current constructs cannot account for, they often look confused. In order for learning to occur, a new construct must therefore be developed. This will involve breaking down neural connections and remaking them. This takes time, uses energy and requires effort (Hartle *et al*. 2012:33). In order to redevelop a construct, students have to be motivated to relate their own personal experiences to the learned information in order to produce understanding (Isman 2011:138).

Constructivist strategies are often viewed as student-centred instruction. The teacher becomes the ‘guide on the side’ instead of the ‘sage on the stage’. In short, teachers can give students ladders that lead to higher understanding, yet the students themselves must climb the ladders (Dymoke 2011:50; Gray & Macblain 2012:5; Hartle *et al.* 2012:32; Morrison 2006:104; Slavin 2009:231, 236, 258). Constructivism assumes that learning can only take place when students are actively engaged with the topic and construct their own knowledge bases. Because of this need for engagement, many constructivist-based teaching methods use student directed activities. However, in order to be based in constructivism, a lesson must build on the prior knowledge of the students which involves much more than simply ‘letting the students do what they want’ (Hartle *et al.* 2012:32).

Key figures in this field are Piaget, Vygotsky and Bruner who will all be discussed next.

2.3.3.1 Piaget

Piaget (1970) devised the theory of cognitive development. This theory is based on the premise that humans generate knowledge and meaning from the interaction between their experiences and their ideas. The popularity of this theory grew from the fact that it offered one of the first theories about the emergence and development of children's thinking (Gray & Macblain 2012:44).

Piaget believed that the child is powerfully and actively engaged in the learning process. He also further believed that cognitive development in a child follows four stages and sub-stages (Gray & Macblain 2012:46; Reid 2005:10). These four stages were defined as sensory-motor (from birth to two years), pre-operational (two to seven years), concrete operational (seven to 12 years) and formal operational (12 years and older, but not attained by all). All children, irrespective of their culture or race, follow the same developmental pathway (Dymoke 2011:50-51; Gray & Macblain 2012:5).

The popularity of Piaget's theory waned in the late 1970s. Opponents to his theory argued that Piaget did not explain why a child is driven to progress from one cognitive stage to another, nor did he explain why learning could never be accelerated, and little emphasis was placed on the teacher (Gray & Macblain 2012:59-60). Despite these criticisms, Piaget still retains a strong presence in education. Teachers continue to ask open-ended questions to foster and develop students' thinking. They observe students and focus on the process rather than on the output of learning. Piaget's theory also fuelled interest in child development and led to others developing alternative theories (Gray & Macblain 2012:62-63).

2.3.3.2 Vygotsky

Modern constructivist thought draws heavily on Vygotsky's theories (Slavin 2009:231). Vygotsky (1978) believed that all aspects of learning have a history based on real life experiential learning, much of which is learned before a child even starts formal education. Vygotsky pointed out that children do not develop in isolation but in a social matrix which is formed by the interconnection of social relationships such as the interactions between themselves and other people like parents, siblings, peers, teachers and significant objects like books or favourite toys. Like Piaget, he believed that infants were born with the basic building blocks of cognition which includes visual recognition, memory, attention and the ability to process information quickly. This enables the child to develop higher order thinking skills such as problem-solving, reasoning, planning and remembering. The child therefore has an innate ability to learn through instruction (Gray & Macblain 2012:70-72).

Vygotsky (1978) also coined the term zone of proximal development (ZPD). ZPD defines the distance which exists between the actual developmental level of learning, and what potentially could be learned through problem-solving with the guidance of a parent, grandparent, sibling or other adult such as a teacher or more capable peers. This is known as targeted assistance (Dymoke 2011:51; Gray & Macblain 2012:77; Oakes *et al.* 2013:164; Reid 2005:7). Students learn best when the concepts they need to know are in their ZPD (Slavin 2009:232).

Vygotsky's (1978) work was very influential in the latter part of the 20th century. Unfortunately he died at an early age so much of his work and research is underdeveloped. Despite this, Vygotsky's notion of learning has made significant contributions to the cultural development of students in a wide range of contexts (Dymoke 2011:51). However, there have been many criticisms of Vygotsky's theories as

some believe that they are incomplete and lack sophistication (Gray & Macblain 2012:83).

2.3.3.3 Bruner

Bruner (1966) was influenced by both Vygotsky (1978) and Piaget's (1970) ideas about cognitive development in children. During the 1940s Bruner's early work focused on the impact of needs, motivation and expectations and their influences on perception. He emphasised action and problem solving in children's learning. He underlined the role of social interaction, language and instruction in the development of thinking. He devised the concept of scaffolding which is the type of support children need to achieve their ZPD (Gray & Macblain 2012:7).

Bruner (1966) did not view learning as something that happens to individuals, but more as a process in which the individual is actively engaged. This idea is central to Bruner's theory of learning and differs markedly from that of early behaviourists who saw learning more in terms of stimuli and responses. Bruner (1966) was chiefly concerned with what occurs within an individual's thinking between the time a stimuli is emitted and the time that individual responds. At the heart of Bruner's theory is the idea that individuals represent the world they live in, and as such, their learning occurs through various modes namely the inactive mode (concerned with actions), the iconic mode (concerned with images and pictures) and the symbolic mode (concerned with words, symbols and language) (Gray & Macblain 2012:108-109).

Bruner (1966) also took great care to emphasise the importance of culture. His arguments shaped thinking and the manner in which the understanding of ourselves and the world in which we live is constructed. Bruner (1966) viewed the manner in which children are supported with their learning at school as being central to the development of their thinking, learning and potential. Bruner (in Gray & Macblain

2012:114) suggested that children could be very involved in moving their own learning forward by undertaking more demanding and challenging tasks provided they are properly supported (Gray & Macblain 2012:114).

Bruner (in Gray & Macblain 2012:116) also viewed children's level of interest in a subject as being one of the best stimuli to their learning. He placed great importance upon learning through discovery and by engaging in problem solving. He suggested that children would use previous knowledge and life experiences to build new knowledge and skills and further develop their thinking. Discovery learning is viewed by those who strongly advocate it as being a means for strengthening the internalisation of meaning and the conceptualisation of new facts into existing knowledge. However, there are problems with discovery learning. Misconceptions maybe acquired and these may go unnoticed by adults managing the learning. Some parents also view discovery learning as underused time (Gray & Macblain 2012:116).

2.3.3.4 Educational implications of the constructivist theory

Constructivist approaches are considered critical to producing deeper understanding and internalising material. An advantage of this is that students who construct their own knowledge have superior generalisation skills, can develop first-class critical thinking skills and have a longer retention of learning (Narayan, Rodriguez, Araujo, Shaqlaih & Moss 2013:169).

However, there have been several criticisms of constructivism. The most prevalent concern seems to be the fragmented and incoherent character of the literature on this theory. This lack of clarity has contributed to misunderstandings of major tenets of the theory. As a result, teachers are being challenged to balance the objective specific curriculum with the more open-ended constructivist methods valued in teacher preparation programmes. There are also perceptions that there is not a wide body of

knowledge associated with constructivism, and therefore teachers who follow this theory have an 'anything goes' attitude towards learning (Narayan *et al*. 2013:173).

Ertmer and Newby (2013:61) suggest that one should not consciously choose one learning theory over another, but should rather stress the usefulness of being well-versed in each of the theories outlined above. These authors are not suggesting that one should work without a theory, but rather that one must be able to intelligently choose, on the basis of information gathered about the students' present levels of competence and the type of learning task, the appropriate methods for achieving optimal instructional outcomes in a particular situation.

A summary of the key aspects of the different learning theories discussed in section 2.3 is shown in Table 2.1.

Table 2.1: Summary of key aspects of different learning theories

	Behaviourism (see section 2.3.1)	**Cognitivism** (see section 2.3.2)	**Constructivism** (see section 2.3.3)
What is learning?	Learning is explained in terms of observable behaviour and how these behaviours are influenced by stimuli from the environment.	Learning is what students know and how students come to acquire it. Students are active participants in learning process.	Learning takes place when students are actively engaged with the topic and construct their own knowledge bases. Student-based learning.
Focus	How do stimuli elicit responses and how, if the responses are rewarded, they become learned.	Acquisition of knowledge, the student's learning processes and how information is received, organised, stored and retrieved by the mind.	Lessons are built on the prior knowledge of the students. Students then construct new meaning based on prior knowledge.
Key theorists	Pavlov; Thorndike; Skinner	Bandura	Vygotsky; Piaget; Bruner
Key concepts	Classical conditioning; Instrumental conditioning; Operant conditioning.	Modelling; Vicarious reinforcement; self-regulated learning.	Cognitive development (Piaget); ZPD (Vygotsky); Discovery learning (Bruner).

Table 2.1 illustrates how the three main learning theories differ with regard to how they define learning and their main focus.

These learning theories do not reveal the whole puzzle. The process of learning can be argued as being one of the central elements in the broad field of education. Teachers have continuously sought ways to improve their delivery so that the increasing numbers of diverse students in their classrooms learn and achieve on the academic front. Although it is well recognised that the general cognitive ability of individual students may play a significant role in overall learning outcomes, this is understood to be only part of the answer. One of many additional pieces of the puzzle which is needed to improve the learning and academic outcomes picture is an understanding of the student's individual learning style (Azevedo & Akdere 2010:192). These learning styles form the basis of the discussion in the next section where the concept of learning styles will be explored and the different types of learning style models will be examined.

2.4 LEARNING STYLES

The concept of learning styles was introduced in the 1960s. It was based on the principle that all individuals are capable of learning, but vary enormously in the speed and manner in which they pick up new information and ideas, and the confidence with which they process and use them. This all translates into students having their own styles of learning or 'learning fingerprints' which create a landscape by which they will either maintain or restrain their own learning (Coffield, Moseley, Hall & Ecclestone 2004:1; Daghani & Akkoyunlu 2012:123; Gappi 2013:70; Reid 2005:5; Sadeghi *et al*. 2012:117). However, students can and should develop their abilities to use those learning styles which are not their natural modes and preferences (Hawk & Shah 2007:14).

When teachers recognise that students have different learning styles, they start to become more sensitive to these students' individual differences and needs in the

classroom. This could ultimately enhance the teachers' teaching practices (Gappi 2013:70). Unfortunately, when the students' learning styles and the teacher's learning styles do not match, the students are likely to become uncomfortable, bored and inattentive in class, do poorly in tests and ultimately become unmotivated (Felder & Spurlin 2005:103). Teachers need to help students discover their own learning styles and provide constructive feedback about the advantages and disadvantages of these various styles. Teachers also need to respect students' learning styles and encourage their development whilst at the same time creating opportunities for the students to experiment with other ways of learning (Farajolahi & Nimvari 2014:159).

When students are made aware of their learning styles and strategies, they are not only more prepared for learning, but also more analytic about their learning styles and the strategies they use. Knowledge of one's own learning style is essential in 'learning to learn' as it enables students to take control of their learning whilst still allowing them to maximise their potential for learning (Farajolahi & Nimvari 2014:159). Therefore, learning styles can be seen to be students' comfort zones or educational conditions under which they learn best (Tuan 2011:287).

Learning styles, according to Reid (2005:56), also overlap with other important aspects of learning such as learning theories, learning strategies, intellectual styles, thinking styles, multiple intelligences, cognitive styles, metacognition types and teaching styles. Learning styles are often added to the concept of learning strategies. Learning strategies can be defined as the unconscious or conscious choices of the student or the teacher (Bostrom 2012:15). Zhou (2011:74) defines learning strategies as an external skill that students use, often consciously, to improve their learning. Donche, De Maeyer, Coertjens, Van Daal and Van Petegem (2013:239) state that learning strategies are closely linked to how students think about learning and teaching (mental models of learning) and their motivation to study or learning orientation. Other authors refer to learning styles as intellectual styles (Zhang, Sternberg & Fan 2013:225).

Many educational researchers have examined the issue of learning styles and have introduced a wide range of models to diagnose an individual's learning style and predict preferred learning processes in the formal classroom setting (Bostrom 2012:13; Brown *et al*. 2013:207). Many of these models focus on relatively narrow aspects of learning styles such as a preference for visual input. Others are far more elaborate and focus on factors associated with personality issues. Some approaches attempt to identify how individuals process information in terms of cognitive style and others emphasise the body's role in learning (Coffield *et al.* 2004:1; Daghani & Akkoyunlu 2012:123; Reid 2005:67; Slavin 2009:120). Other models view learning styles as being stable and influenced by inherited traits, whilst some models are the outcome of the dynamic interplay between self and experience. Another group of theorists claim that learning styles are flexible and influenced by motivational and environmental factors (Kablan & Kaya 2013:48). Each model therefore has its own definition of learning style (Hawk & Shah 2007:14).

There are at least 100 learning styles instruments showing much conceptual overlap among them (Aliakbari & Qasemi 2012:275). A learning style instrument is defined as a questionnaire that assists individuals to evaluate their best way of learning and defines their learning style (Amran, Bahry, Yusop and Abdullah 2011:328). The major families of learning styles, according to Coffield *et al*. (2004:8, 10), are as follows:

- learning styles and preferences which are based on the beliefs about the influence of genetics on fixed inherited traits (e.g. VAK/VARK, Dunn and Dunn and Gregorc),
- learning styles with deep-seated features of the cognitive structure including 'patterns of ability' (e.g. Riding),
- learning styles being one component of a relatively stable personality type (e.g. Apter, Jackson and Myers-Briggs),
- learning styles being flexible stable learning preferences (e.g. Allinson and Hayes, Honey and Mumford, Kolb and Felder and Silverman), and

- learning approaches, strategies, orientations and conceptions of learning (e.g. Entwistle, Sternberg and Vermunt).

Some of the major models which will be discussed in the next section are Kolb's Learning Style Inventory, Honey and Mumford, Dunn and Dunn, Gregorc Style Delineator, Felder and Silverman's learning style model and the VARK learning style model. More details will be given on the VARK learning style model as parts of this model will be used in the design of the questionnaire (see Chapter 4).

2.4.1 Kolb's Learning Style Inventory

One of the most influential models of learning styles was developed by David Kolb. Kolb (in Hawk & Shah 2007:3) defines a learning style as the generalised differences in learning orientation based on the degree to which people emphasise the four modes of the learning process. According to Kolb, a learning style is not a fixed trait but a differential preference for learning which changes slightly from situation to situation (Azevedo & Akdere 2010:192; Bhatti & Bart 2013:2; Coffield *et al*. 2004:60; JilardiDamavandi, Mahyuddin, Elias, Daud & Shabani 2011:187; Platsidou & Metallidou 2009:324).

Kolb also views learning as a holistic set of continuous processes with less emphasis being placed on outcomes (Hawk & Shah 2007:3). In the early 1970s Kolb's theory of experiential learning and the instrument which he devised to test the theory, the Learning Style Inventory (LSI), generated a very considerable body of research. Kolb (1984) was dissatisfied with the traditional methods of teaching students. This led him to experiment with experiential teaching methods. During this process he observed that some students had definite preferences for some activities (such as exercises), but not others (such as formal lectures). From these observations emerged the idea of an inventory that would identify preferences for learning by capturing individual learning differences (Coffield *et al*. 2004:60). Kolb (1984) designed and later refined the

inventory into a self-report LSI which was used to assess learning styles derived from his experiential learning theory.

The LSI is one of the most widely distributed instruments used to assess learning styles and claims to provide a valuable framework for the design and management of learning activities. It is essentially used to describe the way an individual learns and deals with ideas and daily situations. The LSI is based on a bipolar view of two learning continuums namely *perception* and *programming*. The vertical axis looks at how the student takes in information through either concrete experimentation (CE) or abstract conceptualisation (AC). The horizontal axis measures how students interact with information which can be either through active experimentation (AE) or reflective observation (RO) (Castro & Peck 2005:402-403; Duman 2010:2079; Pritchard 2014:55) (refer to Figure 2.1 below).

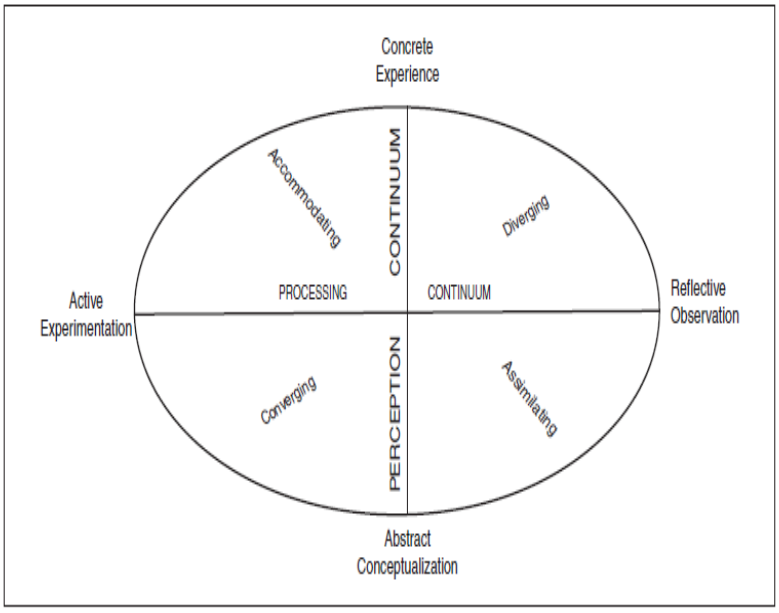


Figure 2.1: Kolb's learning styles model

Source: Azevedo & Akdere (2010:193)

The different learning modes identified in Figure 2.1 (see above) are described by Barmeyer (2004:581) who states the following:

- A high score on CE represents a receptive, experience-based approach to learning. These individuals rely heavily on feeling-based judgments. High CE individuals tend to be 'people oriented'. They learn best from specific examples in which they can become involved such as discussions.
- A high score on RO indicates a tentative and reflective approach to learning. Such individuals rely heavily on careful observation and prefer learning situations such as lectures.
- A high score on AC indicates an analytical and conceptual approach to learning. These individuals rely on logical thinking and rational evaluation. They tend to be more oriented towards things and symbols and less toward other people. They learn best from impersonal learning situations.
- A high score on AE indicates an active orientation that relies on experimentation. These individuals learn best from projects and dislike passive learning situations.

A combination of these learning modes yields four types of learning styles namely convergers, divergers, assimilators and accommodators (Bhatti & Bart 2013:1; Reid 2005:61, 68). The most effective and complete learning takes place when learning activities embrace all four modes. However, depending on the individual's preferences, learning may start at any one of the other modes in the cycle (Hawk & Shah 2007:3).

As stated earlier, the four types of learning styles, according to Kolb (1984), are convergers, divergers, assimilators and accommodators. Each one of these will be explained below:

- **Convergers** are good at solving problems and making decisions. They like to make the abstract concrete. They are quite good at taking practical advantage of ideas and theories. Among their other strengths are skills of deductive reasoning and problem-detecting. They prefer technical tasks to interpersonal issues

(Bennett 2013:146; Duman 2010:2079; Dymoke 2011:55; Yilmaz-Soylu & Akkoyunlu 2009:45).

- **Divergers** are imaginative and enjoy coming up with new ideas. They are interested in people, values and feelings and are keen on viewing situations from many perspectives. They enjoy producing ideas through methods such as brainstorming. Individuals who have this learning style are able to see concrete situations from different perspectives. Their approach to events is limited to observing rather than taking action. They have vast cultural knowledge and enjoy collecting information. Among the remarkable strengths of divergers are creativity, understanding others, being aware of problems and developing a significant perspective about an event by brainstorming (Duman 2010:2079; Dymoke 2011:55; Yilmaz-Soylu & Akkoyunlu 2009:45).
- **Assimilators** are abstract conceptualisers. Individuals having this learning style are able to comprehend and transform comprehensive information into a meaningful whole. They prefer dealing with abstract concepts and topics rather than working with people. They generally attach more importance to logical validity of theories than to their practical value. They are good at planning, creating models, defining problems and developing theories. Such people can be used to organise information, create conceptual models, test theories and ideas, design experiments and carry out quantitative data analysis (Bennett 2013:146; Dymoke 2011:55; Duman 2010:2080; Yilmaz-Soylu & Akkoyunlu 2009:45).
- **Accommodators** prefer concrete examples. They take action readily, prefer acting on the basis of their feelings rather than on the basis of mental analyses and they acquire information through dialogues with people rather than through technical analyses. The most outstanding strengths of students with this type of learning style are practicality, leadership and courage to take risks (Bennett 2013:146; Duman 2010:2079; Yilmaz-Soylu & Akkoyunlu 2009:45).

Figure 2.2 (see below) shows the characteristics which have been highlighted above regarding Kolb's learning style model.

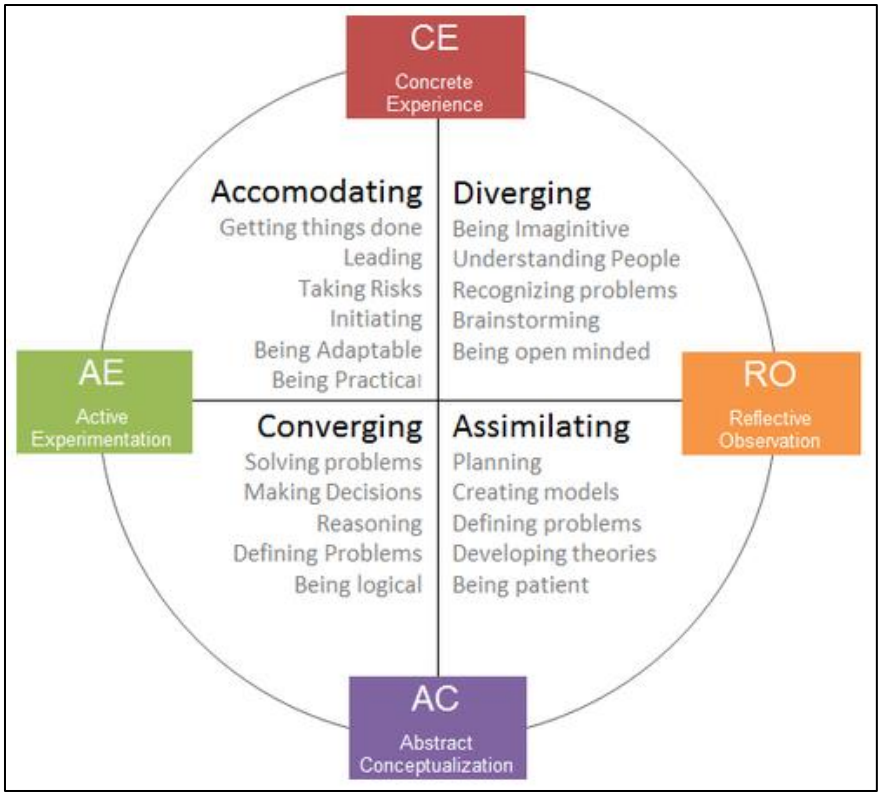


Figure 2.2: Characteristics of Kolb's learning styles model

Source: Barmeyer (2004:282)

Effective students are able to use each of the above four mentioned learning styles rather than only rely on their preferred style (Dymoke 2011:55; Platsidou & Metallidou 2009:324). However, all students have a preferred learning style even though they can develop others with practice (Bennett 2013:146; Castro & Peck 2005:402; Yilmaz-Soylu & Akkoyunlu 2009:44).

The Kolb model has many advantages. The questionnaire is relatively simple to administer and score and it has demonstrated a high degree of reliability (JilardiDamavandi *et al*. 2011:188). It is also the most researched, critiqued and replicated of the myriad of LSIs (Aliakbari & Qasemi 2012:275). However, Kolb's model has been criticised for being too complex (Brown *et al*. 2013: 207).

2.4.2 Honey and Mumford

In 1982 Peter Honey and Alan Mumford (in Fee 2011:33) published a learning style classification based on Kolb's (1984) learning cycle (see section 2.4.1). They took the four phases of Kolb's cycle (i.e., having an experience, reviewing the experience, concluding from the experience and planning the next steps) and identified each one with a particular learning style. Honey and Mumford's Learning Styles Questionnaire (LSQ) has been applied to a wide range of subjects and is also used in higher education (Honey & Mumford 1992:4; Wichadee 2013:106).

Honey and Mumford defined the term 'learning styles' as 'a description of the attitudes and behaviours which determine an individual's preferred way of learning'. According to them learning styles are learned as people repeat strategies and tactics which were found to be successful and discontinue using those that were not. These styles are strengthened as people gravitate towards careers that are compatible with their preferred learning style (Honey & Mumford 1992:3, 5).

In their model (see Figure 2.3) Honey and Mumford identified the following four different learning styles which are connected to the different stages in Kolb's learning cycle (see section 2.4.1):

- **Activist** (connected to stage 1 of Kolb's learning cycle – 'Having an experience')
  Key characteristics - they like to do things; welcome new challenges and experiences; accumulate concrete experiences; work best with other people or in a team where there are few rules and regulations; often take unnecessary risks and rush into action without proper preparation.
- **Reflector** (connected to stage 2 of Kolb's learning cycle – 'Reviewing the experience')
  Key characteristics - they prefer to spend time reviewing an experience and reflecting upon problems; reflect well before acting; are good listeners; like to research and evaluate issues; have a tendency to hold back from direct

participation; are slow to make up their minds and reach a decision; have the tendency to be too cautious; do not take enough risks and are not assertive.

- **Theorist** (connected to stage 3 of Kolb's learning cycle – 'Concluding from the experience')

  Key characteristics **-** they are logical; objective; pay great attention to detail; focus on understanding concepts; like to see the overall picture of a problem and analyse information; are restricted in lateral thinking; have a low tolerance for uncertainty, disorder and ambiguity; intolerant of anything subjective or intuitive and are full of 'shoulds, oughts and musts', and
- **Pragmatist** (connected to stage 4 of Kolb's learning cycle – 'Planning the next steps').

  Key characteristics - they prefer to plan; solve problems; are practical; explore options; test theories; learn best from understanding the real world applications but are not very interested in theory or basic principles; have the tendency to seize on the first expedient solution to a problem; are impatient with indecision and are more task-oriented than people-oriented (Coffield *et al*. 2004:72; Fee 2011:33-34; Honey & Mumford 1992:5-6; Reid 2005:62; Wichadee 2013:106).

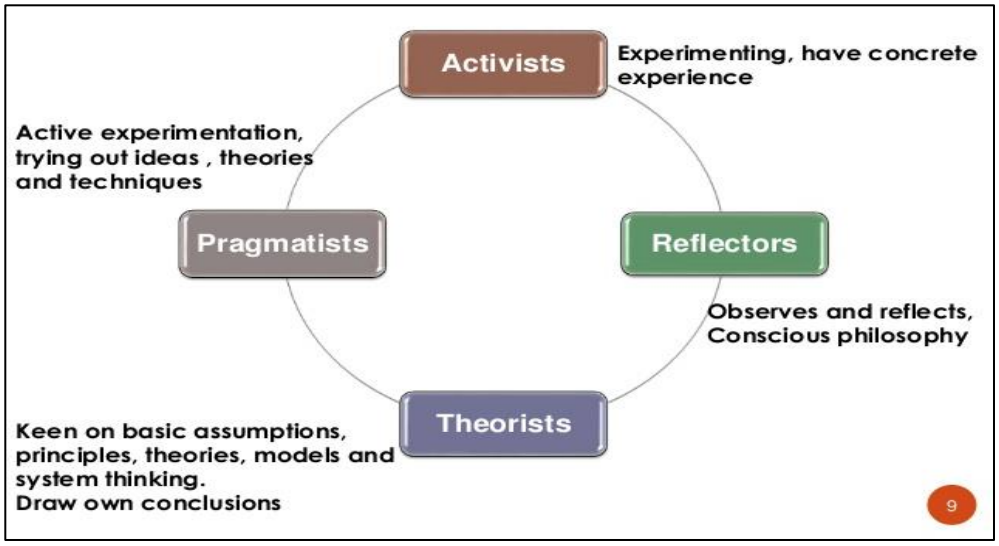


Figure 2.3: Honey and Mumford's learning styles model

Source: Mukherjee (2015)

The current version of the LSQ consists of 80 items which probe preferences for the four learning styles as mentioned earlier. The manual for the LSQ contains a variety of suggestions to help students strengthen an underutilised style. This includes keeping a learning log to encourage students to review their experiences, referring to lessons they have learned from and forming plans to do something better or different. Learning preferences that have been learned can be modified and improved upon (Coffield *et al*. 2004:73).

Honey and Mumford's learning styles model has many strong points. One of the main strengths of the LSQ, according to Coffield *et al*. (2004:76), is that it is not a psychometric instrument but rather a checklist which probes the attitudes and behaviours which determine learning preferences. Another strong point is that it can help students strengthen an under-utilised style. Other advantages of this model are that the different learning styles are easy to remember, they reinforce the stages people go through in order to be balanced students and are widely understood and are therefore accepted and used by many students (Honey & Mumford 1992:17). The LSQ is also modifiable at will as an underdeveloped style can be strengthened (Coffield *et al.* 2004:71).

Coffield *et al*. (2004:76) outlines some of the problems that have been identified with the LSQ such as the danger of labelling people as 'theorists' or 'pragmatists' when most people exhibit more than one strong preference. In addition, only moderate internal consistency has been found.

2.4.3 The Dunn and Dunn learning styles model

The Dunn and Dunn approach to learning styles is considered to be one of the major learning style theories (Englander, Terregrossa & Wang 2013:108) and enjoys substantial support (Hermond 2014:49). It is one of the most widespread, researched and practised learning styles theories. According to this model, most people have

learning style preferences, however, the individual style features are significantly different. These style features vary depending on academic achievement, gender, age, culture, and information processing (Bostrom 2012:13-14).

Dunn (in Hawk & Shah 2007:9) defines learning style as “the way in which individuals begin to concentrate on, process, internalize, and retain new and difficult information”. The interaction of these elements occurs differently in everyone. It is therefore necessary to determine what is most likely to trigger students’ concentration, how to maintain this concentration, and how to respond to their natural processing style in order to produce long-term memory and retention. In order to reveal these natural tendencies and styles, the Productivity Environmental Preference Survey (PEPS) was developed. This questionnaire identifies each student's strengths and preferences across a full spectrum of physiological, sociological, psychological, emotional, and environmental elements (Dunn & Burke 2005:2).

The Dunn and Dunn model (see Figure 2.4 below) consists of five learning style stimuli and several elements within each stimulus. The five stimuli and their respective elements are Environmental (sound, light, temperature and room design); Emotional (motivation, persistence, responsibility and structure); Sociological (learning alone, in a pair, with peers, with a teacher and mixed); Physiological (perceptual intake while learning, chronological energy pattern and mobility needs), and Psychological Processing (global or analytic, hemisphericity, and impulsive or reflective) (Dunn & Burke 2005:2).

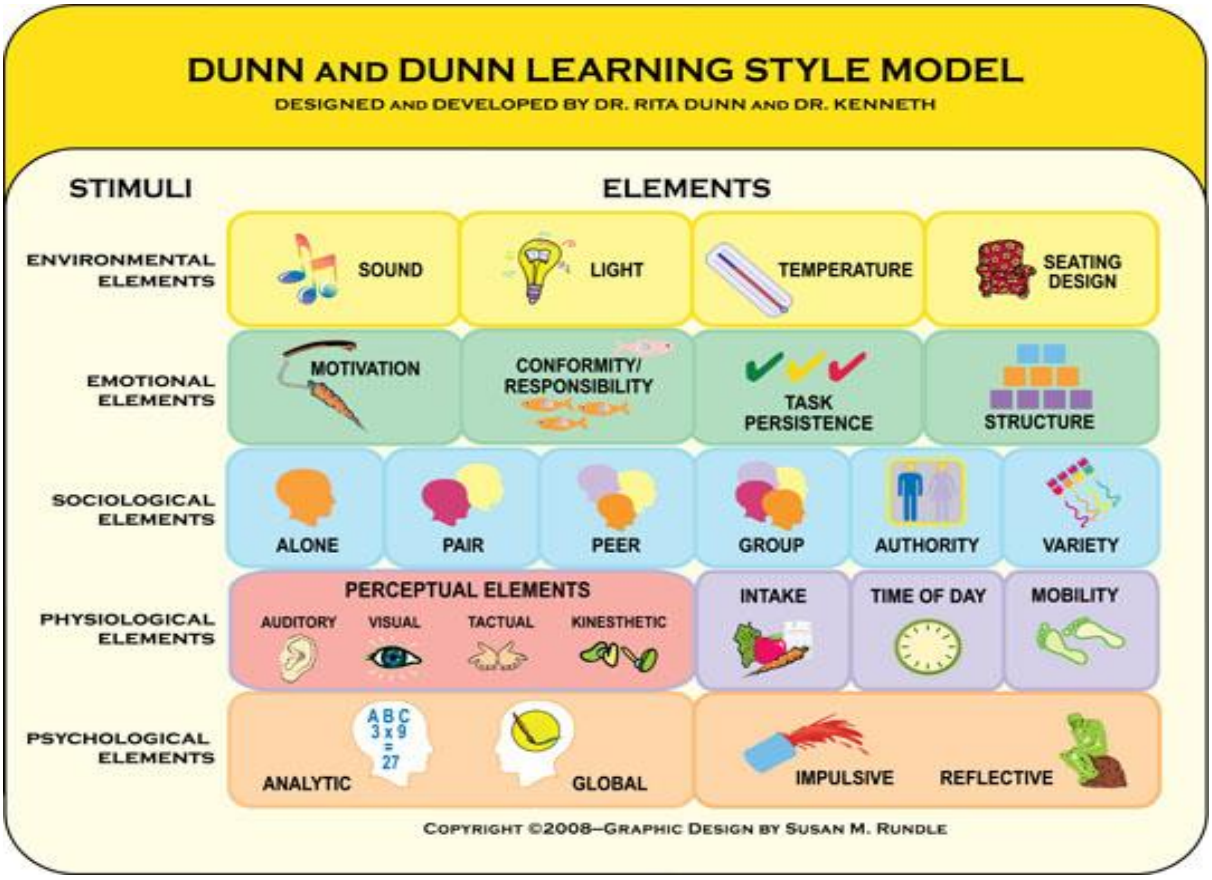


Figure 2.4: Learning style model of Dunn and Dunn

Source: Dunn & Burke (2005:1)

The results of the PEPS show what learning styles the student prefers. These different learning styles are explained in the next sections.

2.4.3.1 Global versus analytic processing (psychological element)

An analytic student can be characterised as one who learns most easily when information is presented step by step in a cumulative, sequential pattern that builds toward conceptual understanding. Global students, on the other hand, learn more easily when they either understand the concept first and can then concentrate on the details,

or are introduced to the information through a story or anecdote replete with visual examples. Both types of reasoning (namely analytic and global) are a reflection of an individual's attempt to optimise the efficient use of neural space-brain capacity. Therefore, both global and analytic students are capable of mastering the same information or skills if they are taught through instructional techniques that address their respective styles (Dunn & Burke 2005:4).

The majority of elementary school students have global learning styles. However, as children age and advance in school, some of them become more analytic. Additionally, analytic and global students appear to have different environmental and physiological needs. Analytics tend to prefer learning in quiet, well-lit, formal settings and often possess a strong emotional need to complete tasks they begin. They rarely feel the need to eat or drink while learning. Global students, on the other hand, prefer subtle distractions while they learn. They often concentrate best with background sound (music or conversation), soft lighting, informal and comfortable seating arrangements, food intake and breaks while studying. They also prefer to work on several tasks simultaneously (Dunn & Burke 2005:4-5).

2.4.3.2 Impact of environmental factors on learning

Students register different responses to a number of environmental factors while learning. Some prefer to study with background music; others prefer quiet; some prefer bright lighting; others prefer dim lighting; some prefer warm environments, others cool; and so on. It is very important to identify and address these environmental preferences. Students have shown higher retention rates, better attitudes and greater achievement when the instructional environment is suited to their individual preferences. Many studies have supported these findings across all grade levels, including several that demonstrate significant improvement in various curriculum areas when environmental preferences are realised. An example is given of a student who is seated in a hard chair (like the traditional wood or steel school desk). The resulting stress of sitting on such an

uncomfortable chair is fatigue, discomfort and frequent postural changes for which students are scolded daily. More informal or comfortable seating can improve students' attitudes and increase their attention span (Dunn & Burke 2005:5).

2.4.3.3 Sociological factors that influence learning

Many teachers present new material and instruct their students in a direct, didactic fashion. Students who have difficulty absorbing and retaining the new information are considered inattentive. Few teachers realise that despite the quality of the teaching, some children are incapable of learning from an adult in a conventional classroom situation. These young people are uncomfortable and usually too tense when under pressure to concentrate in teacher-dominated and authoritative situations. For such adolescents, learning either alone or with peers is a better alternative than working directly with their teachers in either an individual or group session. Four studies have examined the effects of these sociological preferences on attitude towards learning, and have found statistically higher aptitude-test scores when students were taught in ways that complemented their learning preferences (Dunn & Burke 2005:5-6).

2.4.3.4 Physiological learning-style preferences

Physiological elements that can influence learning include perceptual elements, food intake, time of day and degree of mobility. Each of these elements is examined below:

- Perceptual: Perceptual strengths or preferences often are not identified or are under-targeted in the learning environment. The four modalities or types of perceptual preferences are auditory, visual, tactual and kinaesthetic. Considering that most children are not auditory, it is rare for students to remember 75% of what is said to them in a typical class period. This means that lectures, discussions and questioning are the least-effective methods of teaching (Dunn & Burke 2005:6).

- Food intake: this element relates to whether students need to eat, drink, chew or bite on objects whilst learning (Dunn 1990:226).
- Time of day: Task efficiency is related to *when* a student is likely to learn best. Several studies have shown that matching students' time preferences with instructional study and testing schedules resulted in significant academic gains. Most students are not alert early in the morning. Most middle-school students experience their strongest energy between 10:00am and 2:00pm with only 28% being classified as 'morning people' (Dunn & Burke 2005:6).
- Mobility: Students who are restless, apparently disinterested and sometimes disruptive often are mislabelled as hyperactive. Most students exhibiting these characteristics are not clinically hyperactive but are normal children in need of mobility. The less interested the students are in the material being taught, the more mobility they require. Studies show that approximately 95% of these so-called hyperactive students are male. When the same characteristics are observed in girls, they are correlated with a high degree of academic achievement (Dunn & Burke 2005:6).

Teachers are advised to use such a learning style diagnosis when trying to adapt instruction and environmental conditions. Students need to be allowed to work with their strong preferences and to avoid, as far as possible, activities for which they report having very low preferences. Students who have no high or low preferences do not need 'matching' and can therefore adapt more easily to different teaching styles and activities. According to Rita Dunn (in Coffield *et al*. 2004:21, 23), the inability of schools and teachers to take into account the learning style preferences of students has resulted in endemic low achievement and poor motivation. Such a situation needs to be challenged by parents, professionals and researchers.

Learning styles can vary amongst family members. Mothers and fathers tend to have diametrically opposite learning styles. Children often reflect the partial style of one parent but not the other. Siblings learn differently from each other, and offspring do not

necessarily reflect either parent's styles. Because of the difference between their styles, one sibling may perform well while another may perform inadequately or unevenly in traditional schools that primarily respond to the styles of motivated, conforming and analytic students. Preferences for learning styles can also change over time. However, during a period in which an individual has a strong style preference, that person will achieve most easily when taught with strategies and resources that complement these preferences. Although many people can learn basic information through an incompatible style, most learn through their learning-style strengths. No single style is better or worse than any other. Everyone can learn; they all just learn differently (Dunn & Burke 2005:3).

The PEPS is a useful tool for arriving at valid conclusions about a student's learning styles as it has a high reliability as well as excellent face and construct validity (Bostrom 2012:15). The PEPS measures preferences rather than strengths or weaknesses. It does not stigmatise different types of learning preferences. Supporters of this model argue that anyone can improve their achievement and motivation if their teachers match their preferences with individualised instruction. Teachers also need to make changes to the environment especially with regard to food and drink intake, time-of-day activities and opportunities to work alone or with others (Coffield *et al*. 2004:21). The PEPS is also considered to be user-friendly (Coffield *et al.* 2004:35).

Coffield *et al*. (2004:35) outline some of the weaknesses of Dunn and Dunn's learning style model. They state that the model makes simplistic connections between physiological and psychological preferences and brain activity. It is a model of instructional preferences and not learning. It is unsophisticated in its adoption of ideas from other fields such as modality preference, circadian rhythm and hemispheric dominance. Other critics have highlighted major problems regarding the design and reliability of key instruments used in the model indicating a lack of evidence of validity of the model and there is also a serious lack of independent evaluation of the PEPS (Coffield *et al.* 2004:35).

2.4.4 Gregorc Style Delineator

Anthony Gregorc (in Coffield *et al*. 2004:15) developed and published an instrument called the Gregorc Style Delineator (GSD) in 1982 although the model underlying it was conceived earlier. The model itself is based in phenomenological research as well as Kolb's experiential learning cycle. In the model learning styles are defined as "distinctive and observable behaviours that provide clues about the mediation abilities of individuals and how their minds relate to the world and, therefore, how they learn" (Hawk & Shah 2007:5).

The model developed by Gregorc (Mind Styles Model) is a metaphysical one in which minds interact with their environments through 'channels', the four most important of which are measured by the GSD. These four channels are said to mediate ways of receiving and expressing information and have the following descriptors: concrete sequential (CS), abstract sequential (AS), abstract random (AR), and concrete random (CR). A continuum is used to classify students as being concrete or abstract. Concrete students are prone to thinking in terms of right *or* wrong versus abstract students who find value in the idea that things could be right *and* wrong and are open to ambiguity (Brown *et al*. 2013:207; Coffield *et al*. 2004:15; Hawk & Shah 2007:5) (see Figure 2.4).

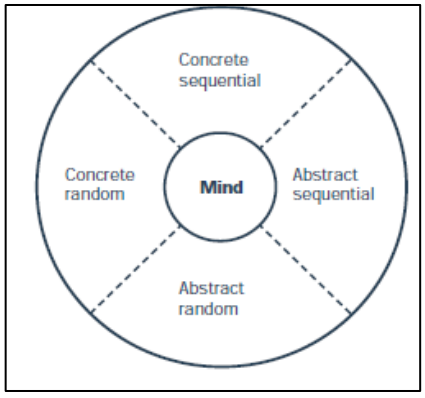


Figure 2.5: Gregorc's learning style model

Source: Coffield *et al*. (2004:15)

The scores in the GSD are obtained by ranking four words at a time from one to four with four given to the most suitable description of oneself and one given to the least suitable one. Each word in a four-word group belongs to one of the four channels. The highest score among the four channels determines the dominant learning style and the lowest score determines the weakest learning style. In practice, a combination of types is likely to emerge (Lau & Yuen 2010:1094).

Gregorc's four styles can be summarised as follows:

- the CS learner is ordered, logical, perfection-oriented, practical and thorough and perceives reality through their physical senses,
- the AS learner is logical, analytical, rational and evaluative and has a preference for mentally stimulating tasks,
- the AR learner is sensitive, colourful, emotional and spontaneous, and
- the CR is intuitive, instinctive, independent, impulsive and original and likes to experiment with ideas and concepts (Coffield *et al*. 2004:16; Hawk & Shah 2007:6; Lau & Yuen 2010:1094).

According to Gregorc (in Coffield *et al*. 2004:16-17), everyone can make use of all four channels, but there are inborn inclinations towards one or two specific channels. Gregorc also adds that it is impossible to act against stylistic inclinations as it puts one at risk of becoming false or inauthentic. Students also suffer if there is a lack of alignment between their learning styles and teaching methods and styles. Gregorc argues against any attempts to force teachers and students to change their natural styles. He believes that this will do more harm than good and will alienate people or make them ill (Coffield *et al*. 2004:16).

Coffield *et al*. (2004:19) outlines some of the weaknesses that have been identified with the GSD. These authors state that some of the words used in the instrument are unclear or may be unfamiliar. Detailed descriptions of the style characteristics are also not validated. Independent studies of reliability raise serious doubts about the GSD's

psychometric properties. There is no empirical evidence for construct validity other than the fact that the 40 words were chosen by 60 adults as being expressive of the four styles. Gregorc makes the unsubstantiated claim that students who ignore or work against their style may harm themselves. Coffield *et al*. (2004:19) concludes that the GSD is theoretically and psychometrically flawed and is not suitable for the assessment of individuals.

2.4.5 Felder and Silverman's learning style model

Felder and Silverman (in Tuan 2011:286) define learning style as "the characteristic strengths and preferences in the ways individuals take in and process information" (Hawk & Shah 2007:8). In 1988 Felder and Silverman formulated a learning style model designed to capture the most important learning style differences amongst engineering students. It was believed that this would provide a good basis for engineering instructors to formulate a teaching approach that would address the learning needs of all students (Felder & Spurlin 2005:103; Platsidou & Metallidou 2009:325). It was also assumed that students vary in terms of the learning styles and learning strategies that they use. All students are thought to have some degree of each of the four learning dimensions (processing, perception, input and understanding) present within them (Kelly 2013:21). Therefore, a knowledge of these learning styles and strategies would be important for students and teachers alike in order to maximise the teaching and learning process (Dahlan, Noor & Hashim 2010:20).

The Felder-Solomon learning style model categorises students' preferences in terms of type and mode of information perception approaches (sensory or intuitive; verbal or visual), organisation and processing of information (inductive or deductive; active or reflective), and the rate at which the students progress towards understanding (sequential or global). According to Felder and Silverman (in Tuan 2011:286), these learning style dimensions may be defined in terms of the answers to the following four questions:

- Learning style dimension - Perception (this subscale refers to students' approaches to problem-solving and their tolerance for factual learning).

  What type of information does the student preferentially perceive: ***sensory*** *(sights, sounds, physical sensations) or* ***intuitive*** *(memories, ideas and insights)?*

  Sensors enjoy learning facts and are better at memorising them. They also prefer using well-established methods to solve problems. They dislike complications and surprises. They are not big risk takers. Conversely, intuitors are less tolerant of learning that requires repetition, routine and memorisation of facts. However, they are innovative and better able to grasp new concepts (Dahlan *et al*. 2010:20-21; Felder & Spurlin 2005:103; Graf *et al*. 2009:5; Kelly 2013:21; Naik 2013:130-131; Platsidou & Metallidou 2009:325).

- Learning style dimension - Input (the ability of students to retain information is influenced by the way the information is presented).

  Through which modality is sensory information most effectively perceived: ***visual*** *(pictures, diagrams, graphs, demonstrations), or* ***verbal*** *(written and spoken words and formulas)?*

  Some students prefer more visual modes of information intake such as through charts and diagrams whereas others appreciate more verbal explanations (Dahlan *et al*. 2010:20-21; Felder & Spurlin 2005:103; Graf *et al*. 2009:6; Kelly 2013:21; Naik 2013:130-131; Platsidou & Metallidou 2009:325).

- Learning style dimension – Processing (this subscale refers to students' preferred degree of involvement in dealing with learning tasks).

How does the student prefer to process information: ***actively (****through engagement in physical activity or discussion), or* ***reflectively*** *(through introspection)?*

Active learners prefer being actively engaged in the learning task such as through practical application of what has been learned and through group discussions. Reflective learners like to think things through before jumping into any practical application. They also prefer to work alone rather than in groups (Dahlan *et al*. 2010:20-21; Felder & Spurlin 2005:103; Graf *et al*. 2009:5; Kelly 2013:21; Naik 2013:130-131; Platsidou & Metallidou 2009:325).

- Learning style dimension - Understanding (this subscale is concerned with the ways learners organize or comprehend information).

  How does the learner progress toward understanding: ***sequentially (****in a logical progression of small incremental steps), or* ***globally (****in large jumps, holistically)?*

  Sequentials learn in small incremental steps. They establish logical connections from one piece of information to another whereas global learners do not immediately see the relationships between materials. Globals use holistic thinking processes, put pieces together randomly and will suddenly 'get it'. Thus, global learners are able to connect things in novel ways whereas sequential learners are more methodological in their approach (Dahlan *et al*. 2010:20-21; Felder & Spurlin 2005:103; Graf *et al*. 2009:6-7; Kelly 2013:21; Naik 2013:130-131; Platsidou & Metallidou 2009:325).

The students' preferences on each scale may be strong, moderate or mild, may change with time, and may vary from one subject or learning environment to another (Ku & Chang 2011:267; Platsidou & Metallidou 2009:325). Each of the stated dimensions has parameters in other learning styles models, although the combination is unique to this

model. The active/reflective dimension is analogous to the same dimension in Kolb's learning style model and the extravert/introvert in the Myers-Briggs Type Indicator (MBTI). The sensing/intuitive dimension is also taken from the MBTI and has connections with the concrete/abstract dimension of the Kolb model (Felder & Spurlin 2005:103).

Felder and Silverman designed the Index of Learning Styles (ILS) which is a 44-question instrument designed to assess preferences on the four dimensions of the Felder-Silverman model. Each learning style dimension has associated with it 11 forced-choice items with each option corresponding to one or the other category of the dimension. A student's preference for one or the other pole of a given dimension (visual or verbal, active or reflective) may be mild, moderate or strong. The learning style preferences of a student may be affected by a student's educational experience. In order to function effectively, students need skills associated with both categories of each learning style dimension (Felder & Spurlin 2005:104-105).

The most important application of learning styles, according to Felder & Spurlin 2005:104-105), is that it is used to design effective instruction. Knowing the different types of students in a class can assist a teacher to formulate an approach which addresses the needs of all the students (Felder & Spurlin 2005:104-105). Other advantages of Felder and Silverman's ILS are that it can be self-administered, self-scored and self-interpreted. Unfortunately there is very little evidence of published research that addresses the validity and reliability of the instrument (Hawk & Shah 2007:9).

2.4.6 VAK and VARK learning style model

Although there are different ways of classifying learning styles, one of the more commonly used models is based on sensory modality preferences or modalities that one prefers to use when taking in and giving out information (Dobson 2010:197;

Juskeviciene & Kurilovas 2014:20). Research into how one communicates and how this affects one's learning led to the development of three particular learning styles namely visual (V), auditory (A) and kinaesthetic (K) thus forming the VAK model. An extension of this neuro-linguistic programming description of learning styles was developed by Fleming (2001) and read/write (R) was added to the VAK model to form the VARK model (Pritchard 2014:51).

The sensory modalities of an individual, whether it is visual, aural, read/write or kinaesthetic, are measured using the VARK 16-item learning style questionnaire. The statements in the questionnaire describe a situation and the respondent needs to pick one or more of three or four actions that the respondent would take. Each action corresponds with a VARK learning style preference. Students can be categorised as unimodal (e.g. singly V, A, R or K), bimodal (e.g. VA, VR), trimodal (e.g. VAR, ARK) or quadmodal/multimodal with all four learning preferences (e.g. VARK) (Hawk & Shah 2007:6-7; Mestre 2010:813) (see Figure 2.5). Fleming (in Hawk & Shah 2007:6-7) reports that 41% of the population who have taken the instrument online are unimodal, 27% are bimodal, 9% are trimodal and 21% have a preference for all four styles (multi/quadmodal). The multi/quadmodal student is shown at the intersection of all four modes in Figure 2.5 (see below).

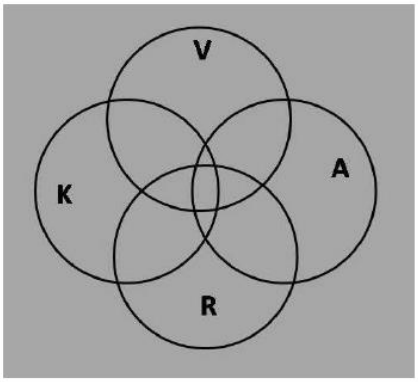


Figure 2.6: Components of the VARK modalities

Source: Khanal, Shah & Koirala (2014:2)

Each of the sensory modalities (V, A, R, K) highlighted above will be discussed next.

2.4.6.1 Visual (V) learners

According to Fleming (2015) the visual preference includes the depiction of information using maps, spider diagrams, charts, graphs, flow charts, labelled diagrams and all the symbolic arrows, circles, hierarchies and other devices that people use to represent what could have been presented in words. It also includes designs, whitespace, patterns, shapes and the different formats that are used to highlight and convey information. Visual learners are generally the largest group in a classroom (Nel & Nel 2012:35). This mode could have been called Graphic (G) as this better explains what it covers. Visual (V) learners have a strong sense of colour and prefer flow charts, diagrams and visualisation (Amran *et al*. 2011:328) and as such learn best through seeing (Bennett, 2013:145; Fee 2011:35; Leopold 2012:98). However, pictures, movies and animated websites are not included as these belong to the kinaesthetic learning preference (Juskeviciene & Kurilovas 2014:20).

Visual learners need to see the teacher's body language and facial expression in order to fully understand the content of a lesson. They like to sit at the front of the classroom and they may think in pictures as they need to see a mental model of the learning material (visual information is processed and stored in the occipital lobe at the back of the brain) (Simsek 2014:48; Tileston 2005:20).

Visual learners are usually tidy in their private lives. They do not like mess and cannot work at an untidy desk. They have to tidy it up first in their own way so that they can study. They specify certain places for tools such as pencil, eraser and pencil sharpener on the desk and always keep them in those places. Their bags and wardrobes are always tidy. Even though they do not like writing, they use their notebooks neatly and carefully (Simsek 2014:48; Tileston 2005:20). These types of students enjoy looking at

books and drawing pictures. They enjoy building puzzles and seeing details (Nel & Nel 2012:35).

Those students with a visual preference can be assisted by a teacher who uses the whiteboard to draw diagrams with meaningful symbols (and not just words) showing relationships between different things (Fleming 2015). Other areas where such students can be helped are as follows:

- making posters, graphs, flowcharts or slides with study notes on,
- underlining key terms using highlighters,
- using textbooks that have diagrams and pictures,
- using models, puzzles, DVDs, demonstrations, mind-games and patterns,
- when studying, redrawing pages of notes from memory, and
- practising turning visuals back into words when preparing for a test (Fleming 2015; Nel & Nel 2012:35).

2.4.6.2 Auditory (A) learners

This perceptual mode, according to Fleming (2015), describes a preference for information that is heard or spoken. It is one of the least used of the modalities and only makes up 20% or less of the class (Nel & Nel 2012:35). Auditory learners learn through listening and need to hear and speak before they can read and write (Amran *et al*. 2011:328). They learn best through verbal lectures, group discussions, radio, email, using mobile phones, speaking, discussion boards and web-chat (Fee 2011:35; Fleming 2015; Juskeviciene & Kurilovas 2014:20; Tileston 2005:17). They are able to tell stories from memory (Nel & Nel 2012:35). Email is included in this modality because even though it is text (and should then suit the read/write category); it is often written in chat-style using abbreviations, colloquial terms, slang and non-formal language (Fleming 2015).

Auditory learners listen to the teacher's tone of voice, pitch and speed. To them, written information has little meaning until it is heard (Bennett 2013:145; Leopold 2012:98). Such students may repeat what has already been said, or ask an obvious and previously answered question. They often need to say it themselves as they learn through saying it their way (Fleming 2015). Such students talk to themselves at early ages. They are sensitive to sound and music. They often speak harmonically and are good at foreign language learning. They remember the things they want to remember by hearing as if someone is telling them those things. Information that is auditory is processed and stored in the temporal lobes on the sides of the brain (Simsek 2014:48; Tileston 2005:17).

In order to learn effectively, such students need to do the following:

- attend classes, discussions, lectures and tutorials,
- participate in direct instruction where the teacher guides the learning through the application of declarative (what students need to know) and procedural (what students can do with the learning) objectives,
- participate in peer tutoring,
- participate in musical activities,
- participate in group discussions,
- discuss topics with others especially their teachers,
- explain new ideas to other people,
- use a tape recorder,
- leave spaces in their notes for later recall (as their notes may be poor because they listen),
- expand on notes by talking with others and collecting notes from the textbook,
- put summarised notes onto tapes and listen to them,
- read summarised notes aloud,
- explain their notes to another 'aural' person,
- practice writing answers to old exam questions, and

- speaking answers aloud or inside their head (Fleming 2015; Nel & Nel 2012:35; Tileston 2005:20).

2.4.6.3 Read/write (R) learners

This preference is for information displayed as words. Many teachers and students have a strong preference for this mode. Text-based input and output in the form of reading and writing in all its forms especially manuals, reports, essays and assignments is emphasised. People who prefer this modality often enjoy PowerPoint, the internet, lists, diaries, dictionaries, thesaurus, quotations, Google, Wikipedia and words (Fleming 2015; Juskeviciene & Kurilovas 2014:20). These types of students usually catch every word from their teachers and they never miss out on hand outs and references (Fleming 1995:310; Prithishkumar & Michael 2014:184). Such students like taking notes verbatim which they reread over and over again (Khanal *et al*. 2014:2).

In order to learn effectively, read/write learners need to do the following:

- make lists and write essays,
- use dictionaries, glossaries, handouts, textbooks, the library, manuals,
- make verbatim notes,
- attend classes of teachers who use words well and have lots of information in sentences and notes,
- read notes (silently) again and again,
- rewrite the ideas and principles into other words,
- turn any diagrams and graphs into statements e.g. “The trend is…”
- turn reactions, actions, diagrams, charts and flows into words, and
- practise with multiple choice questions (Fleming 2015).

2.4.6.4 Kinaesthetic (K) learners

Kinaesthetic learners learn best through moving, doing and touching (Amran *et al.* 2011:328). They prefer videos, teaching others, pictures of real things and practical sessions (Juskeviciene & Kurilovas 2014:20). They may find it difficult to sit for long periods as they can become distracted by their need for activity and exploration (Bennett 2013:145; Fee 2011:36; Leopold 2012:98). They are therefore quite active and cannot stand still in their places in the class. They always want to be the ones who do the tasks in the class such as cleaning the board, opening the window, closing the window and bringing chalk. They might fail to understand what is going on in the lesson if they are forced to sit for a long time. They usually cause problems in the class if they are not engaged in the right tasks. As such, they are generally affected negatively by the schooling system and might be declared as naughty, lazy and unintelligent. They make the least use of 'chalk and talk' teaching (Simsek 2014:48; Tileston 2005:24).

Kinaesthetic information is stored at the top of the brain in the motor cortex until permanently learned and then it is stored in the cerebellum (Simsek 2014:48; Tileston 2005:24). As their class notes may also be poor because the topics covered in the class were not 'concrete' or 'relevant' to them (Fleming 2015), they are advised to try and record in their notes examples, analogies, stories and cases (Fleming 1995:310).
In order to learn effectively, kinaesthetic learners need to do the following:

- make use of laboratories,
- go on field trips and tours,
- if possible, select teachers who give real-life examples,
- choose 'hands-on' subjects like computing and design and technology,
- keep collections of rock types, plants, shells and grasses,
- put plenty of examples into summaries as case studies and applications help with principles and abstract concepts,
- break up lessons into manageable chunks,
- encourage cooperative learning activities,

- use pictures and photographs that illustrate a concept, and
- write practice answers to exam questions (Fleming 2015).

2.4.6.5 Advantages and disadvantages of using the VARK model

The VARK tool has been utilised extensively as it is easy to use, can be self-administered, self-scored and self-interpreted (Fleming & Mills 1992:138). It avoids diagnostic labelling and provides a basis for selecting practical strategies that students and teachers can use (Fleming 1995:308). A wealth of learning materials has also been designed to accompany the model (Leite, Svinicki & Shi 2010:324). The VARK learning styles model also provides a very easy and quick reference inventory to assess people's preferred learning styles, and then most importantly, to design learning methods and experiences that match people's preferences (Al Muhaidib 2011:442).

Unfortunately, little research has been done on the validity or reliability of this model (Hawk & Shah 2007:6-7; Mestre 2010:813) because the instrument is primarily used to stimulate reflection and discussion (Fleming & Mills 1992:138). The language of the items is occasionally difficult to interpret consistently across a wide range of respondents (Leite *et al*. 2010:335). The instrument provides a simplified sensory profile of student learning, with no explicit account for engagement or motivation. Student responses to the VARK survey may also reflect students' perceptions of how other people prefer information to be delivered as well as their own preferences. An example could be someone with a strong V preference who wants to provide directions to a group may be more successful by drawing a map, yet elect to verbally describe the directions due to a higher perceived audience impact (Good *et al*. 2013:82-83).

A summary of the key aspects of the different learning styles explored in section 2.4 is shown in Table 2.2.

Table 2.2: Summary of learning styles

	Details of model	Measurements
Kolb's LSI (see section 2.4.1)	The learning process consists of the following four modes: Concrete Experience, Abstract Conceptualization, Reflective Observation and Active Experimentation.	Accommodator, converger, diverger and assimilator
Honey and Mumford (see section 2.4.2)	Based on Kolb's experiential learning model	Activist; Reflector; Theorist; Pragmatist.
Dunn and Dunn (see section 2.4.3)	An individual's strengths and preferences are identified across a full spectrum of elements.	Environmental, emotional, sociological, physiological and psychological.
Gregorc Style Delineator (see section 2.4.4)	Based on Kolb's experiential learning model.	Concrete Sequential; Abstract Random; Abstract Sequential; Concrete Random.
Felder and Silverman (see section 2.4.5)	Looks at the way individuals take in and process information.	Perception, input, processing and understanding.
VARK (see section 2.4.6)	Sensory/perception model	Visual, auditory, read/write and kinaesthetic.

As stated in section 2.4, there are over 100 learning style instruments. Table 2.2 only summarises the six models which were discussed in the chapter. As can be seen from this table, some of these models are similar (Kolb's LSI, Honey and Mumford and Gregorc's style delineator) whilst others are very different (Dunn and Dunn versus Kolb). The learning style model used in the research was the VARK model (see Chapter Four).

2.4.7 Learning styles critique

According to Reid (2005:53, 66, 80) and Sparks (2006:522) there have been some criticisms of the concept of learning styles. The criticisms rest on a number of key issues namely the lack of reliability and validity of some of the learning style instruments and the many competing perspectives on learning styles (in light of the fact that there are over 100 identification and assessment instruments) (Allcock & Hulme 2010:67). According to Coffield *et al.* (2004:1) there are 71 models of learning styles and only 13 of these are considered major models. The remaining 58 consist of rather minor adaptations of one of the leading models and therefore lack any influence. Some models offer new labels for existing constructs as the basis for claiming to have developed a new model. Others have been used only on very small or homogeneous samples or have been briefly popular and then fallen into obscurity. It is important to note that the field of learning styles research, as a whole, is characterised by a very large number of small-scale applications of particular models to small samples of students in specific contexts. There have been very few robust studies which offer, for example, reliable and valid evidence and clear implications for practice based on empirical findings (Coffield *et al*. 2004:1).

Another criticism directed at the concept of learning styles is that there are many competing ideas about the term ‘learning’. This has led to a proliferation of terms and concepts, many of which are used interchangeably in learning styles research. Examples of such terms are learning strategies, approaches to learning, cognitive styles, conative styles, cognitive structures, thinking styles, teaching styles, motivational styles, learning orientations and learning conditions. Sometimes these terms are used precisely in order to maintain distinctions between theories; at other times, they are used very loosely and interchangeably. Some theorists offer clear definitions of their key concepts at the outset, but forget to maintain the limitations they have placed on their language in later papers (Coffield *et al*. 2004:2).

Other criticisms levelled at the concept of learning styles highlight the impracticality of addressing all the individual learning styles of all the students in a class. There is also much controversy on whether matching individual learning styles to teaching styles and teaching materials does actually produce more effective learning. The commercial element that accompanies a particular learning style perspective also needs to be highlighted. Teachers often have to attend training workshops and purchase expensive materials in order to understand learning styles. As a result, the learning styles approach does not always have a sound image in educational psychology literature (Coffield *et al*. 2004:2; Reid 2005:80).

Sparks (2006:521-522) concludes by stating that numerous studies have shown that teaching to a student's learning style does not improve achievements any more than *not* teaching to it. Moreover, a lot of the learning style questionnaires are self-reporting so if the students do not understand *how* they learn, they might answer the questions incorrectly.

2.5 CONCLUSION

The main aim of this chapter was to provide the conceptual framework for the study. The theories on the concept of 'learning' and 'learning styles' were explored. The relationship between the brain and learning was established. The concept of learning was then analysed in more depth and several different learning theories were explored namely behavioural, cognitive and constructivist. The chapter then continued with an exploration of learning styles and several different learning style models were examined. The chapter ended with a brief look at numerous criticisms which have been levelled against the use of learning style models.

In the next chapter the factors that impact learning, learning styles and academic achievement will be presented.

CHAPTER 3

FACTORS THAT IMPACT LEARNING, LEARNING STYLES AND ACADEMIC ACHIEVEMENT

Enjoy the style diversity in your class. Never stop learning new ways to reach very student because they all want to learn - but in their own way (Prashnig 2006:95).

3.1 INTRODUCTION

The third chapter of the study starts with a discussion on academic achievement and learning. The chapter then moves on to examine the factors that impact on learning and academic achievement. These factors include the family, the school context, and the students themselves. Finally, the chapter examines factors that influence learning styles such as gender, age and culture.

3.2 ACADEMIC ACHIEVEMENT AND LEARNING

Academic attainment is an important element when determining the success of an individual student (Ahmad, Jelas & Ali 2011:266) and can predict key life outcomes such as income and health (Briley, Harden & Tucker-Drob 2014:2614). For acceptable academic achievement, quality education is needed. As a result, policy makers and researchers are increasingly concerned with low quality education in an era of increased education spending. They have realised that poor education outcomes can have detrimental effects on a country's economic and social development. At the individual level, inefficient learning and poor academic achievement not only limits one's progression in school but also negatively affects an individual's future income and productivity (Kasirye 2009:1). Such students are more likely to experience unemployment, substance use and delinquency as adults. They have the potential to

become a hefty burden on themselves, their families and their communities at large. They are therefore more likely to be recipients of welfare payments and unemployment insurance. Their children are also at an increased risk of having similar academic trajectories (Chase, Hilliard, Geldhof, Warren & Lerner 2014:884; Vitaro, Brendgen & Tremblay 2014:15). It is therefore important to examine the potential determinants of a student's academic success so as to avoid such individuals from becoming burdens to their respective governments.

Academic achievement is defined by Ahmad *et al*. (2011:266) as a measure of the success of a student. Academic performance or achievement is related to the knowledge and skills developed by a student in various courses. The level of academic achievement or success is measured using tests, assignments and final examination results and is dependent on the standards put in place by the educational institution (Garner-O'Neale & Harrison 2013:108).

Academic achievers or high performers do exhibit certain characteristics. They often study alone and in silence. They study at regular times, take notes in class, ask questions in class, read the material before class, review notes before the exam and talk about their work with other students. They basically prepare for their exams throughout the year and then put in extra effort during the two weeks prior to the exams. Other characteristics which such students exhibit are that they attend all their classes, are always on time for such classes and hand in assignments on time. Such students follow class instructions and assignment formats, pay attention in class and proactively give opinions. Their opinions are extensive and include 'analysis in progress' while speaking. They give personal opinions based on reading material and class content. They often look for the teacher after class. They sit at the front of the classroom, engage in conversations regarding the topic being studied, ask questions regarding concepts they do not fully understand and ask for feedback regarding their assignments. When facing low marks, they look for their teacher and then utilise facts

from the class, reading materials and course content in order to get the marks they believe they deserve (Cerna & Pavliushchenko 2015:49-50).

Students who are actively immersed in the learning process (like the ones described above) will be more likely to achieve success. Once students are actively involved in their own learning processes, they start to feel empowered and their personal achievement and self-direction levels rise. A key to getting and keeping students actively involved in learning lies in understanding learning style preferences. Such preferences can positively impact a student's performance as it can result in an enhanced attitude towards learning, an increase in thinking skills and creativity and ultimately improved academic achievement. Matching students' learning styles with appropriate instructional strategies also improves their ability to concentrate and learn (Tuan 2011:286). In summary, learning can be improved through the use of teaching that considers learning styles which can lead to enhanced academic achievement.

The determinants of academic achievement and success have captured the attention of many scholars. Teachers and researchers alike are concerned with maximising the potential of all students (Evans, Richardson & Waring 2013:211), and instituting proper interventions for those students at risk of academic failure (Caprara, Vecchione, Alessandri, Gerbino & Barbaranelli 2011:78-79). A student's academic success is the product of many factors, both individual and contextual. Students do not exist in a vacuum, and thus cannot succeed academically without contextual supports within their families, neighbourhoods and schools (Chase *et al*. 2014:884-885; Ghaedi & Jam 2014:1232). In the next section of this chapter such factors will be discussed and shown how they can influence learning and academic achievement. This is followed by a discussion of the factors which influence learning styles.

3.3 FACTORS WHICH INFLUENCE LEARNING AND ACADEMIC ACHIEVEMENT

There are many factors which can influence students' learning and consequently their academic achievement. The most important of these factors are discussed under three main headings namely the family, the school and the students themselves.

3.3.1 The family

One of the main factors which can affect students' academic achievements and their learning is their family, and more specifically their parents and their family's circumstances. Each of these influences is discussed below.

3.3.1.1 Parents

A major factor which can affect the academic achievement of students is parental educational involvement. Research on the educational involvement of parents in their children's schoolwork and homework clearly conveys its benefits for the children's school learning and achievement (Toren 2013:643, 645). Parental involvement at home generally facilitates an understanding about the purposes, goals and meaning of academic achievement. Involved parents also often help their children to obtain learning strategies which they can use (Toren 2013:637).

Once students become adolescents they usually need less direct parental involvement. This is due to adolescence being a time when family relationships usually change a great deal. Since the relationships become less hierarchical during this time, parents tend to have less influence over their children. Also, during this time, the cognitive development of adolescents increases. This affects their sense of self-efficacy as well as their ability to make decisions and to understand how academic achievement and extracurricular activities help them achieve their goals and aspirations. Unfortunately, low parental monitoring during this period can correlate with the development of risk

behaviours such as delinquency, substance abuse, teenage pregnancy, lower grades and poor academic achievement (Toren 2013:636-637).

Research has also shown that another key role parents can play in trying to ensure the academic achievement of their children is through positive, optimistic parental educational expectations. Such expectations may help children achieve greater academic success than would be predicted simply based on their family's socio-economic backgrounds. On the other hand, pessimistic parental educational expectations may influence the child to achieve to a lesser extent. Parents instil levels of educational expectations in their children which are then internalised to inform academic self-concepts. For example, parents who have expectations that their children will attend college may be more likely to form relationships with their children's teachers or spend additional time reading to their children, when they are little. It therefore follows that parents who have higher expectations for their children, on average, have higher achieving children (Briley *et al*. 2014:2615, 2617, 2624).

3.3.1.2 Family circumstances

The circumstances of the family can have a significant effect on the academic achievements of students. One of the predicaments families often have to face is a lack of income. An academic achievement gap exists between children living in low-income families and those in more well-off families (Awang, Ahmad, Abu Bakar, Ghani, Mohd, Ibrahim, Ramalu, Saad & Rahman 2013:22; Morrissey, Hutchison & Winsler 2014:741-742). One possible reason for low achievement at school is poor school attendance. The breadwinner in low-income families may have to work rotating or non-standard shifts. This could result in the child having to be more self-reliant in getting ready for and getting to school thus giving rise to increased school tardiness or absenteeism. Such absenteeism could lead to low academic achievement. Research done with students in elementary school who missed school frequently (they were present for less than 80% of the school days) found that such students scored 20 points lower on a test of reading

achievement compared with students who had close to perfect attendance (Family Housing Fund in Morrissey *et al*. 2014:742).

There are other reasons why poor school attendance can have negative consequences for the academic achievements of students. According to Morrissey *et al*. (2014:741-742) students who miss class fail to benefit from teachers' instructions, modelling, peer interactions and other activities designed to foster learning and academic achievement. It may also be particularly detrimental for children from low-income families to miss or be late for school because caregivers in such families are less likely to have the time or resources necessary to help their children catch up with missed school work (Morrissey *et al*. 2014:741-742).

Another factor related to low-income families is the neighbourhoods where such families reside. Low-income families are more likely to live in dangerous neighbourhoods and experience greater exposure to neighbourhood violence than higher income families. This could result in problems getting to and from school safely thus leading to absenteeism. Low-quality neighbourhoods may also negatively impact students' school attendance and therefore academic achievement. Living in such neighbourhoods may bring increased stress from community violence, gangs or drug activity, a lack of positive role models and the presence of negative peer influences. This could lead to problem behaviour and truancy resulting from a lack of institutional resources in the community such as police protection (Morrissey *et al*. 2014:741-742).

In addition to the above, children from low-income households are more likely than their high-income peers to attend low-quality schools. Such schools often lack resources that would enable teachers to intervene with students who have poor attendance records or who are often late for class (Morrissey *et al*. 2014:742).

3.3.2 The school

Another factor which can affect students' academic achievements is the school environment. In this regard, the school climate, the peer culture, the discipline in the school and the teachers are all important role players. Each of these influences is discussed below.

3.3.2.1 School and classroom climate

The school climate plays a key role in the performance of students and therefore in their academic achievement. The term 'school climate' refers to the interpersonal relationships which are developed at school and whose quality and stability affects the cognitive, social and psychological development of the child. The term also refers to the atmosphere which characterises either the school or the classroom. A positive school climate can be created by constructive relationships between the teachers and the students. Teachers who encourage their students to perform, emphasise commitment to learning, provide a relaxed learning environment (dominated by positive feedback and discovery learning), create feelings of security and attract the students' attention are providing the conditions necessary for a supportive, pleasant and serene school climate. Such an atmosphere improves the overall quality and effectiveness of the school and thus enhances the academic achievements of the students (Awang *et al*. 2013:24-25; Babalis, Tsoli, Artikis, Mylonakou-Keke & Xanthakou 2013:55-56; Fiksl & Abersek 2014:30). On the other hand, an undesirable school climate is defined by perceptions of unfairness, hostility and victimisation and is negatively related to school engagement and academic achievement (Lynch, Lerner & Leventhal 2013:8).

Another factor which can affect academic achievement within the ambit of the school climate is the level of respect and self-respect of the students. Sonn, Fisher and Bustello (in Njoroge & Nyabuto 2014:291) stress the fact that if self-respect prevails in

the school situation, students will learn self-discipline. If there is self-discipline, there is more chance that students will achieve academically.

If schools have good facilities and the needs of the students are well-catered for in the form of sufficient resources, clear codes of conduct, conducive learning spaces and efficient teachers, there should be high-quality academic achievement of the students (Njoroge & Nyabuto 2014:291-292). Efficient teachers exhibit relevant teaching styles, competent guidance and counselling, positive modelling, teaching efficacy, and the effective use of rewards and punishments. In essence, one of the keys to meaningful learning is therefore trying to make school more enjoyable (Bostrom 2012:13).

Within every school there are many classrooms. Fiksl and Abersek (2014:28) state that the classroom's function is first and foremost to cultivate learning. A positive classroom climate promotes students' motivation to work, develops their internal motivation and reduces fear. Students should sense the classroom's academic atmosphere from the moment they enter it. Every item in the classroom needs to emphasise learning in some fashion. Once teachers organise their classes to promote learning, they establish a climate of respect and safety. When students feel they are in a safe and respectful environment, they will express themselves freely. Students also create the classroom climate that is specific to their personalities. Students' personalities are also integral to creating a classroom climate that is conducive to learning (Fiksl & Abersek 2014:28, 35).

In addition to the school and classroom climate, the peer culture at a school also influences learning. This issue is discussed next.

3.3.2.2 Peer culture

According to social norms theories, individuals' behaviours are influenced by their perceptions of the behaviours of other individuals within their peer group. That is,

individuals are more likely to engage in behaviours which they believe other members of their peer group would also participate in. Therefore, individuals monitor the behaviours and attitudes of their fellow peers to gauge which behaviours are acceptable, and which behaviours allow individuals to maintain their membership of particular groups. If adolescents perceive that their fellow students in the same class or in the same racial group are academically engaged, and they treat others with kindness and respect, the adolescents are more likely to engage in similar behaviour. This should lead to increased academic achievement (Lynch *et al*. 2013:7-8).

The influence of peer culture on academic achievement is further illustrated in research conducted by Ogbu (in Lynch *et al*. 2013:9). In a year-long ethnographic analysis of the local school system, the researcher observed relationships amongst African-American youth living in an affluent suburb. His results suggested that the African-American students in that suburb were part of a tight-knit peer culture which devalued the importance of academic achievement. Within this culture, there was pressure for students to neglect academic responsibilities and display negative attitudes towards education. It is postulated that in schools with a positive relational peer culture, the behavioural peer culture will have stronger associations with student outcomes than in schools where the relational peer culture is negative. As such, in order to see positive changes in individual academic outcomes, a peer culture needs to pair favourable perceptions of student relationships with behavioural messages that support academic achievement. When students' perceptions of peer relationships are generally positive, the peer culture will have stronger links with student outcomes, whether positive or negative. In short, positive perceptions of peer relationships will bolster the strength of peer messages regarding academic behaviour (Lynch *et al*. 2013:9).

3.3.2.3 Discipline

Discipline is a vital ingredient of the academic success of students at school and in the creation of a happy and industrious school community (Njoroge & Nyabuto 2014:289).

Discipline is particularly essential during the years of a student's life in primary and secondary schools. It is not only the key to high-quality academic performance, but also provides preparation for success later in life. If high-quality academic qualifications do not accompany solid levels of self-discipline, then individuals are of little use to themselves, their family or the society which they are part of. Schools can teach discipline through the implementation of standard codes of conduct, and by offering guidance and counselling services in order to instil in students a sense of responsibility and curb incidences of ugly and destabilising indiscipline (Njoroge & Nyabuto 2014:292, 294).

Students learn to the best of their abilities in an orderly and safe environment which should not be intimidating or threatening. If discipline is not taken into consideration, the school environment could become dangerous and the educational process may be disrupted. This could result in the educational performance of students and their overall academic achievements being negatively affected. It is therefore necessary that discipline is maintained in a school so that the welfare and safety of students and teachers is maintained and the highest academic achievements are reached (Njoroge & Nyabuto 2014:289).

Another way that poor discipline can affect the academic achievement of students is if they are suspended. This is likely to lead to repetitive poor behaviour which may result in students losing interest in their studies and achieving poor grades. A further factor which can create disciplinary problems in school and ultimately result in poor academic outcomes is excessive control at home. The conflict between students' desires for freedom and their parents' unwillingness to make allowances for this need may encourage the students to rebel and the rebellion may be extended to the school. Rebellion at school may lead to a lack of self-efficacy which will ultimately hamper academic achievement (Njoroge & Nyabuto 2014:291).

Good discipline does not only refer to the students. Lewis and Doorlay (in Njoroge & Nyabuto 2014:291) state that if teachers are well-disciplined and understand their work, the students will then be in a position to achieve academically.

3.3.2.4 Learning environment

One of the most important factors that can affect student achievement is the teacher. Research from Turkey has shown that students with teachers who have more than 10 years teaching experience usually have higher achievement scores than the students of teachers with less experience. However, it should be kept in mind that experienced teachers usually have more say than less experienced ones at schools and thus they may be assigned more successful classes who will probably achieve top academic results (Bostrom 2012: 12-13; Jebson & Moses 2012: 90-91).

Apart from experience, the teachers' subject knowledge is also important. The importance of teachers who majored in their subject areas was noted by Goldherber and Brewer (in Jebson & Moses 2012:90-91).

It was also found that when teachers feel satisfied with their profession, are confident teaching their subject and have participated in professional development activities, the academic achievement of their students is significantly higher than students being taught by dissatisfied teachers. The career satisfaction of teachers, pleasant working conditions and the use of appropriate teaching methods which match the students' learning styles were considered important factors which may have positive effects on the instruction process and therefore on student performance (Wichadee 2013:104; Yetisir 2014:13, 15).

Other factors which can also affect academic achievement are positive teacher-student relationships, a satisfactory rapport between key role players and a positive school environment and ethos. These factors are more influential than class size, teacher

experience or availability of instructional means. If teachers can meet the students' needs for a social connection and can develop positive relationships and trust, students will be more engaged and motivated. They are then more likely to attend school, co-operate, socialise and engage in learning and will thus be more likely to achieve academically. Teachers, who show sensitivity to individual differences among students, include students in the decision-making and acknowledge students' needs often produce greater motivation in their students thus resulting in better academic performance. On the other hand, students who are in conflict with their teachers often have behavioural problems and consequently achieve poor marks at school (Awang *et al.* 2013:24-25; Buka 2013:323-324, 328; Vitaro *et al*. 2014:34).

Another key factor which can affect learning and therefore academic achievement is the teaching methods of the teacher. Some teachers adopt a content-focused/transmission-oriented approach, whilst others implement a more learning-focused/student-focused approach to teaching. Previous findings have indicated that surface learning is more commonly reported in learning environments that are characterised by heavy workloads, little student autonomy and high teacher control. Such environments are generally characteristic of content-focused/transmission-oriented teaching approaches. In these environments teachers exert a high level of control over their students' learning processes. They also use elements of direct instruction in their teaching practice such as asking many quick questions during the class in order to check if students understand the material. In a learning-focused teaching approach, teachers help students to take control of their learning (Donche *et al.* 2013:242-243).

Students are attracted to teachers who are adept at organising fun activities in class and teachers who use teaching aids. Teaching aids not only strengthen the students' understanding of related concepts, but also provide for effective and fun learning. If teachers do not use teaching aids during the teaching process, the interest of students in the subject is reduced and consequently the students assume that the content of the subject is uninteresting. This may ultimately impact negatively on the academic

achievement of such students (Awang *et al.* 2013:24-25). The teachers' tasks are therefore to make the learning process visible to the student by asking the students reflective questions about what they learn and how they learn. It is important that teachers build on students' interests and on their own initiatives (Bostrom 2012:12-13).

In addition to the above, teachers can play a crucial role in the academic achievement of their students through encouraging self-efficacy. This can be achieved if teachers individualise and tailor classroom instruction to the academic abilities of the students. Students are then encouraged to estimate their progress according to their own internal standards. Another way teachers can build self-efficacy in students is to help them set goals and monitor their learning progress. Self-efficacy beliefs and self-regulatory habits that are developed early persevere and are relatively resistant to change. Thus teachers face the challenge of facilitating the growth of positive self-efficacy beliefs and self-regulatory strategies in their students so that these become automatic and habitual as early as possible. This approach enhances academic achievement (Caprara *et al*. 2011:92).

3.3.2.5 Learning and teaching style mismatches

Not only do students learn in different ways, but teachers teach in different ways. Students preferentially take in and process information in diverse ways: by seeing and hearing, reflecting and acting, reasoning logically and intuitively, analysing and visualising. Teaching methods should vary accordingly. When this does not happen, the learning process suffers and the natural differences in learning patterns exhibited by the students can be interpreted by teachers as deficient. A mismatch between the teaching style of the teacher and the learning styles of the majority of students can therefore lead to poor performance and negative attitudes towards a course (Naik 2013:136). As a result, teaching and learning style dimensions should parallel one another. However, this does not often happen. It is difficult to determine each student's learning style and then teach to it exclusively or to put students into different classes based upon their

learning style preferences. However, teachers can address the learning style of the majority of the students in a class or provide a variety of learning experiences that cater for different styles (Aliakbari & Qasemi 2012:276, 282).

Research has shown that matching a learning style with a teaching style of a teacher enables the students to retain information for much longer, to apply it more efficiently and effectively and to have more positive post-course attitudes toward the subject than their counterparts who experience learning and teaching style mismatches (JilardiDamavandi *et al.* 2011:187). There is also strong empirical evidence from various disciplines that students' academic performances increase when teaching is arranged according to their learning preferences. Bhatti and Bart (2013:1) point out that teachers and administrators are able to improve the quality of instruction in their schools when they are aware of the learning styles of their students. In other research conducted by Bas and Beyhan (2013:134), it was found that learning styles-based instruction activities were effective in the positive development of the students' academic achievement levels and in the positive development of the students' attitudes towards an English course. Amran *et al*. (2011:326-327) also adds that previous research has shown that a teacher's understanding of their students' preferred learning styles can influence and contribute to the improvement and enhancement of those students' understanding of what is being taught. By understanding their students' preferred learning styles, teachers are in a better position to develop appropriate curriculum content and to formulate teaching strategies that match the students' preferred learning styles. This enables the students to improve the quality of their learning and therefore empowers them to perform better academically.

Bhatti and Bart (2013:4) found that in many undergraduate courses the common instructional methods employed favoured and better fitted the converger learning style (also see section 2.4.1). As a result, many students with non-converger learning styles, such as the dominant assimilator learning style, may not perform as well as the converger learning style students. Since they believed this state of affairs was

unacceptable, they suggested that courses and programmes in the university should be designed to accommodate multiple student learning styles. This would therefore facilitate student learning.

Ahanbor and Sadighi (2014:183) corroborate the above findings. According to them, the academic potential of students can be enhanced if teachers modify their instruction and offer a variety of opportunities for students to learn what is presented in class. Therefore, prior to choosing any teaching materials, teachers should conduct a needs analysis in order to determine the learning styles of their students.

In summary, it can be stated that the matching of teaching styles with students' learning styles is vital for effective student learning and academic achievement (Zhou 2011:73). Other factors which can affect a student's learning styles are explained in the next section.

3.3.3 The student

Another factor which can affect students' academic achievements is the students themselves, and more specifically their problem behaviour, their individual characteristics, academic self-efficacy and their ability for self-regulation, self-concepts, achievement motives and goals, and personality traits and how they are affected by stress. Each of these issues is discussed below.

3.3.3.1 Student problem behaviour

Student misbehaviour such as disruptiveness in the classroom and defiance towards teachers is common in everyday school life. Such behaviour, also known as aggressive or antisocial behaviour, includes cursing, fighting, stealing or destroying property. At some point during adolescence, most individuals exhibit some kind of deviant behaviour. This is expected as adolescence is part of a transitional developmental

phase. The majority of adolescents move beyond such problematic behaviour as they get older. However, some students behave more aggressively than others which negatively affects their learning and academic achievement. Problem behaviour often leads to poor academic achievement since it distracts students from engaging in academic activities (Zimmermann, Schütte, Taskinen & Köller 2013:747). In the long run, these students are at risk of dropping out of school and are less likely to participate in and complete a post-secondary education.

Empirical studies provide a fair amount of evidence of the relationship between student misbehaviour or aggressive behaviour and low achievement (as assessed by tests, school grades or other ratings). One of the first longitudinal studies to investigate social behaviour and achievement compared children who had been nominated by their teachers as behaving either in a socially acceptable manner or as behaving aggressively (Zimmermann *et al*. 2013:748). In this study it was found that after five years, those children who had been identified as aggressive-disruptive received lower grades and had lower objective test scores in English, mathematics, science and social studies as compared to the students who acted in a socially acceptable manner. Further studies have supported the fact that problem behaviour has negative long-term effects on the acquisition of skills. Breslau, Breslau, Miller and Raykov (in Zimmermann *et al.* 2013:748) found that problem behaviour identified between the ages of six and 11 usually predicted poor mathematics and reading test scores at the age of 17. Following students from kindergarten to Grade five, Stipek and Miles (in Zimmermann *et al.* 2013:748) confirmed that increases in aggression lead to decreases in academic achievement.

Apart from the fact that problem behaviour inhibits academic achievement because less time is spent on academic tasks, such behaviour also impacts indirectly on achievement. Aggressive disruptive behaviour may lead to negative relationships with teachers and peers, which, in turn, could have different adverse effects such as a rejection of misbehaving students, minimal direct instruction and less opportunity for co-operative learning with other students. Furthermore, misbehaving students may

associate troubled classroom interactions with negative feelings towards academic activities and may therefore be less inclined to put any effort into academic work (Vitaro *et al*. 2014:18; Zimmermann *et al.* 2013:748).

The relationship between poor achievement and aggressive behaviour has been shown in other research. Miles and Stipek (in Zimmermann *et al*. 2013:749) state that in past studies it was found that poor reading achievement in Grade one predicted aggression in Grade three. This finding was replicated in Grade three through to Grade five. In other research it was shown that poor reading achievement predicted poor behaviour during the first years of primary school (Zimmermann *et al*. 2013:749). The reason for this finding may be related to the frustration that students experience when they fail repeatedly in their quest to achieve valued academic goals. Having experienced failure to conform to conventional norms, they may then redefine their identity and start to value deviant behaviour as a means of restoring their self-esteem. Their academic achievement may never recover.

3.3.3.2 Individual characteristics

Much research has been conducted on the effect student characteristics have on learning and academic achievement (Donche *et al*. 2013:240). Hoskins, Newstead and Denis (in Nyikahadzoi, Matamande, Taderera & Mandimika 2013:2) conducted a study with students at the University of Plymouth and found that variables such as age, gender, prior qualifications and discipline effect their academic performance. These factors were also examined in other research. With regard to age, Barrow, Reilly and Woodfield (in Nyikahadzoi *et al*. 2013:2) found that mature students generally achieve marginally better degree outcomes.

As noted above, another student characteristic which can affect academic performance is gender. Over the last decade there has been evidence of a growing gender gap in the academic achievement of students in a number of developed countries. The gender gap

refers to the underachievement in school of males in comparison to females (Ahmad *et al*. 2011:265; Dahlan *et al.* 2010:15). In addition, females are attending university in higher numbers (Ahmad *et al*. 2011:265). In Malaysia and in the Caribbean, similar data was obtained in that girls outperformed their male counterparts at school in the majority of subjects (Ahmad *et al*. 2011:265-266; Nyikahadzoi *et al*. 2013:2-3). According to Bhatti and Bart (2013:4), the fact that females outperformed males academically maybe due to their superior linguistic skills, better work habits, more effective study skills and better class attendance.

The issue of the relatively weak academic performance of male students, in comparison to female students, has been studied extensively in the past few years. A review of studies conducted in the United Kingdom and Australia shows that since the 1990s, female students are more consistent in achieving better grades at the General Certificate of Secondary Education level than male students (Ahmad *et al*. 2011:266; Dahlan *et al*. 2010:16). A brief survey of other countries such as Germany, France, Japan and New Zealand also showed a similar scenario. Over the last decade in England and Wales more female students obtained grades A to C than male students in school-leaving examinations. As for the language subjects, female students also outperformed the male students in the languages and in the traditionally male dominated subjects of mathematics and science (Ahmad *et al*. 2011:266; Dahlan *et al*. 2010:17).

The factors that have caused the above mentioned trends are diverse and complex and include various aspects concerned with the students' school and the students' learning styles and strategies. It was found, in various studies, that male and female students use different learning styles. Learning styles affect a student's performance indirectly via learning strategies. This means that students who learn by means of their preferred learning styles use more positive learning strategies which assist them in obtaining higher academic achievements (Ahmad *et al*. 2011:276). In other research it was construed that female students outperformed male students because the instruction and

assessment methods that teachers use favour the learning styles of females (Dahlan *et al*. 2010:18).

In addition, Vitaro *et al*. (2014:20) found that the link between behavioural dimensions and non-high school graduation was stronger for males than for females. This was probably due to that fact that males tend to be more aggressive-oppositional and inattentive-hyperactive than females. However, females may be more negatively affected than males by interpersonal stressors such as peer rejection and teachers' sanctions.

Another factor which can affect the academic achievements of male and female students is whether they attend single gender or co-educational schools. Some studies found that these different school types do not have an impact on the academic achievement of males and females, however, other studies provide evidence to the contrary (Ahmad *et al*. 2011:267). Female students were found to achieve better results in single gender schools, while male students showed enhanced performance in co-educational schools. Female students in co-educational schools were less able to engage in question and answer sessions and discussions in class (Ahmad *et al*. 2011:267).

Research has also shown that achievement motivation may be related to gender socialisation patterns. Many cultures raise females to be obedient, responsible and take schoolwork seriously whereas males are given a higher degree of autonomy and relative freedom to do as they like, and view schoolwork as a feminine rather than a masculine pursuit (Dahlan *et al*. 2010:18). For example, a study conducted in Malaysia, found that parents were less restrictive on their sons in comparison to their daughters. In addition, males from less fortunate families helped their parents earn a living and this affected their school attendance. Hence, these factors may influence their attitudes towards schooling and could explain their poor academic records.

Previous studies also found a positive relationship between students' interest in academic subjects and their academic performance (Arham, Mesir & Mohammad in Awang *et al*. 2013:22). Students' attitudes or interests should be important to teachers because affective dispositions are powerful predictors of students' subsequent behaviour and therefore their academic performance. There is also a strong association between individuals' attitudes towards education and their academic performance and commitment. Students who have negative attitudes towards educational activities are found to exhibit challenging behaviour (refer to section 3.3.3.1) which could negatively influence their academic achievement.

3.3.3.3 Self-regulation and self-efficacy

Studies have examined the relationship between positive emotions, self-regulation and improved learning and academic achievement (Drake, Belsky & Pasco Fearon 2014:1352; Villavicencio & Bernardo 2013:331). In every classroom there are students who are more independent than their classmates. These students are eager to begin working, are actively involved in their own learning process, can match the task to the needed study behaviour and often plan how to accomplish assigned tasks. Researchers have coined the term 'self-regulated learner' to depict the proactive nature of such students' approaches to learning. These students seek assistance from peers and teachers, exhibit effective time management skills, are goal directed and self-motivated. By being able to resist distraction, manage frustration, focus attention and persist at difficult tasks, these students are more likely to experience a greater sense of self-efficacy when dealing with challenges. They gain greater intrinsic satisfaction and extrinsic reward from their successes and are better able to manage the emotions associated with setbacks. Too often, however, these competencies are not cultivated in all students. Emphasising short-term mastery goals without attending to students' development of strategic learning skills can adversely affect what students think about their own ability to develop understanding and what it means to learn. This could ultimately limit their competence as problem solvers and self-regulated learners (Bell &

Pape 2014:23; Cerna & Pavliushchenko 2015:45; Drake *et al*. 2014:1352) and could therefore lead to decreased academic achievement.

Emotional self-regulation is defined by Shaffer and Kipp (2014:375) as “the controlling of emotions”. Cognitive self-regulation is also important. According to social cognitive theory, there are three phases of self-regulation: forethought, performance, and self-reflection (Bell & Pape 2014:24). Students who are self-regulating, and who experience enjoyment and pride during the learning task, are more than likely to value both the task and the outcomes thereof. They have the knowledge, skills and disposition to accomplish the academic goals that they set for themselves. They are thus more likely to attain higher levels of learning achievement. On the other hand, self-regulating students who do not experience enjoyment and pride in a task may not value the task and the outcomes. In this case, self-regulation could still lead to academic achievement, but not at the same levels as with students who experience task enjoyment and pride (Bell & Pape 2014:24; Villavicencio & Bernardo 2013:331-332).

Another concept which is closely linked to self-regulation is self-efficacy. Self-efficacy is concerned with a person's beliefs in his or her capabilities to learn or perform a behaviour or a task (Anderman & Anderman 2014:7; Bjornebekk, Diseth, Ulriksen 2013:772-773; Joo, Kim, Kim & Chung 2011:262; Mega, Ronconi & De Beni 2013:122-123). Caprara *et al*. (2011:81) offer another definition of self-efficacy stating that it is the judgements people hold about their capabilities to organise and affect courses of action which are needed to attain given goals. Students who believe they are capable are more likely to be self-regulating. They try to understand their academic work, and to plan, monitor, and regulate assignments.

Research has focused on the two different facets of self-efficacy in students namely (a) the perceived ability to successfully master specific academic subjects and curricula areas, and (b) the perceived ability to self-regulate study by planning and organising study times and activities, motivating themselves to fulfil their school assignments and

pursuing academic activities when there are other interesting things to do. Both facets of self-efficacy exert a notable influence on learning, academic achievement and career choices as they sustain effort, persistence and aspirations (Caprara *et al*. 2011:81).

Many educational researchers argue that academic self-efficacy is one of the most important internal variables related to academic achievement (Joo *et al*. 2011:262). Studies on perceived academic self-efficacy and student learning have confirmed that perceived self-efficacy impacts on students' aspirations, levels of interest in academic pursuit, academic accomplishments and how well they prepare themselves for different occupational careers. A meta-analysis of 39 research findings confirmed the positive influence of academic self-efficacy on academic success and persistence (Abd-Elmotaleb & Saha 2013:117-118).

The relationship between academic self-efficacy and academic performance can also be understood from the perspective that students with a high sense of efficacy have the capacity to accept more challenging tasks. They have a high ability to organise their time and show increased persistence in the face of obstacles. They often show lower anxiety levels and more flexibility in the use of learning strategies and have the ability to adapt to different educational environments (Abd-Elmotaleb & Saha 2013:125-126). This often translates into increased academic achievements.

With particular reference to secondary school, research indicates that academic achievement at the end of primary school significantly contributed to later perceived academic self-efficacy in secondary school. Academic self-efficacy beliefs contributed more to academic achievement in secondary schools than in primary schools. In high school students need to have confidence in their capacity to regulate their own learning and to manage the various scholastic activities and relations with teachers and peers. This needs to happen if one is to nurture the motivation needed to realise one’s own potential and ultimately achieve academic achievement (Caprara *et al*. 2011:91).

Self-efficacy is not only important at school. In studies conducted with first year university students, it was found that the level of self-efficacy that these students reported during their first year was a powerful predictor of academic performance. Students who enter college with confidence in their ability to perform well academically perform significantly better than others with less self-efficacy (Mega *et al*. 2013:122-123). They are able to sustain the cognitive, affective and motivational processes that lead to successful academic achievement (Caprara *et al*. 2011:79).

In summary, self-regulation and self-efficacy can positively predict academic achievement.

3.3.3.4 Self-concept

Self-concept is the way in which people perceive their strengths, weaknesses, abilities, attitudes and values. It is formed from experiences and relationships with the environment where significant people play an important role. It is one of the most important psychological constructs in the behavioural sciences. Self-concept serves as an important factor that influences economic success, and long-term health and well-being. The desire to feel positively about oneself and the benefits of this feeling on choice, planning, persistence and subsequent accomplishments are also well documented in the literature. Research evidence suggests that students who have a higher self-concept are more likely to engage in academic tasks, regulate their learning and engage in effective learning strategies which will ultimately enhance their academic achievement (Dupe 2013:1150; McInerney, Cheng, Mok & Lam 2012:249, 252).

A major factor which impacts on the relationship between self-concept and academic achievement is the students' approach to learning, in particular *deep* versus *surface* learning. These two types of learning strategies were identified in Biggs's (1987) framework (in McInerney *et al.* 2012:251-252). Students who adopt deep learning strategies engage actively in learning the study materials. They try to understand the key concepts and the underlying meaning of the materials. They relate new learning

with previous relevant knowledge and personal experiences. They are interested in the tasks and would like to achieve thorough mastery of the knowledge. In general, deep learning strategies enable students to organise new information, relate ideas and monitor their understanding of learning materials and, therefore, perform better on academic tasks. Students who are deep learners are more likely to have enhanced self-concepts which often lead to improved academic achievement.

On the other hand, students who adopt surface strategies only pay attention to bare essentials. They use rote learning and do not devote much effort to reaching any form of understanding. They also do not attempt to organise their learning materials or relate them to personal experiences. Since these students only aim to pass, surface strategies may allow them to pass tests and examinations with minimal effort. This low-quality learning may result in poor academic achievement in the future (McInerney *et al*. 2012:251-252).

Academic self-concept is also positively associated with academic achievement in related subjects. Having a positive self-concept in English is positively associated with English academic achievement, and a positive self-concept in mathematics is positively associated with mathematics academic achievement. In addition, a positive English self-concept is also positively associated with mathematics academic achievement. Deep learning strategies are positively associated with English and mathematics self-concepts, but are not significantly associated with academic achievement in either subject. Surface learning strategies are negatively associated with academic achievement in English and mathematics (McInerney *et al*. 2012:260). It can therefore be concluded that academic self-concept, learning strategies and academic achievement are three key components for student success that must be seen as interactive. A focus on all three in classrooms is likely to lead to enhanced school achievement (McInerney *et al*. 2012:264).

3.3.3.5 Achievement motives and goals

Achievement motives are one of the most studied personality characteristics related to academic outcomes. Motives are activated in situations where performance is evaluated against a standard of excellence. Moreover, the arousal of the motives is assumed to depend on the possibility of succeeding or failing in a particular task. Once a motive is activated, it energises the individual through approach motivation (attraction to the tasks, feelings of pleasure, approach-goal adoption) or avoidance motivation (anticipation of negative evaluations, anxiety about the future, avoidance-goal adoption). Avoidance motivation (activation of the motive to avoid failure), is assumed to reduce the overall positive motivation or tendency to undertake an activity, whereas approach motivation (activation of the motive to approach success), instigates actions directed at achieving academic success (Bjornebekk *et al.* 2013:772).

Several studies have shown that achievement motives are important in relation to performance in academic settings. Bjornebekk *et al*. (2013:772) found a weak but statistically significant correlation between examination grades and achievement motivation. This view is supported by Cheung and McBride-Chang (2008:3-4) who also state that students' learning motivation is strongly linked to their academic achievement. They further add that studies conducted in the United States showed that students may perform best and persist on school tasks when they find the learning task enjoyable and interesting, and are therefore motivated to learn. However, other studies have failed to find any statistically significant relationship between achievement motives and academic achievement (Bjornebekk *et al*. 2013:772).

Whereas achievement motives are considered to be relatively stable dispositions reflecting personality characteristics, achievement goals refer to the reasons why students engage in particular academic and learning tasks. Achievement goals are distinguished along two dimensions which capture different reasons for competence-based striving. The first dimension reflects a mastery-performance distinction and delineates the various referents of competence that may be employed. Mastery goals

are those in which the individual seeks development of his competence or task mastery, whereas performance goals are those in which the individual seeks to increase competence relative to others. The second dimension reflects the valence of competence. Approach goals involve trying to obtain a desirable outcome, whereas avoidance goals involve trying to avert an undesirable outcome (Bjornebekk *et al*. 2013:772-773).

In a review of more than 90 studies, it was found that mastery goals are positively related to academic achievement in at least 40% of the reported effects. A similar positive effect for performance-approach goals was also found. In a meta-analysis of 243 studies, it was shown that approach goals were positively related, and avoidance goals were negatively related, to performance outcomes and interest (Bjornebekk *et al*. 2013:772-773). The adoption of performance-avoidance goals is associated with lower achievement and has also emerged as a negative predictor of performance. Despite the positive effect of performance-approach goals on academic achievement, earlier experimental studies have found that mastery-focused conditions have a more positive effect on intrinsic motivation and satisfaction during problem solving than performance-focused conditions.

In summary, it can be concluded that motivation can influence a student's learning and achievement, as well as predict and explain the student's academic performance. Students are more motivated if they believe they are able to do well and they find learning activities enjoyable and interesting rather than anxiety laden or boring. If students are motivated, they are able to sustain their interest in learning the material and should achieve better academic grades (Mega *et al*. 2013:122).

3.3.3.6 Personality traits

Many personality researchers have argued that personality traits account for a significant portion of variance in academic performance. According to Caprara *et al*. (2011:80) individual differences in personality play a unique role across undergraduate

performance. They state that personality traits account for 10 to 17% of the unique variance in academic performance, and personality traits explain about one-fifth of the variance in examination marks and one-third of the variance in essay grades.

Two personality traits, namely conscientiousness and openness, are associated with academic achievement (Caprara *et al*. 2011:81). Recent research has pointed to conscientiousness as the strongest predictor of academic performance at both the secondary and tertiary levels of education. Conscientiousness is associated with sustained effort and goal setting which both contribute to academic success, to compliance and concentration on homework, as well as to time management and effort regulation in learning. Each specific facet of conscientiousness namely diligence, dependability, self-discipline, prudence, competence, dutifulness, order and achievement striving is also conducive to academic aspirations and performance. It is argued that a basic trait like conscientiousness exerts its influence on academic achievement by fostering self-regulatory abilities over the course of a scholastic career (Caprara *et al.* 2011:91).

Other findings have pointed to the personality trait of openness as a major correlate of academic achievement and success, the use of effective learning styles and higher academic aspirations. Openness has been positively associated with final school grades and with strategies that emphasise critical thinking, innovative learning approaches and learning motivation (Caprara *et al*. 2011:81, 91). Openness generally exerts its influence on academic achievement at an early stage and is no longer very important in senior high school where the capacity to regulate one's learning is most crucial in order to take advantage of one's own talents.

3.3.3.7 Stress

The impact of stress on learning has been widely studied. Research has shown that cognitive abilities are affected by the physical and psychological manifestations of

stress. However, there is limited consensus in the literature as to whether stress plays an inhibitory or facilitative role in the learning process. On the one hand, stress and the exposure to stressful events has been shown to have an inhibitory effect on cognitive functioning across a number of domains. Research has indicated that stressful environments and associated elevations of stress-related hormones may result in the impairment of logical reasoning, reaction time, vigilance as well as limitations in spatial reasoning, language deficits, processing speed, hand-eye coordination and executive functioning (Palmer, Economou, Cruz, Abraham-Cook, Huntington, Maris, Makhija, Welsh & Maley 2014:199). For individuals who have experienced sustained or traumatic stress, the release of stress-related hormones may be disruptive. This could prevent the hormones' ability to regulate neural activity and contain the biological stress response and may explain why traumatic memories are strongly encoded in the innate cognitive abilities of the individual (Palmer *et al.* 2014:200).

Nevertheless, it is also argued that within the context of a learning experience, stress focuses attention, improves memory and retrieval of relevant information and is essential for adequate learning. In a low stress context, individuals with higher levels of working memory are able to employ conceptually based problem-solving techniques, whereas individuals with lower levels of working memory may use simpler techniques for solving the same problem. Alternatively, when the demands of the environment are greater, individuals with higher working memory capacities will resort to problem-solving strategies of equal or less desirability than their counterparts with lower working memory capacities (Palmer *et al.* 2014:200).

There are numerous studies indicating that learning challenges can increase college students' risk of anxiety, depression and stress, and these are commonly associated with fatigue. Symptoms of fatigue include cognitive impairment (feeling slowed down or forgetful), behavioural changes (irritation) and somatic complaints (sore muscles). Unaddressed fatigue can contribute to absenteeism, poor academic performance and

school dropout (Palmer *et al*. 2014:201). Fatigue can therefore negatively impact on learning.

In this section the concepts of academic achievement and learning were explored. Some of the factors which can influence academic achievement were discussed in detail and are summarised in Table 3.1.

Table 3.1: Summary of factors influencing student learning and achievement

The family	The school	The students
Parents	School and classroom climate	Problem behaviour
Family circumstances	Peer culture	Individual characteristics
	Discipline	Self-regulation and self-efficacy
	Learning environment	Self-concept
	Learning and teaching style mismatches	Achievement motives and goals
		Personality traits
		Stress

In the next section the factors which can influence learning styles are further explored.

3.4 THE FACTORS WHICH INFLUENCE LEARNING STYLES

In this section the link between learning styles and academic achievement is explored. This is followed by a discussion of the factors which influence learning styles with a focus on gender, culture and age.

3.4.1 The link between learning style and academic achievement

Several studies have shown that when learning styles are taken into account during the learning process, the academic success of students is greatly improved (Elci, Kilic & Alkan 2012:145; Peters, Jones & Peters 2008:158). This point is further explored in the next section where the link between academic achievement and particular learning style models (see section 2.4) is explored. Consideration is also given to individual versus group learning as well as research which indicates that there is no link between academic achievement and learning styles.

3.4.1.1 Kolb's LSI

In research done on medical education students using Kolb's LSI (see section 2.4.1), it was found that accommodators were more successful in terms of problem-based learning examinations, whereas assimilators were more successful in theoretical block examinations. In science and mathematics, either convergers or assimilators were more successful. These studies indicate that, in general, assimilating and converging students demonstrate better academic performance (Kablan & Kaya 2013:100). Kablan and Kaya (2013:100) also concluded in their study that the influence of learning styles on academic achievement is dependent on subject area, the instructional methods and the assessment techniques being used.

Learning styles can also be used to predict an individual's preferred specialisation. Research using Kolb's LSI has shown that assimilators tend to specialise in sciences and information technology, while convergers are likely to specialise in engineering, medicine and technology. However, Kablan and Kaya (2013:108) offer another explanation for this phenomenon. They state that the educational system may reward certain learning styles. Assimilators and convergers in their study may have been more successful in a science test because the teachers may have used teaching styles that favoured these particular learning styles.

3.4.1.2 VARK learning style model

In a study done by El Tantawi (in Khanal *et al*. 2014:6) on postgraduate dental students, a statistically significant difference was observed between students with unimodal and multimodal learning preferences (see section 2.4.6). Students with multiple preferences had a score about six points higher than that of students with single preferences. These findings were also corroborated in a study done by Nuzhat *et al*. (in Khanal *et al*. 2014:7) where multimodal learners were found to have achieved higher grades as compared to unimodal learners. Statistically significant differences were also observed between students with and without different learning preferences (visual, aural, read-write, and kinaesthetic). Students who had a specific learning preference had significantly higher academic scores than students who did not. Regression analysis also showed that the aural preference was one of the predictors of the final exam score along with other variables (Khanal *et al*. 2014:7).

Leung, McGregor, Sabiston and Vriliotis (2014:118-119) found in research done on economics students that a preference for the kinaesthetic learning style was the only factor that had a significant relationship with final grades in the macroeconomics course. This finding is consistent with evidence from existing literature regarding personality traits. However, Dobson (in Leung *et al*. 2014:115) found that a strong kinaesthetic learning style had a significant negative relationship with performance in physiology courses.

With regard to the influence of learning style on achievement levels, Park (in Aliakbari & Qasemi 2012:276) found that high achievers were the most visual learners whereas low achievers were the least visual. Similarly, Suh and Price (in Aliakbari & Qasemi 2012:276) found that gifted Korean students living in Korea were more persistent and expressed greater preference for visual and kinaesthetic learning than academically non-gifted peers. The gifted students were also less parent-motivated and desirous of

having an authority figure present than the academically non-gifted. They preferred to learn in several ways, and were less socially inclined than the American students.

3.4.1.3 Group versus individual learning

In research conducted by Peters, Jones and Peters (2008:164), it was found that students generally preferred group learning even though individual learning often achieved higher grades. The results from the research may indicate that the students who were attracted to the group-learning environment and developed, or who already had developed, the group learning style preference, do so as they were allowed to take advantage of the opportunity to 'social loaf' (that is that they can apply less individual effort). Those students who preferred an individual learning style preference would obviously not prefer to undertake group work as they perceive the group environment as a development of their own abilities but between less able students (Peters *et al*. 2008:164). In addition, Park (in Aliakbari & Qasemi 2012:276) found that middle and low achievers had minor preferences for group learning, whereas high achievers had a negative preference for such learning.

3.4.1.4 No relationship

Many studies in the literature show that there is no relationship between learning styles and academic achievement. One such study was conducted by Prajapati, Dunne, Bartlett and Cubbidge (2011:75) on optometry students. Using Felder and Silverman's ILS (see section 2.4.5), these researchers found no connection between learning styles and academic achievement, and therefore assumed that a large proportion of students had balanced learning style preferences. This meant that these students would easily adapt to any teaching style. Only the active–reflective learning style dimension came close to being statistically significant, with reflective learners having a higher academic performance than active learners (Prajapati *et al*. 2011:75).

In further research conducted by Prajapati *et al*. (2011:75) on Turkish students, no statistically significant differences between first-semester grade point averages and learning styles was found. Shenoy *et al*. (in Khanal *et al*. 2014:6) also found similar results when researching 200 students in India. These students' academic grades were correlated with their preferred learning styles. The absence of correlation between these two variables probably proved that no learning style was superior, and learning in the preferred style only made learning easier and more enjoyable rather than improving academic performance.

Ng, Pinto and Williams (2011:16) also found in their research that learning styles were insignificant in determining a student's overall course score. This provided some evidence that the design of the course did not favour students with any particular learning style. However, for a small group of students, learning styles were statistically significant in determining exam averages. That is, some students experienced either a disadvantage or advantage with their learning style for the exam course component. However, for the overall course performance, a student with a particular learning style was neither advantaged nor disadvantaged.

Eudoxie (in Leung *et al*. 2014:115) also found no significant relationship between VARK learning style preferences and course performance among a sample of students studying soil management science.

3.4.2 The link between learning styles and gender

Several studies have demonstrated that females and males learn differently (Gabe 2002:433). This point is further explored in the next section where the link between academic achievement and a particular learning style model (see section 2.4) is explored.

3.4.2.1 Kolb's LSI and Gregorc's LSD

In research conducted by Bhatti and Bart (2013:2) using Kolb's LSI (see section 2.4.1), differences were found in the learning styles of male and female students. Females tend to prefer to experience new information concretely, whereas males prefer to experience new information through abstract conceptualisation. In contrast, O'Brien (in Lau & Yuen 2010:1095) found that most of the males in his study preferred concrete experiences whilst most of the females preferred abstract experiences.

Some researchers found that females tended to be accommodators and/or divergers whereas males tended to be assimilators and/or convergers (Bhatti & Bart 2013:2). In research conducted by Aliakbari and Qasemi (2012:281) in Iran, the majority of the female students preferred an assimilating and a diverging style respectively. Only a small amount of the females preferred a converging learning style and an accommodating learning style. In contrast, at least half of the male participants preferred a diverging style and about a third of them were characterised as assimilators. Similar to the female participants, only a few of the males were convergers and an even smaller number were accommodators. This shows that diverging and assimilating styles are the dominant learning styles for both genders. Durmuscelebi (2013:215, 217) also found similar gender differences in relation to learning styles. In his study females mostly have diverger, accommodator and assimilator learning styles (Durmuscelebi 2013:217).

Gender differences were also highlighted in research conducted by Barmeyer (2004:584-585). The dimension of CE (which reflects social and emotional competencies) between female students and male students was found to be significant. Female students scored higher than male students in this dimension. The results also show significant differences concerning the dimensions of RO (watching) and of AC (thinking). In both these dimensions, male students showed a higher average score than the female students. There was no significant difference concerning the fourth

dimension, AE (doing). The research also revealed that more male students represent the assimilating learning style type than the female students. On the other hand, female students were slightly more represented in the diverging learning style type. More females than males were found to be convergers and accommodators (Barmeyer 2004:584-585). These results are shown in Figure 3.1 (see below).

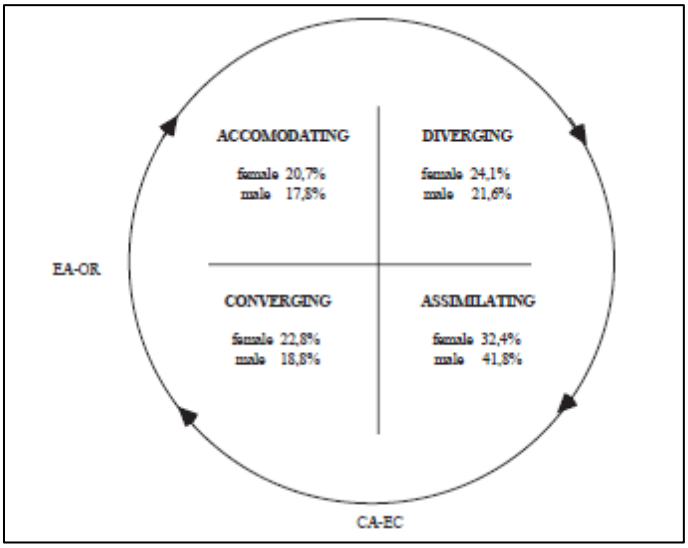


Figure 3.1: Results of Barmeyer's research

Source: Barmeyer (2004:586)

Learning style preferences based on gender, as identified by the GSD model (see section 2.4.4), have been well-documented in the literature (Myers & Dyer in Lau & Yuen 2010:1094). In general, males tended to be CS/CR learners whereas females tended to be AR learners. O'Brien (in Lau & Yuen 2010:1095) found that although AR students accounted for 40% of a sample of high school students, males were predominantly CR whereas females were predominantly AR. Ames (in Lau & Yuen 2010:1095) showed that a significant gender difference in the AR subscale existed and females were more likely to be AR than males.

3.4.2.2 VARK learning style model

Honigsfeld and Dunn (in Aliakbari & Qasemia 2012:276) found that male students were more kinaesthetic (see section 2.4.6) and peer-oriented than female students. By contrast, female students were found to be more self-motivated and persistent, preferred to learn in a friendly atmosphere and appreciated parent and teacher motivation.

With regard to learning style and gender, Amran *et al*. (2011:333) found that the majority of males and females preferred the visual learning style and the least preferred was the kinaesthetic style. These findings concur with those of previous studies conducted by Thambusamy and Nasir (in Amran *et al*. 2011:325). In other research conducted by Amran *et al*. (2011:333) it was found that the predominant learning style amongst both genders, according to the VAK/VARK model, was visual followed by auditory and kinaesthetic. These findings are consistent with that of previous studies done by Erton and Sizemore and Schultz (in Amran *et al.* 2011:333).

Contradictory evidence was found by Ren (2013:21, 24) who discovered that male students were more visual and kinaesthetic whereas female students were more auditory-orientated. These findings were confirmed in previous research conducted by Smith, Dunn and Griggs and Church (in Ren 2013:24).

Much research has been conducted into whether males or females are unimodal through to multimodal (see section 2.4.6). In research conducted by Al-Saud (2013:1373), the majority of the male students had a single or tri-modal learning preference, whereas more than half of the female students had a quadmodal learning preference. These findings were confirmed in a study conducted by Mon *et al*. (Khanal *et al*. 2014:5) on Malaysian preclinical students. In this study a greater percentage of female students preferred a multimodal presentation while for male it was unimodal. In addition, female students had more diverse preferences than male students by having

10 out of the other 11 possible combinations in multimodal learning style, whereas the male students only had 5 out of the 11 combinations. In a similar study conducted by Kharb *et al*. (in Khanal *et al*. 2014:5), it was shown that learning style preferences in females were more variable than in males. VR and AR bimodal combination were only found in females. Such findings were also confirmed in a study done by Breckler *et al.* (in Khanal *et al*. 2014:5) involving premedical, predental and prescientist groups of students.

Conflicting evidence was found in a study conducted by Wehrwein *et al*. (in Khanal *et al.* 2014:5) when comparing the learning style of students of two genders from Michigan State University. It was found that most of the females and only very few males preferred a single mode of information presentation. Therefore, the majority of male students preferred multimodal instruction whereas the majority of female students preferred single-mode instruction with a preference toward K. Thus, it was concluded by the authors that male and female students had significantly different learning styles.

Further contradictory evidence was found in research conducted by Choudhary, Dullo and Tandon (2011:43) where both males and females were reported to prefer information to reach them via multiple sensory modalities. More males preferred two modes and three modes whilst more females preferred four modes. More females preferred a combination of A and R, R and K (see section 2.4.6). Of the male and female students who preferred three modes of information processing, more males preferred A, R, and K and V, A and R. A number of male and female students were quadmodal (more females than males) preferring all four modes of information processing. Over half the male students included in the study had learning style preferences containing V somewhere in their profile (whether it was their unimodal choice or contained within one of the male multimodal combination, such as VA, VK, VAK, VAR, VRK or VARK). In contrast, just less than half of the females preferred V in their modality mix. More females than males preferred A in their modality mix, either as a unimodal preference or part of a multimodal combination. R was preferred by more

males than females in their modality mix; and K was preferred by more males than of females in their modality mix (Choudhary *et al.* 2011:43).

In research conducted by Dobson (2010:199), a relationship was found between gender and learning preferences. Most females indicated a preference for R learning followed by V, A and K; whereas most males preferred V learning followed by K, R and A. Further investigation of the data revealed that the two genders were equally unimodal and quadmodal. However, females were more bimodal and less trimodal than males (Dobson 2010:199).

3.4.2.3 Felder and Silverman

Prajapati *et al*. (2011:73) found, when using the Felder and Silverman learning style model (see section 2.4.6), that there were no statistically significant differences between the sensing-intuitive and the sequential-global learning styles in males and females. However, there was a statistically significant difference in the active-reflective and the visual-verbal learning styles. Females were on average more likely to have a reflective and visual learning style in comparison to males. However, Prajapati *et al*. (2011:75) did note that these findings were inconsistent with findings from other studies where it was found that female health science students were more likely to have a verbal and active learning style, whilst others have found no gender differences.

3.4.2.4 Dunn and Dunn learning style model

Regarding the learning-style preferences of German male and female students, Hlawaty (2009:38) found that diverse and significant gender variables were revealed for five of the 22 learning-style elements (light, motivation, responsibility, learning in several ways and intake) when using the Dunn and Dunn learning style model (see section 2.4.4). The size of the relationship between gender and the learning-style elements was small

for light and intake but medium for motivation, responsibility, and learning in several ways.

3.4.2.5 No relationship

In research done on the learning style preferences of Anglo, Chinese, Filipino, Korean and Vietnamese students in secondary schools, Park (in Aliakbari & Qasemia 2012:276), found no gender differences regarding learning styles. Similarly, Riding and Cheema and Kolb (in Aliakbari & Qasemia 2012:276) noted that there did not appear to be overall gender differences with respect to cognitive style, and that any differences found were usually small and non-significant. Loo (in Naik 2013:129) also did not find any significant differences in learning style distribution with respect to gender. In research conducted by Fitkov-Norris and Yeghiazarian (2013:148, 150) no significant association between gender and the number of learning modes used by students or the strength of the students' learning preferences was found.

Dobson (2010: 197) found contradictory evidence to support an association between gender and learning styles. In at least four of the eight studies mentioned by Dobson (2010:197) sensory modality preferences in women and men were compared. In two of these studies no significant difference was found in the learning preferences of men and women, whereas one did report a difference.

In a study done by Baykarn and Nacar (in Khanal *et al*. 2014:5) no difference was found in the learning styles of male and female students. Similar conclusions were made by El Tantawi and Shenoy *et al*. (in Khanal *et al*. 2014:5) in their research.

3.4.3 The link between learning styles and culture

Culture, according to Barmeyer (2004:586), is determined by socialisation through institutions such as family, friends, school, universities and work. All of these factors

influence the development of learning styles and help to create a system of shared values, assumptions and knowledge. Consequently, culture can be related to the development of learning styles. These views were similarly shared by Joy and Kolb (2009:69) who stated that many researchers have observed that cultural differences among students have a significant impact on the learning process. These points are further explored in the next section where the link between culture and a particular learning style model (see section 2.4) is explored.

3.4.3.1 Kolb's LSI

Barmeyer (2004:586), using Kolb's LSI (see section 2.4.1), found differences between the learning styles of French, German and Quebecois students. With regard to the CE (feeling) scores, the French and Quebecois students scored higher than the German students. This could indicate a preference for personal involvement with people and a more intuitive approach to problems and situations. The RO scores did not show significant differences, but the AC scores did as the German students scored higher than the French and the Quebecois (see Figure 3.2 below).

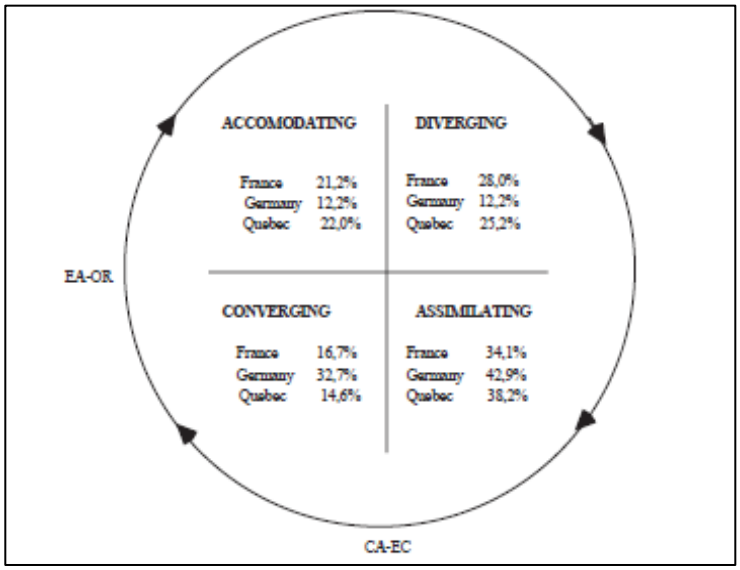


Figure 3.2: Barmeyer's results regarding culture

Source: Barmeyer (2004:588)

Figure 3.2 shows that the German students possess assimilating and converging learning styles. The French and the Quebecois students are more to be found in the opposite quadrants with a more emotional orientation (converging and accommodating). In all quadrants, the students from France and Quebec are more close together than their German counterparts.

Mestre (2010:811) graphically shows how learning styles differ between ethnic and cultural groups according to Kolb's LSI (see Figure 3.3 below).

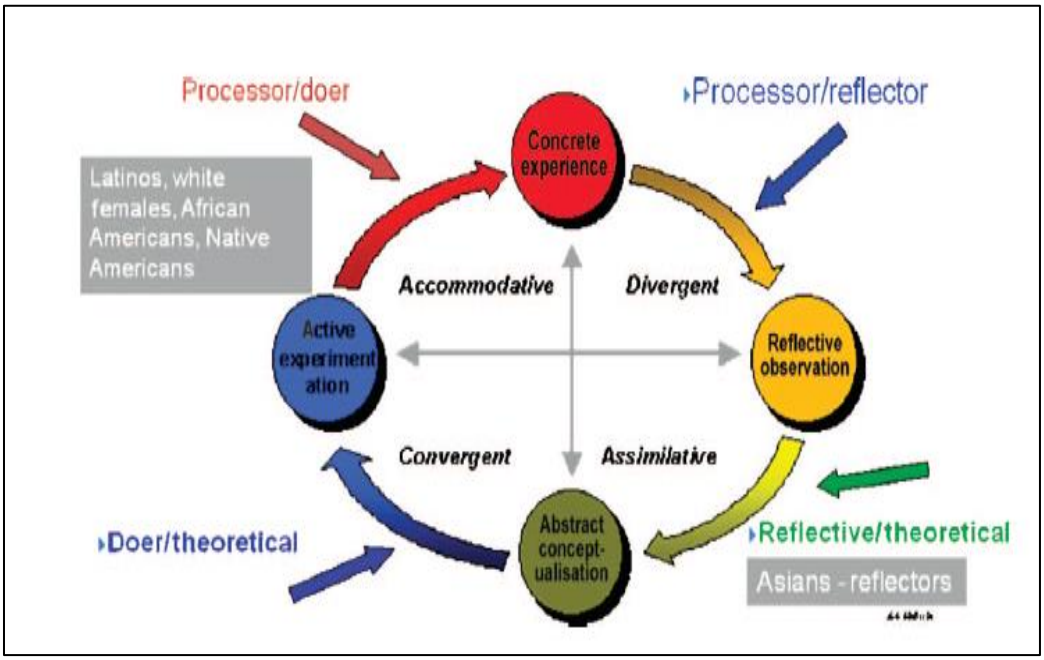


Figure 3.3: Learning styles and gender

Source: Mestre (2010:811)

Figure 3.3 shows that Latinos, African-Americans and Native Americans are more processors/doers whilst Asians are more reflective.

A number of comparative studies have also used Kolb's LSI and found significant differences in the learning style preferences amongst samples from different countries (Joy & Kolb 2009:72). According to Joy and Kolb (2009:83) culture has an impact on the

learning style scales that is comparable to that of some of the demographic variables. Culture has a significant effect in deciding a person's preference for abstract conceptualization versus concrete experience. The significance of its effect on the preference between active experimentation and reflective observation was marginal. Joy and Kolb (2009:72) also found the following:

- Japanese managers, Chinese and American EFL teachers and Australian and French students were divergers,
- German students, Quebec students, Chinese students from Taiwan and Hong Kong and full-time American MBA students were assimilators,
- American managers and part-time American MBA students were convergers, and
- No cultural groups were accommodators.

3.4.3.2 VARK model

Ramburuth and McCormick (2001:345) also found cultural differences when using the VARK model (see section 2.4.6). They found that Australian students indicated a stronger preference for auditory learning than Asian international students. This finding was explained by Ballard and Clanchy (in Ramburuth & McCormick 2001:345) who stated that international students may have had limited exposure to this mode in their home countries. Regarding tactile learning, international students reported a stronger preference for this type of learning than Australian students. This is consistent with other research conducted by Reid (in Ramburuth & McCormick 2001:345) who found that English speaking students demonstrated a lower preference for tactile learning than all eight of the non-English speaking groups (such as Arabic, Chinese, Korean and Spanish) involved in her research.

3.4.3.3 Felder and Silverman learning style model

In research conducted by Heffernan, Morrison, Basu and Sweeney (2010:35-36) it was found that both Chinese and Australian students are more active than reflective with a greater percentage of Australian students being more active. Australian students were also more visual, more verbal and more sequential than their Chinese counterparts. The only learning style dimension on which Chinese students scored greater was the global learning style.

3.4.3.4 Dunn and Dunn learning style model

In research conducted by Cozens (in Otrar 2007:1417) and Li, Yu, Liu, Shieh and Yang (2013:233) it was found that learning styles appear to differ across cultures when using the Dunn and Dunn model (see section 2.4.3). This is shown in examples of Chinese-Americans who were found to be more able to handle their assignments independently, and to prefer a quiet environment and formal structure for learning. In contrast, African-Americans preferred to work with peers rather than by themselves, and tended to prefer sound, music and informal seating while learning (Dunn in Li *et al*. 2013:233).

3.4.4 The link between learning styles and age

There is limited literature showing the relationship between learning styles and age. This literature is discussed below.

Hlawaty (2009:31) used Dunn and Dunn's Learning Style Inventory (see section 2.4.4) to test the strength of association between age and learning-style variables. The learning-style elements of temperature, persistence, tactual perceptual preference and time of day were all tested. The results generally showed the following:

- 13 years olds were more persistent and tactual than 17 year olds,
- 13 years olds were more authority-oriented than 15 and 17 year olds,

- 13 year olds preferred to learn more in the afternoon than 17 year olds,
- 13 year olds were more teacher- and parent-motivated than 17 year olds,
- 15 year olds required more warmth than 13 year olds,
- 15 year olds were more teacher-motivated than 17 year olds,
- 17 year olds needed more light than either of the younger groups, and
- 17 year olds required more warmth and intake than 13 year olds.

Hlawaty (2009:37) concluded from her study that nine of the 22 elements (light, temperature, persistence, authority-figure presence, tactual perceptual strength, intake, time of day, parent motivation, and teacher motivation) were significantly discriminated among the three age groups. Due to the wide range of psychological, physiological, and emotional changes that German adolescents experience as they develop, certain profiles of learning-style characteristics may be expected in most classrooms in Germany. Younger adolescents appear to be more persistent, authority motivated, parent motivated, and teacher motivated than older students. As they mature, these students become less tactual and more in need of light. Age differences in learning-style preference indicate a shift from adult-based to self-driven motivation, which should therefore be incorporated into classroom instruction (Flammer & Schmid in Hlawaty 2009:37). These same trends were reported earlier by Dunn and Griggs (in Hlawaty 2009:37) for American adolescents.

Age, according to Khanal *et al*. (2014:4), was considered as a factor for shifting of learning methods from one to another. In a study done by Whillier *et al*. (in Khanal *et al*. 2014:4) there was no significant difference between unimodal and multimodal learning styles from first year to fifth year medical students. However, there was a significant difference in preferences for visual and read/write type of learning styles as age increased. Different results were found in studies done by Murphy *et al.* (among undergraduate dental student) and by El Tantawi (among postgraduate dental students) (in Khanal *et al.* 2014:4). The age difference of the sample subjects of those two studies was around five years. This comparison showed that preferences for kinaesthetic and

aural increased as subjects became older and visual and read/write presentations were decreasing in the same pattern.

However, in research conducted by Prajapati *et al*. (2011:72), no statistically significant differences were found in the learning styles across three year groups.

In summary, it can be said that some of the literature highlights the relationship between learning styles, academic achievement, gender, culture and age. However, there is also a fair amount of literature disproving these relationships. It therefore makes it difficult to come to a conclusion regarding these relationships.

3.5 CONCLUSION

The main aim of this chapter was to examine the key factors which influence students' learning, their learning styles and their academic achievements. These three concepts are interrelated. The terms 'learning' and 'academic achievement' were examined first, and their relationship to learning style was established. The chapter then continued with an examination of those factors that influence learning, learning style and academic achievement namely the family of the student, the school the student attends and relevant student characteristics. These characteristics include behaviour, self-efficacy and self-regulation, self-concept, achievement motives, personality traits and how stress is experienced. The chapter concluded with a discussion of the relationship between learning styles and academic achievement, gender, culture and age.

In the next chapter the research design that will be employed in the study in order to answer the research questions as stated in section 1.2 will be explained.

CHAPTER FOUR

THE RESEARCH DESIGN AND DATA COLLECTION

4.1 INTRODUCTION

In Chapter two the theoretical framework of the study was presented. Several different learning theories and learning styles were explained. In Chapter three the researcher examined the literature that dealt with academic achievement, learning and learning styles and the factors that influence these elements.

The fourth chapter of the study starts with a description of the research problem, the research questions, the aims of the research and the hypotheses. This is followed by an explanation of how these research questions were investigated ethically, and a description of the different data collection methods that were used, namely a questionnaire and individual interviews. The chapter then moves on to examine how the data was analysed and the concepts of validity and reliability.

4.2 RESEARCH PROBLEM, RESEARCH QUESTIONS, AIMS OF THE RESEARCH AND THE RESEARCH HYPOTHESES

The problem under focus in this study pertains to the relationship between the academic achievement of students and their learning styles in a multicultural senior school (see section 1.2). The primary reason for doing such research is that classrooms in South Africa, since 1994, have become more multicultural. In order to teach effectively in such an environment, teachers need to use strategies that meet the needs of all the students whilst also considering their different nationalities. Teachers also need to know how individual students learn and which specific learning styles are significantly related to academic achievement. The question therefore arose as to what was the relationship between learning styles and academic achievement in a multicultural senior school and

the roles played by nationality, gender, age and grade/form in shaping these learning styles (see section 1.2). The topic of learning and learning styles was explored in the second chapter, and the elements that affect learning styles and academic achievement such as nationality, gender and age/form were further explored in the third chapter.

Accordingly, the following variables were identified as being important for the study:

- four sensory modality preferences as identified in the VARK learning style model namely auditory, visual, kinaesthetic and read/write (see section 2.4.6),
- individual or group learning factors as identified in the Dunn and Dunn learning style model (see section 2.4.3),
- gender (male or female) (see section 3.4.2),
- nationality (South African, Botswana, Zimbabwean, Zambian, Malawian, Mozambique, Kenyan, Tanzanian, Nigerian or other nationality) (see section 3.4.3);
- age (see section 3.4.4), and
- achievement at the end of term 1 and 2 for both English and mathematics (see section 3.4.1).

There were many reasons the researcher chose to work with these four sensory modalities as identified in the VARK model (see section 2.4.6). Consideration was given to the differing characteristics of the participants in the research. These participants ranged in age from 14 to over 19 years. They also came from a wide array of ethnic backgrounds and nationalities. Some of the participants did not speak English as a first language. For these reasons the researcher chose what she considered the most straight forward and uncomplicated model to use and then adapted it to suit her needs. The researcher also considered who would be more likely to use the results of the research. It was concluded that the most likely beneficiaries would be the students (the participants) themselves and the teachers at the school. It was again believed by the researcher that the VARK model offered the most practical information which was easy

to understand and utilise and presented teachers and students with information with which they could probably identify with.

Two other factors from the Dunn and Dunn model regarding sociological factors that influence learning also seemed significant for classroom teaching. These factors were individual versus group learning (see section 2.4.3). Therefore, they were also chosen to be investigated empirically by means of a questionnaire. Such information would be of great use to the teachers who often feel that group learning is good for students as they can learn from each other. However, this may not be true for many students who may find that learning in a group is stressful or a waste of time because of idle chatter. The researcher therefore believed that it was pertinent to examine these factors in more depth.

As many of the learning style questionnaires are copyrighted, it became incumbent on the researcher to design an original questionnaire to test these sensory modal preferences and factors.

The researcher also decided to focus on the students' achievements in English and mathematics and relate them to their learning styles. The reason for choosing English and mathematics was that these are the only two compulsory subjects (and as such the most commonly taken subjects) that students from Form 2 to Form 5[5] have to study at the school in question. Many 6th Form students also study English and mathematics as it aids their entry into university and opens up many academic opportunities. It was therefore decided by the researcher that the marks achieved in these subjects would give an adequate frame of reference as to the students' academic achievements.

[5] Form 2 is Grade 8, Form 3 is Grade 9, Form 4 is Grade 10, Form 5 is Grade 11, Lower 6th is Grade 12 and Upper 6th is one year post-matric

The above variables were examined in order to answer the main research question which was:

> *What is the relationship between student achievement and student learning styles in a multicultural senior school?*

On the basis of this research question, the following three specific quantitative research questions (see section 1.2) and hypotheses were stated:

Research question 1:
What are the learning styles of the students in the sample?

Research question 2:
What is the relationship between students' academic achievements in English and mathematics and their learning styles?

Hypothesis 2a: There is a significant relationship between students' academic achievements in English and mathematics and their learning styles.

Justification:
Many educational theorists and researchers consider learning styles as an important factor in the learning process and agree that incorporating them in education has the potential to facilitate effective learning for students (Graf, Kinshuk & Liu 2009:3) (see section 1.1 and section 3.4.1). In this study the researcher believed that it was important to investigate what the learning styles are of different groups of achievers. Examining the learning styles of high achieving students in English and mathematics was seen to be important as teachers and other students could learn from their success stories. This is the main reason for asking this specific research question.

Research question 3:
How are students' learning styles and their academic achievements in mathematics and English influenced by age, form, nationality and gender?

Hypothesis 3a: There is a significant difference in the learning styles of the following groups of students: those of different age, form, nationality and gender.

Justification:
In much of the literature differences have been found in the learning styles of male and female students (see section 3.4.2), students from different cultures (see section 3.4.3) and students of different ages (see section 3.4.4). However, examination of the literature has also revealed that there is evidence to suggest that no relationship exists between learning styles and these same variables (see section 3.4). The researcher therefore decided that it was important in this case to determine whether or not there was a statistically significant relationship between learning styles and these variables in the school. Such information would be of use to teachers as they operate in multicultural classes and teach students from a wide range of ages.

Hypothesis 3b: There is a significant difference in the academic achievements in English and mathematics of the following groups of students: those of different age, form, nationality and gender.

Justification:
Since learning styles and academic achievement are hypothesised to be significantly related (hypothesis 1), and the learning styles of different groups of students may differ significantly (hypothesis 2a), it follows logically that there could be significant differences in the academic achievements in English and mathematics of students who differ with regard to gender, nationality, age and form.

The above mentioned quantitative research questions were followed by a qualitative research question that aimed to investigate, by means of interviews, how a group of students studied mathematics and English (as will be explained).

Before the research proceeded to test the above mentioned hypotheses, the researcher ensured that the research was conducted in an ethical manner. This was done by adhering to the following principles of conducting ethical research which are discussed next.

4.3 ETHICAL CONSIDERATIONS

The researcher has a moral and professional obligation to be ethical even when research subjects are unaware of or unconcerned about ethics. The term 'ethics' is defined by Wellington and Szczerbinski (2007:59) as referring to the moral principles or guidelines for conduct which are held by a group or profession. The ethical issues are the concerns, dilemmas and conflicts that arise over the proper way to conduct research. Many ethical issues involve a balance between two values - the pursuit of scientific knowledge and the rights of those being studied or of others in society. Potential benefits of doing the research (such as advancing the understanding of social life) must be weighed against potential costs (the loss of dignity and the loss of self-esteem) (Neuman 2006:129). For the purposes of this study the following ethical considerations were continuously borne in mind: obtaining informed consent, protecting vulnerable research participants, the non-violation of privacy, and the actions and competence of researchers. Each of these points will be discussed further.

4.3.1 Obtaining informed consent

The goal of all social researchers should be the conduct of ethically informed social research. Most common ethical issues arise with research designs that use qualitative methods of data collection as close relationships can develop between the researcher and the researched. Other ethical issues that have to be addressed revolve around privacy, anonymity, secrecy, being truthful, the desirability of the research and getting the informed consent of those being interviewed, questioned and observed (Blaxter *et al*. 2008:158).

As a starting point, permission was obtained for ethical clearance from the relevant ethics committee in the College of Education (see Appendix A). To facilitate this, permission was obtained from individuals in authority at the relevant school. This involved writing letters identifying the extent of time, potential impact and outcomes of research (Creswell 2003:65). Permission to proceed with the research at the school was received from the Headmaster/CEO of the school during a meeting the researcher had with him to discuss the investigation. Further written explanation of the research was forwarded to him after this meeting. Permission was also sought from the Chairman of the Board of Governors of the relevant school (see Appendix B).

With regard to the students that participated in the study, it was important that participants knew the purpose of the study so that they could understand the nature of the research and its likely impact on them. Participants also needed to know the procedure to be used in the study so they knew what to expect. Participants always have the right to ask questions, to obtain a copy of the results and to have their privacy respected (Creswell 2003:64-65). The researcher needed to explain to the participants that they could opt out of the research at any stage. The participants needed to be assured of the researcher's respect for their confidentiality and that a summary of the research results would be offered to them (Mouton 2001:244). The participants in the study were informed that they could discontinue with the study at any time. They were assured of anonymity and that their responses would be used only for the purposes of the study. To the above mentioned ends, the researcher sought the consent of parents of students who were younger than 18 years, for their participation (see Appendix C). In addition, the students indicated their assent to participate in the research in writing (see Appendix D). Other assent forms the students completed included permission to be interviewed (see Appendices E and G).

4.3.2 Protecting vulnerable research participants

When doing research, participants must not be put at risk. Vulnerable populations such as those under the age of 18 (children), mentally handicapped, illiterate and those with low social status need to be respected. The anonymity of individuals, roles and incidents must also be protected. In order to do this, coding must be used (Creswell 2003:64, 66; Mouton 2001:245).

In this investigation every effort was made to avoid putting the participants in the study at risk and to ensure that all participants were respected. Although the participants needed to put their names on the questionnaire so that their learning styles could be correlated to their academic achievements from test results, the results were treated as confidential. Moreover, in the individual interviews, each participant was referred to as 'Participant 1'; 'Participant 2' and so on and not by their name (Mouton 2001:243-244; Neuman 2006:138-139). It is very important in such a study that participants be protected in order to ensure that the information from the study is not used against a certain student.

4.3.3 Non-violation of privacy

The researcher needed to make every effort to protect the information given by the participants. The researcher took all necessary precautions to protect the privacy of the participants. This was not difficult as the research did not focus on sensitive issues but on learning style preferences which are not seen as right or wrong.

4.3.4 Actions and competence of researchers

Researchers are powerful as they can influence their research and their findings (Blaxter, Hughes & Tight 2008:83). The researcher had no fixed opinions and views about the issues associated with the research. However, every effort was made to

ensure that the results were reported as objectively as possible. This implies that the researcher had to adhere to the highest possible standards in the research. The limits of the findings and the methodological constraints which determine the validity of the findings were indicated by the researcher. Results were not misrepresented and theories, methods and research designs were fully disclosed.

In the next section the research setting, research design and methods that were used in the research are explained.

4.4 THE RESEARCH SETTING, OUTLINE OF THE RESEARCH DESIGN AND THE RESEARCH METHOD

The research problems and aims were discussed in the preceding section of this chapter (see section 4.2). The research setting, research design and research method used by the researcher are now explained.

4.4.1 Research setting

For practical reasons the study was restricted to an independent school in the North-West Province. Thus, the sampling of the school was a convenience sample (McMillan & Schumacher 2014:2). Only students in Grade 8 (Form 2) through to post-matric (Upper 6th) were used in the research (see section 4.2).

4.4.2 The research design

When one speaks about a general strategy for solving a research problem, one is talking about a research design. According to McCaig (2010:30) a research design is an overarching strategy for unearthing useful answers to problems. Babbie (2010:117) adds to McCaig's definition by stating that a research design involves a set of decisions regarding what topic is to be studied, among which population, with which research

methods and for what purpose. A research design thus provides the overall structure for the procedures the researcher will follow, the data the researcher will collect and the data analysis the researcher will conduct (Leedy & Ormrod 2013:74). It is, in short, a 'blueprint' for the study (Formosa, Scicluna, Azzopardi, Pace & Calafato 2011:34).

When deciding which research design to use, a researcher needs to look at what kind of study will be done and what type of study will best answer the question that has been formulated. The focus must therefore be both on the point of departure (the research problem/question) and on the end product (the kind of results being aimed at). For that reason the focus is always on the logic of the research and the kind of evidence that is required to address the research question adequately (Mouton 2001:56; Neuman (2006:33).

The specific type of research design used in the study was a mixed methods design which was sequential explanatory. The quantitative phase was also descriptive and the qualitative phase, exploratory. The reasons for using these types of research designs were as follows:

- Descriptive research designs help to provide answers to factual questions in order to determine 'what is happening'. As such descriptive research often involves using statistics to outline the nature and shape of the data and the distribution of the measured data (Woodwell 2014:8-10, 35-37). The research design in this case was said to be descriptive because descriptive statistics (such as average scores and correlation) were used;
- Exploratory research was also used because research on the relationship between learning styles and academic achievement has not yet been conducted in the particular setting that was used in this study;
- A mixed methods research design was deemed most suitable for the following reasons:
    - the research problem (see section 1.2) is best understood by collecting diverse types of data (Creswell 2003:23) in the form of a mixed methods

research design which uses a combination of quantitative and qualitative research methods (Woodwell 2014:61);

- there is an assumption that the data received will be more valid due to the process of triangulation. Krathwohl (2009:285), Struwig and Stead (2013:17) and Wellington and Szczerbinski (2007:34) define triangulation as an attempt to compare data which is obtained using two or more methods of data collection in the form of a mixed methods research design. If different research methods produce data that is more or less the same, then the process of triangulation will show the researchers that they can be confident that their findings are accurate (Denscombe 2007:109; McCaig 2010:35; Neuman 2006:150). In this research triangulation of methods was achieved by using quantitative data collection methods in the form of a structured questionnaire and qualitative methods in the form of individual interviews; and
- it compensates for the weaknesses of the different research methods (quantitative and qualitative) being used (Denscombe 2007:110).

The following notation can be used to illustrate the research design:

QUANT → QUAL

This notation shows that the two phases are seen as being equally important. The reason for using this approach was that it was believed that it was more advisable to gain a large amount of data at the beginning of the fieldwork. The sequential approach started with the structured questionnaire (a quantitative research method) where information regarding the students' biographical details (e.g. gender and nationality), the students' learning styles and their achievements was obtained. During the analysis of this data, pertinent points were picked up and explored further in a smaller setting by means of individual interviews. Thus, the quantitative phase was followed by the individual interviews (a qualitative research method). There were two main reasons why individual interviews were used. The first reason was to obtain information which was

difficult to obtain during the quantitative process with regard to how students studied mathematics and English. The second reason was to further explore the results of the quantitative phase.

In the next section the data collection methods that were used in this study are explained in detail.

4.5 DATA COLLECTION METHODS

As indicated previously, the two main data gathering techniques that were used in the research were structured questionnaires (for the three quantitative questions) and individual interviews (for the qualitative question). These two different data collection techniques are now discussed. For each data collection method, details are given on the different participants and how they were selected as well as information on the design and administration of the particular data collection method.

4.5.1 The population

The population of the study was the total number of students in Form 2 through to Upper 6th (see section 1.5.3 and 4.2) which was 309. Only those students in Form 2 (Grade 8) through to Upper 6th (post-matric) (309 students) were chosen to participate in the study because they were considered adolescents (see section 1.5.4). These students were in the Senior Phase of the GET Band plus the FET Band (see section 1.5.3) and they were essentially part of a senior school as per the research question (see section 1.2) (Form 1s/Grade 7 should be part of the primary school).

4.5.2 Sampling

When doing research, it is difficult and often impractical to consult all the people in a specific category (or population) when collecting data for a quantitative study. It is more

appropriate to select a sample. Sampling is the process of selecting units from a population of interest so that by studying the sample, one can fairly generalise the results back to the population from which they were chosen (Singh 2013:73). Sampling is therefore a practical method for investigating a whole population (Formosa *et al*. 2011:11).

The sample technique which was used in the study to select a school was convenient and purposeful as noted in section 4.4.1. Convenience sampling takes people or other units which are available (Leedy & Ormrod 2013:214). Participants are selected because they are accessible and cooperative (Struwig & Stead 2013:116). The students at the school were easily accessible and conveniently located for the researcher as the researcher worked at the school. In the study all students from Form 2 through to Upper 6^{th} (who gave their consent and who studied both English and mathematics) were used in the research. Thus, the sample for the quantitative phase was a representative sample. This implies that the questionnaire results may be generalised to the school population.

Purposeful or purposive sampling was also used for the qualitative phase (the individual interviews) of the research. As the name implies, sampling is done with a purpose in mind (Singh 2013:87) and people or other units are chosen in this particular type of sampling for a particular purpose (Leedy & Ormrod 2013:215). This type of sampling is used when one needs to target a group of the population (Formosa *et al*. 2011:11). Purposive sampling allows researchers to select cases from which they can learn the most. It utilises expert judgement and focuses on the depth of information that is generated by the cases (Clark & Creswell 2008:207). It is for these reasons that purposive sampling was used in the qualitative phase of the research. Students from Form 2 to Form 6 (totalling 10 students) were selected to participate in the qualitative stage of the research (the individual interviews). These students were selected from the top students in each form who were most successful at English and mathematics in the

first term of 2015. The researcher also ensured that all cultural groups and genders were represented.

In the next sections the data collection instruments which were used in the research are explained.

4.5.3 The structured questionnaire

4.5.3.1 The design of the structured questionnaire

A structured questionnaire was designed by the researcher and was used to collect data from the students (see Appendix F). The questionnaire technique was chosen as one of the methods of data collection as it allows the researcher to collect original data that describes a population which is too large to observe directly. Questionnaires are also excellent vehicles, according to Babbie (2010:254), for measuring different orientations (such as learning styles) in a population.

The researcher, when drawing up the questionnaire, tried to avoid problems such as ambiguous or vague terms or double-barrelled questions. These points were identified by Mouton (2001:103-104) and Struwig and Stead (2013:94). The researcher was also careful about the order of the items and tried to avoid leading or negatively phrased questions, a confusing layout, and a questionnaire which was too long or contained sensitive or threatening questions. When designing the questionnaire the researcher started off with simple questions and then moved on to more complicated ones (Blaxter *et al*. 2008:182; Wisker 2001:142,148-149).The researcher also tried to ensure that the questionnaire maintained the interest of the respondents (Struwig & Stead 2013:93).

The structured questionnaire that was used in this research consisted of two main sections. The first section (consisting of five items) requested the student's biographical details namely:

- age,
- gender,
- ethnic background,
- nationality, and
- form.

The second section provided data of a quantitative nature. Scaled-response questions were used in order to gather data on attitudes and perceptions. The questions were closed to structure the answers according to preselected categories (Denscombe 2007:166). The questions were structured in such a way that the participants were asked to select the most appropriate answer on a five point Likert scale. The options were:

1. = Definitely disagree
2. = Disagree
3. = Neutral
4. = Agree
5. = Definitely agree.

A Likert Scale was used because it is a scaling method that is fairly easy to understand and use, reliability and content validity are improved and the difference in intensity between items can be demonstrated (Babbie 2010:179; Neuman 2006:209-210). The questionnaire consisted of 85 items. Table 4.1 shows the number of items that were constructed to measure each sensory modality preference or factor (see section 4.2), and is presented in Section B of the questionnaire (see Appendix F).

Table 4.1: Number of questions per sensory modality preference/factor

Sensory modality preference/factor	Question number
Auditory	6-20
Visual	21-35
Kinaesthetic	36-50
Reading	51-58
Writing	59-65
Individual learning	66-72
Group learning	73-80

Each of the modalities/factors in Table 4.1 was scored using the five point Likert Scale. The higher the score the students gained for each modality, the more likely those students were to be of that type of modality. By scoring in this way, the rank order of the students' learning preferences was determined and the averages for the different factors could be compared for the whole sample and for different groups.

4.5.3.2 The pilot study

The questionnaire was pre-tested in a pilot study. Piloting is a vital part of questionnaire design and construction (Wellington & Szczerbinski 2007:98). It is done for the following reasons:

- to improve reliability - that is that all participants understand the questions in the same way (Babbie 2010:233; Leman 2010:181),
- to test for validity - respondents' answers mean what you take them to mean (Leman 2010:181), and
- to test for the layout, language use, possible ambiguity, clarity of instructions and acceptability of the statements and the length of the questionnaire (Babbie 2010:98).

In the pilot study that was done for this research, the researcher personally administered the questionnaire to 20 students who would not participate in the main study. These students were randomly selected from Form 2, 4, 5 and Lower 6th. The students were informed that this was the pilot test of the questionnaire and that all responses were to remain anonymous. In line with the above, the main purpose of the pilot study was to firstly scrutinize the effectiveness of the questionnaire items in respect of the appropriateness of the wording and the clarity of the items; and secondly, to determine how much time was needed to complete the questionnaire.

The following modifications were made to the questionnaire after receiving feedback from the students:

- the box (on page 1) with the terms 'Office Use' in it was removed as it served no purpose and was confusing the students,
- the students found Q39 too vague so the question was changed from 'I enjoy handling objects' to 'I enjoy building things',
- Q59 and Q61 were very similar and as such Q59 was changed to 'I remember best by writing things down', and
- Q64 needed more clarification and was changed to read 'I prefer writing to reading **when I study'**.

4.5.3.3 The administration of the structured questionnaire

The questionnaire was administered to 240 students (who submitted consent and assent forms) in Forms 2 to Upper 6th at the school during May 2015. The questionnaire was completed during the Personal and Social Development lessons at the school under the supervision of the form teacher who had already been briefed on the questionnaire. At the start of the period the researcher introduced herself and explained the purpose of the questionnaire. The participants were assured of the confidentiality of their replies. The instructions on the front of the questionnaire were clear and the questionnaire was not cramped in appearance. These were all points highlighted by

Blaxter *et al*. (2008:183) as well as Wellington and Szczerbinski (2007:99) and taken into account when administering the questionnaire. The researcher informed the participants that they were free to ask their form teacher if they were unsure of the meaning of any of the questions. The questionnaire took the students between 10 and 15 minutes to complete.

When the 240 students handed in their questionnaires, the form teacher checked to see that the questionnaires had been fully completed and then handed the questionnaires to the researcher.

4.5.4 Individual interviews

As noted (in section 4.5.2), one student from Form 2, two students from Form 3 to 5 and three students from Form 6 (totalling 10) were selected to participate in the qualitative part of the study. These students were selected from the top students in each form who were successful in English and mathematics in the first term of 2015. All cultural groups and genders were represented. It was believed by the researcher that it was important to hold such interviews as the information gained from high performing students regarding learning and how best they learnt mathematics and English could be of great use to teachers and to other students who could learn from such success stories.

The individual interviews done for this research were held after the completion of the structured questionnaires as the information gathered in the structured questionnaires was considered in the individual interviews. The students were contacted two weeks prior to the meeting to ensure that they were available. The interviews were held in the researcher's classroom during the afternoon and lasted about thirty five minutes. The interviews were semi-structured (see Appendix H) in that the interviewer followed standard questions but added one or more individually tailored questions to seek clarification or probe a person's reasoning (Leedy & Ormrod 2013:190). Such a method of data collection is very useful in exploratory types of research (Sahu 2013:65). In

accordance with Sahu (2013:65-66), this allowed the researcher to get more detailed information in a flexible manner and avoid misinterpretation. However, it was also time-consuming, and the presence of the interviewer could have affected the students, thus hampering the quality of the data.

During the interviews the researcher/interviewer was not seated behind her desk so as not to intimidate the students. At the beginning of each interview the researcher welcomed and thanked the participants for their presence and participation as the researcher wanted to make the participants feel at ease. The researcher informed the participants that they should feel free to communicate their feelings and thoughts as there were no wrong or right answers. The researcher further assured the participants that their contributions would only be used for the purposes of the study, and all responses were confidential and anonymous as their names would not appear in the research report (thesis).

The researcher informed each participant why they had been chosen to be interviewed. Once the interviews started, the researcher followed the interview guide, although answers were probed for clarity purposes. Head nodding and signs of approval were used to motivate participants and indicate acceptance of answers. Field notes were also taken. The researcher transcribed the interviews verbatim as soon as the meeting finished.

Some problems were experienced during the interview process. The younger students in Form 2 and 3 found the questions quite difficult to answer and did not hold as many views as the older students. The students, in general, also found it difficult to answer questions where they perceived they would be criticising their teachers. The researcher continuously assured them that their answers were confidential.

4.6 VALIDITY AND RELIABILITY

Validity suggests truthfulness. It refers to how well an idea 'fits' with reality (Neuman 2006:188). Validity is defined by Creswell (2012:159) as the development of sound evidence to demonstrate that the test interpretation of scores about the concept or construct that the test is assumed to measure, matches its proposed use. Blaxter *et al*. (2008:221) state that validity refers to whether the researcher's methods, approaches and techniques indeed relate to or measure the issues that are being explored. In other words, validity is concerned with the integrity of the conclusions that are generated from a piece of research.

Regardless of the type of scale a measurement instrument involves, the instrument must have both validity and reliability for its purpose (Leedy & Ormrod 2013:89). According to authors (Neuman 2006:188,190; Wellington & Szczerbinski 2007:43) reliability and validity are central issues in all forms of measurement and are widely used to discuss the quality of research. Both concepts help to establish the truthfulness, credibility and believability of findings. They reflect the degree to which there may be error in measurements (Leedy & Ormrod 2013:92).

An accepted method of ensuring validity is to use the triangulation data collection method (McCaig 2010:35). This method enhances the confidence in the validity of the findings, allows for the accuracy of the findings to be checked and enhances the completeness of the findings (Denscombe 2007:137-138). In this study, both quantitative and qualitative methods were used to ensure triangulation of data.

The next sections explain how validity and reliability for the two phases of the research, which involved a questionnaire and an individual interview, were ensured.

4.6.1 Validity and reliability of the structured questionnaire

4.6.1.1 Validity of the questionnaire

In this research, the validity of the questionnaire was ensured in the following ways:

- *Face validity* is the extent to which, on the surface or 'on its face', an instrument looks like it is measuring a particular characteristic. Face validity is often useful for ensuring the cooperation of people who are participating in a research study. This type of validity is the most basic. In this study relevant experts (such as the researcher's promoter and the Ethical Clearance Committee) agreed that the items in the questionnaire focused on (i) the different kinds of learning styles that were selected namely the auditory, visual, kinaesthetic, reading, writing, individual or group learning styles, and (ii) the students' academic achievements. In this way the items were considered to be suitable to measure the intended variable and therefore had face validity.
- *Content validity* is the extent to which a measuring instrument is a representative sample of the content area or domain being measured (Davies & Hughes 2014:160-161; Leedy & Ormrod 2013:89-90; Sahu 2013:42). In this study relevant experts (such as the researcher's promoter) agreed that the items covered the whole domain of learning styles and had practical value for teachers in consideration of the VARK model in particular.

4.6.1.2 Reliability of the questionnaire

According to Johnson and Christensen (2008:144) reliability refers to the consistency and stability of a set of test scores. Reliability therefore implies dependability, consistency, repeatability and replicability (in that if the same thing is repeated or recurs under the identical or similar conditions, the researcher will get the same results and not erratic, unstable or inconsistent results) (Wellington & Szczerbinski 2007:43). Blaxter *et al*. (2008:221) state that reliability also has to do with how well a research project is

carried out. Several factors can result in unreliable data such as questions on instruments being ambiguous or unclear, procedures used in test administration not being standardised and participants misinterpreting questions or guessing on tests (Creswell 2012:159).

In this research, the reliability of the questionnaire was calculated statistically by means of Cronbach's coefficient alpha. This is a measure of the internal consistency of the questionnaire items that use a Likert scaled response (Struwig & Stead 2013:141). These correlation coefficients were as follows:

- Auditory learning style: .61
- Kinaesthetic learning style: .60
- Visual learning style: .76
- Reading learning style: .60
- Writing learning style: .70
- Individual learning style: .85
- Group learning style: .89

Thus, the questionnaire was reliable in particular with regard to a visual learning style, a writing learning style, an individual learning style and a group learning style (reliabilities of 0.7 and above) (McMillan & Schumacher 2014:198)

4.6.2 Validity and reliability of the qualitative phase

In this research, validity and reliability (also called trustworthiness of qualitative data) were ensured in the following ways. The researcher:

- was aware the entire time of the possibility of researcher bias,
- used a lengthy data collection time for the study,
- used a tape recorder to tape interviews and transcribed the interviews verbatim;

- used multi-method strategies (triangulation) which allowed for data collected in the qualitative phase to be compared with data from the quantitative phase in order to test for consistency,
- talked to a number of teachers about the research and the findings in order to determine whether the information received was accurate, could be trusted and was credible,
- used another academic to look at the analysis of the data (the promoter),
- reanalysed parts of the raw data collected during the qualitative phase in order to assess the consistency of the results from the first analysis,
- was fully involved in the qualitative stage and developed a trusting relationship with the participants; and
- constantly reflected on the data which was being collected to judge whether it was reliable.

These were all ways suggested by Creswell and Clark (2011:210), Liamputtong (2013: 28-32) and Struwig and Stead (2013:137).

4.7 ANALYSIS OF THE DATA

According to Blaxter *et al*. (2008:183) analysis is an on-going process which may occur throughout the research with earlier analysis often informing later data collection. Analysis is about the search for explanation and understanding in the course of which concepts and theories will likely be advanced, considered and developed.

4.7.1 Analysis of the questionnaire data

The information from the questionnaires was manually entered into Microsoft Excel. Once the data was entered, a process of cleaning was done. According to Haughton and Stevens (2010:201) data cleaning involves working methodically, question by question, to ensure the data is as accurate as possible. In this research the data

cleaning process involved checking whether the data was within the expected parameters and ranges of the responses, and that data was not missing.

In order to analyse the data that will address each one of the research questions and hypotheses (see sections 1.2 and 4.2) in the quantitative part of the study, the researcher used both descriptive statistics and inferential statistics. Descriptive statistics indicate the general tendencies in the data (e.g. correlations and means) and the spread of scores (e.g. standard deviations) (Creswell 2012:182). Inferential statistics allow for the analysis of data from a sample in order to draw conclusions about a population. In this research, inferential statistics were used to test the hypotheses as follows:

- Hypothesis 3a (which investigated the difference between students' learning styles and their gender, nationality, age and form) was tested by means of Pearson's correlations; and
- Hypothesis 3b (which examined the differences in the academic achievements in English and mathematics of the following groups of students - those of different gender, nationality, age and form) was tested by means of ANOVAS.

4.7.2 Analysis of the individual interviews

The analysis of the individual interviews was done in the following stages as suggested by Wellington and Szczerbinski (2007:101-108):

- *Immersion* - the researcher immersed herself in the data in order to get an overall sense or feel for the data. This involved reading and re-reading the transcripts, listening to the tapes and highlighting and annotating the transcripts. The researcher looked for buzzwords and other commonly used words and phrases in the transcripts.
- *Reflecting* - after immersing herself in the data, the researcher 'stood back' from the data and literally 'slept on it'.

- *Analysing the data* - the researcher started coding the data in order to create categories, patterns or recurring themes which could be used to 'make sense of the data'. According to Smith and Davies (2010:152) codes are labels for the data that allow for categorisation of such data so that it can be used in the research. The coding was, in one sense, deductive as the interview schedule indicated the categories that were formed. In other words, the following categories were chosen: how students learn English and mathematics; what kind/s of teaching works best for them in the English and mathematics classes; what kind/s of teaching does not work well for them in the English and mathematics classes; what do they recommend with regard to English and mathematics teaching for effective learning, and so forth. However, within each category, the analysis of the data was inductive.
- *Recombining/synthesising data* - at this stage the researcher looked for patterns and themes in the categories. In this regard, the researcher noted specific acts or behaviours, events, activities or practices relevant to the research questions.
- *Relating and locating data* - during this stage the researcher interpreted the results by comparing and contrasting the data to what was found in the literature review. This allowed the researcher to reflect upon the data and make sense of it and thus discuss it.
- *Presenting qualitative data* - the researcher, in this last stage of analysing the data, tried to present the data as fairly, clearly and coherently as possible. The researcher also integrated the qualitative data with the quantitative data in order to get an overall view of what the data meant. This allowed the researcher to answer the main research problem (see sections 1.2 and 4.2).

4.8 SUMMARY

The main aim of this chapter was to provide information on the research design that was used in this study. The chapter started with an exposition of the research problem and specific research questions that were investigated. This was followed by a

discussion of how an ethical approach was ensured, and an examination of the mixed methods research design which was deemed to be the most suitable design to use in this type of research. The mixed methods research design was made up of quantitative and qualitative research methods which were both described in the chapter. The chapter concluded with a discussion of the reliability and validity of the various measuring instruments that were used and a discussion of how the data from the structured questionnaire and the individual interviews was analysed.

In the next chapter the results and findings of the research are analysed and presented.

CHAPTER FIVE

RESULTS AND DISCUSSION

5.1 INTRODUCTION

In Chapter 4 the research design and methodology were discussed. In this regard, a mixed methods design was used which was sequential explanatory. The research design was also descriptive and exploratory.

In this chapter the researcher aims to answer the main research question and the various specific research questions (see section 1.2) by presenting the results of the quantitative phase (gathered by means of a structured questionnaire) and a qualitative phase (gathered by means of interviews). The tables and figures which follow show the demographic data of the respondents; the results of research question 1; the results of research question 2; and the results of research question 3. Thereafter follows the qualitative findings and finally, a discussion of both phases.

5.2 QUANTITATIVE RESULTS

5.2.1 Demographic data

The demographics of the 240 respondents are indicated in Tables 5.1 to 5.5 and Figures 5.1 to 5.5. The demographic variables are age, gender, ethnic group, nationality and form.

Table 5.1: Age of the respondents

	Frequency	Percent
14 years and younger	67	27.9
15 years	50	20.8
16 years	56	23.3
17 years	43	17.9
18 years	19	7.9
19 years and older	5	2.1
Total	240	100.0

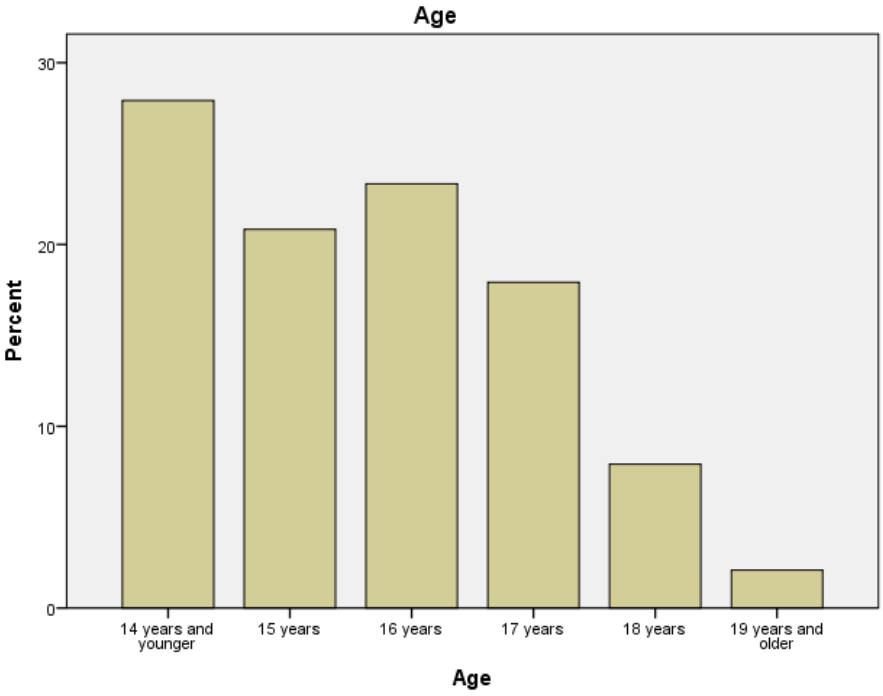


Figure 5.1: Age of the respondents

Table 5.1 and Figure 5.1 show that most of the respondents (27.9%) were 14 years and younger. The smallest group (2.1%) were 19 years and older.

Table 5.2: Gender of the respondents

		Frequency	Percent
Valid	Male	107	44.6
	Female	133	55.4
	Total	240	100.0

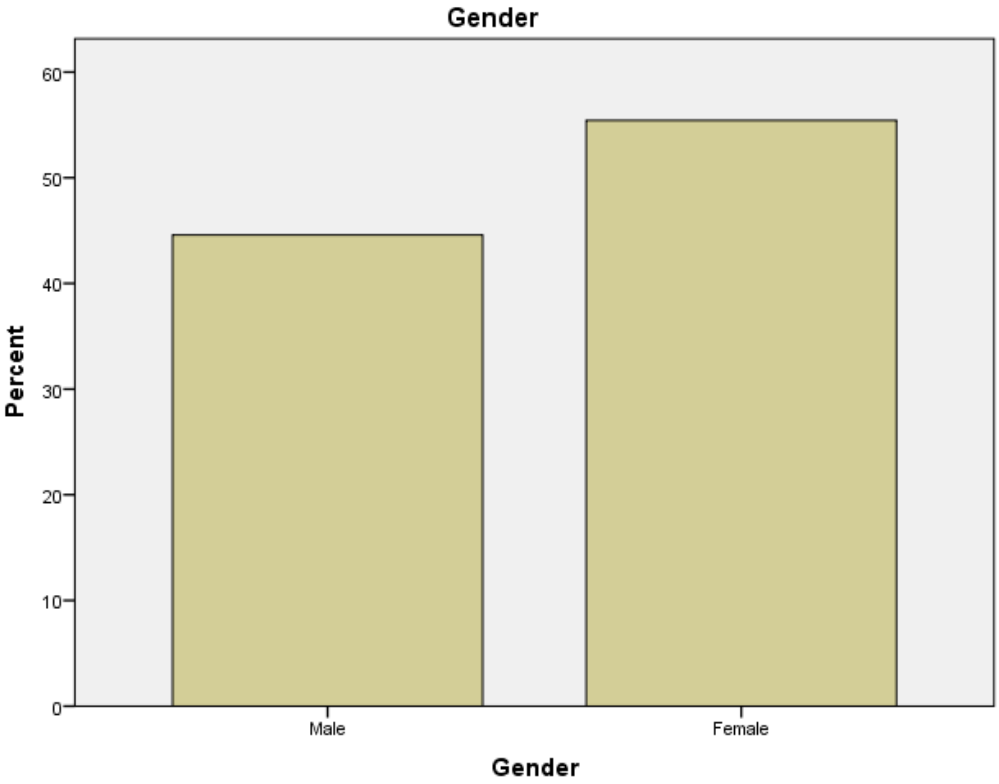


Figure 5.2: Gender of the respondents

Table 5.2 and Figure 5.2 show that the majority of the respondents were female (55.4%).

Table 5.3: The ethnic group composition of the respondents

		Frequency	Percent
Valid	Black	185	77.1
	Mixed race	21	8.8
	Indian	21	8.8
	White	13	5.4
	Total	240	100.0

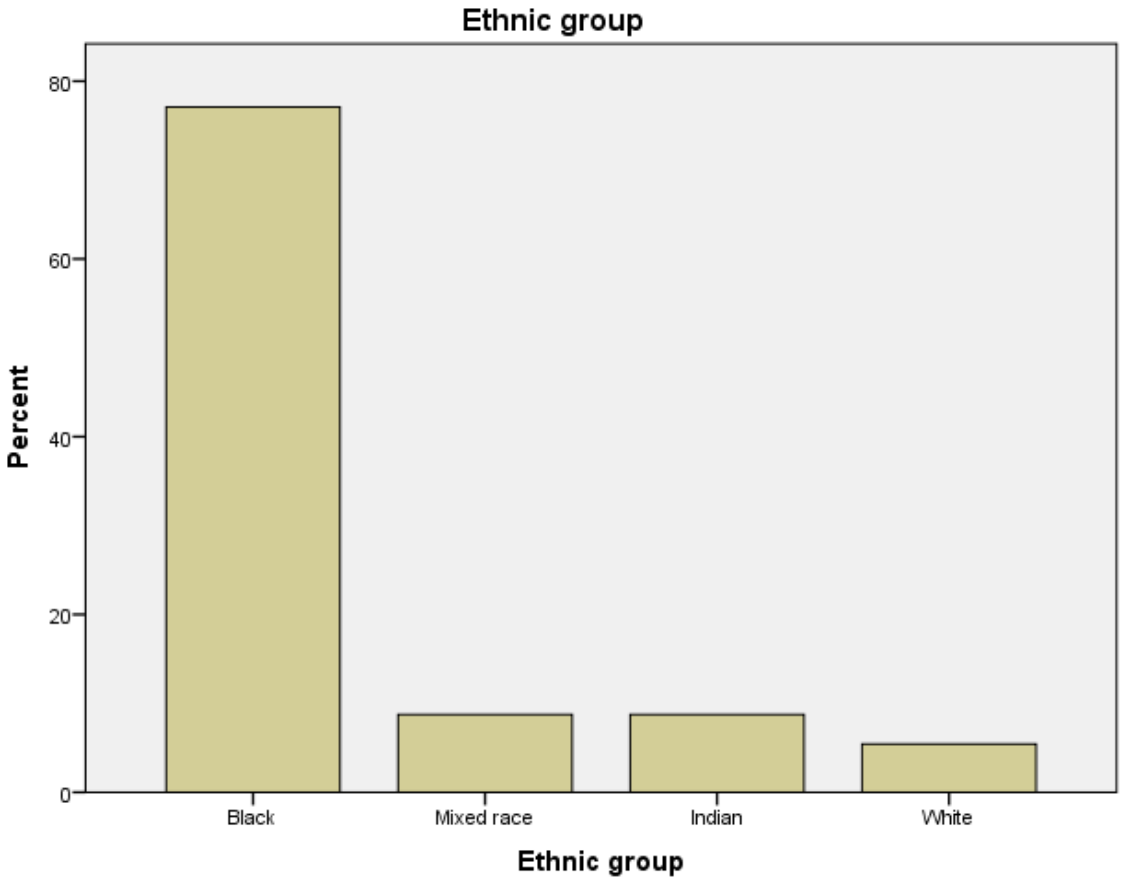


Figure 5.3: The ethnic group composition of the respondents

Table 5.3 and Figure 5.3 show that the largest ethnic group was Black (77.1%) followed by Mixed race and Indian (both 8.8%).

Table 5.4: Nationality composition of the respondents

		Frequency	Percent
Valid	South African	132	55.0
	Botswana	20	8.3
	Zimbabwean	35	14.6
	Malawian	19	7.9
	Total	206	85.8

The sample composition in terms of nationalities is also illustrated in Figure 5.4.

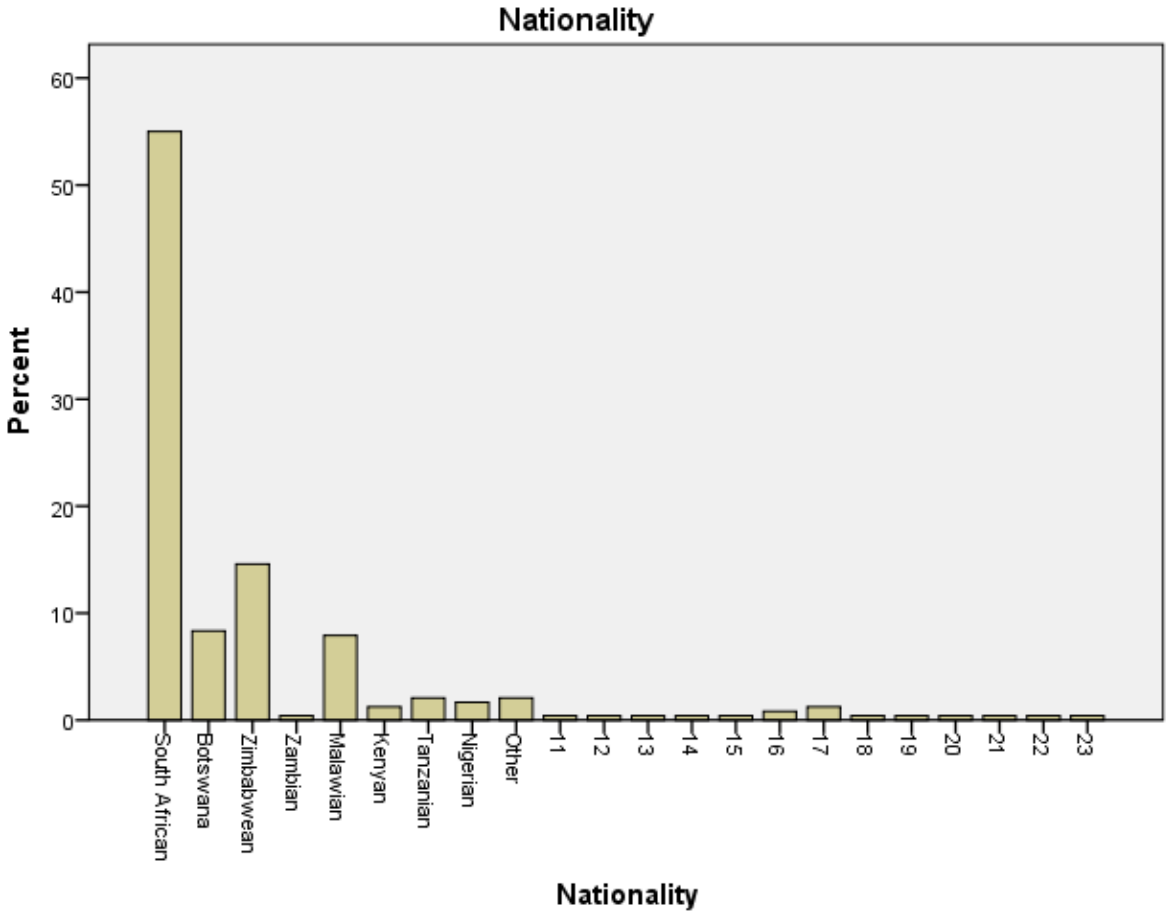


Figure 5.4: Nationality compositions of the respondents

Table 5.4 and Figure 5.4 show that the four main nationalities in the sample were South African (55%), Zimbabwean (14.6%), Botswana (8.3%) and Malawian (7.9%). The largest group was the South African group whereas the smallest group came from Malawi. The focus in the report back on the findings will only be on these four main nationalities. Examples of other nationalities that were identified were: Pakistani (1); Chinese (1); German (1); Austrian (1); Australian (1); Togolese (2); Angolan (3); Lesotho (1); British (1); Ethiopian (1); Canadian (1); Ugandan (1); and American (1).

Table 5.5: The frequency and percentage of respondents in each form

		Frequency	Percent
Valid	1	42	17.5
	2	43	17.9
	3	61	25.4
	4	55	22.9
	5	39	16.3
	Total	240	100.0

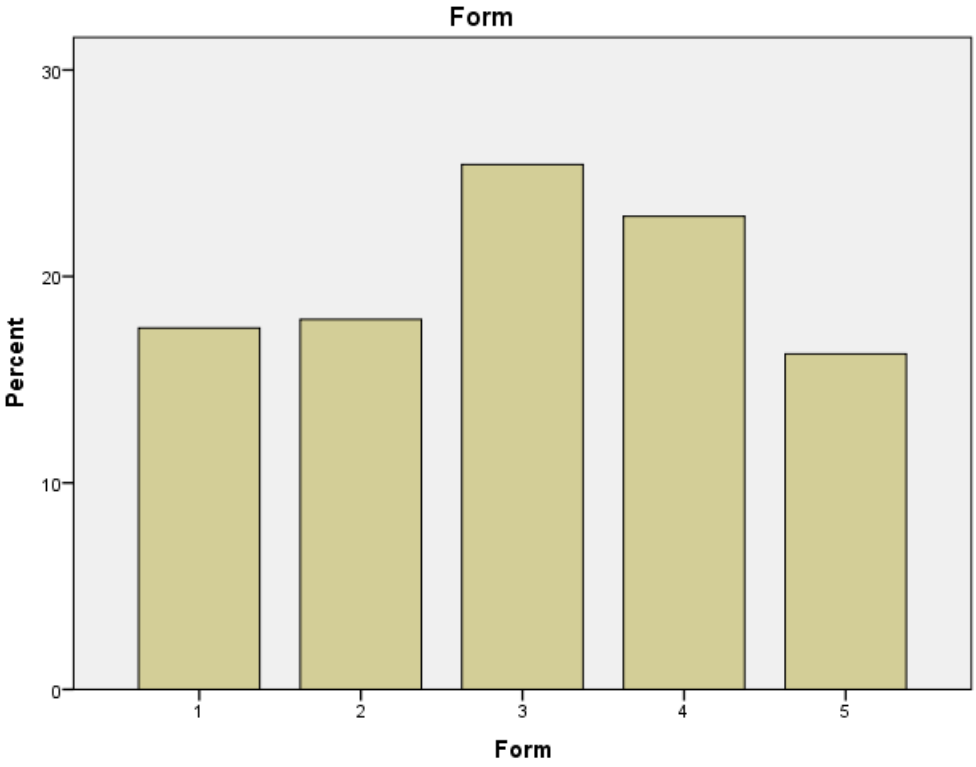


Figure 5.5: The frequency and percentage of respondents in each form

(In the above table and graph the following numbers refer to the following forms:

1=Form 2; 2=Form 3; 3=Form 4; 4=Form 5; 5=Form 6).

Table 5.5 and Figure 5.5 show that the greatest number of respondents come from Form 3 (25.4%), followed by Form 5 (22.9%) and Form 3 (17.9%). The smallest group was Form 6 (16.3%).

In the next section research question 1 is answered.

5.2.2 Research question 1

Research question 1 stated: *What are the learning style preferences of the students in the sample?* This question is answered by looking at both the individual items of the questionnaire and the seven learning styles in total. In Tables 5.6 to 5.12 the frequencies, percentages, means and standard deviations (SD) for the individual questionnaire items for each of the seven learning style preferences are given. For this section, the responses on “definitely disagree” and “disagree” have been combined into one variable (“disagree”). Similarly, the responses on “definitely agree” and “agree” have been combined into one variable (“agree”).

The results are given in the following order: auditory sensory modality; visual sensory modality; kinaesthetic sensory modality; reading preferences; writing preference; preference for individual learning and preference for group learning.

5.2.2.1 Auditory sensory modality preference

Table 5.6 indicates the descriptive statistics of preference for an auditory sensory modality.

Table 5.6: The frequencies, percentages, means and standard deviations of preference for an auditory sensory modality

Item	Dis-agree	f (%) Neutral	f (%) Agree	M	SD
I enjoy listening to the teacher talk	27 (11,3)	137 (57,1)	76 (31,7)	3,26	,85
I prefer that teachers give me direct instructions	12 (5)	31 (12,9)	197 (82,1)	4,14	,89
I love it if students explain work to me	50 (20,8)	88 (36,7)	102 (42,5)	3,25	1,09
I learn a lot from listening to groups of students talk	65 (27,1)	75 (31,3)	100 (41,7)	3,24	1,15
I can follow directions given in class easily	19 (7,9)	73 (30,4)	148 (61,7)	3,72	,89
I often talk aloud to myself	88 (36,7)	46 (19,2)	106 (44,2)	3,06	1,45
I enjoy listening to what others in a group say	45 (18,8)	75 (31,3)	120 (50)	3,34	1,05
I learn a lot by listening to the teacher	23 (9,6)	75 (31,3)	142 (59,2)	3,68	,94
I understand when teachers tell me what to do	10 (4,2)	71 (29,6)	159 (66,3)	3,78	,81
I listen well in class	34 (14,2)	100 (41,7)	106 (44,2)	3,38	0,87
I love listening to stories	35 (14,6)	54 (22,5)	151 (62,9)	3,84	1,13
I like to learn from songs	62 (25,8)	53 (22,1)	125 (52,1)	3,48	1,39
I learn best by listening to what others say	61 (25,4)	100 (41,7)	79 (32,9)	3,09	1,03
I learn well by concentrating on what teachers say in class	28 (11,7)	71 (29,6)	141 (58,8)	3,65	1,00
I like to be told what to do when my teachers give me work	27 (11,3)	49 (20,4)	164 (68,3)	3,81	1,04

Table 5.6 shows the frequencies, percentages, means and SDs of the preference for an auditory sensory modality. The items which have the highest percentages as well as the highest means and SDs are as follows:

- 57.1% of the respondents indicated that they were neutral on the issue of enjoying listening to the teacher talk,
- 82.1% of the respondents indicated that they prefer the teacher to give them direct instructions and the respondents were very positive towards this issue (indicated by a high mean of 4.14),
- 61.7% revealed that they can follow instructions easily in class,
- The question “I often talk aloud to myself’ had a high SD of 1.45 meaning that the respondents were divided on this issue,
- 59.2% of the respondents agreed that they learn a lot by listening to the teacher,
- 66.3% indicated that they understood when teachers told them what to do and the respondents were very positive towards this issue (a high mean of 3.78),
- 62.9% of the respondents indicated that they loved listening to stories and they were very positive towards this issue (indicated by the large mean of 3.84),
- 52.1% stated that they like to learn from songs, however the students were divided on the issue (SD=1.39),
- 58.8% revealed that they learn well by concentrating on what the teacher says in class, and
- 68.3% like to be told what to do when the teachers give them work (the respondents were positive towards this issue as the mean is 3.81).

In the next section the responses for the visual sensory modality will be discussed.

5.2.2.2 Visual sensory modality preference

Table 5.7 indicates the descriptive statistics of a preference for a visual sensory modality.

Table 5.7: The frequencies, percentages, means and standard deviations of preference for a visual sensory modality

Item	f (%) Dis-agree	f (%) Neutral	f (%) Agree	M	SD
I like to watch the teacher show me how to do something	16 (6.7)	27 (11.3)	197 (82.1)	4,16	1.0
I love watching TV	23 (9.6)	31 (12.9)	186 (77.5)	4,15	1,07
I love watching a movie	10 (4.2)	23 (9.6)	207 (86.3)	4,41	,86
I like classes where the teacher uses the data projector or whiteboard to explain work	14 (5.8)	43 (17.9)	183 (76.3)	4,02	,93
I can easily understand diagrams or figures	31 (12.9)	82 (34.2)	127 (52.9)	3,58	1,04
I enjoy looking at books	74 (30.8)	53 (22.1)	113 (47.1)	3,2	1,25
I like to draw when I study	105 (43.8)	57 (23.8)	78 (32.5)	2,78	1,36
I like watching demonstrations or experiments	13 (5.4)	32 (13.3)	195 (81.3)	4,20	,90
I like using mind maps or diagrams when I study	109 (45.4)	50 (20.8)	81 (33.8)	2,87	1,29
I like to use a highlighter pen when revising my work	52 (21.7)	40 (16.7)	148 (61.7)	3,71	1,32
I like sitting at the front of the classroom	89 (37.1)	72 (30)	79 (32.9)	2,93	1,36
I enjoy spelling	67 (27.9)	72 (30)	101 (42.1)	3,24	1,17
I enjoy puzzles	61 (25.4)	51 (21.3)	128 (53.3)	3,42	1,29
I love art	86 (35.8)	54 (22.5)	100 (41.7)	3,10	1,44
I love playing video games	48 (20)	44 (18.3)	148 (61.7)	3,75	1,33

With regard to Table 5.7, the items which had the highest percentages, means and SDs are as follows:

- 82.1% of the respondents indicated that they like the teacher to show them how to do something (a high mean of 4.16),
- 77.5% of the respondents loved watching television (a high mean of 4.15),
- 86.3% said that they loved watching a movie (a high mean of 4.41),
- 76.3% revealed that they liked classes where the teacher used the data projector or whiteboard to explain work (a high mean of 4.02),
- 81.3% liked watching demonstrations or experiments (a high mean of 4.20),
- 61.7% liked using a highlighter pen when revising their work and they loved playing video games, and
- there are certain items with high SDs (greater than 1) indicating that students were divided on these particular issues.

In the next section the responses for the kinaesthetic sensory modality will be discussed.

5.2.2.3 Kinaesthetic sensory modality preference

Table 5.8 indicates the descriptive statistics of a preference for a kinaesthetic sensory modality.

Table 5.8: The frequencies, percentages, means and standard deviations of preference for a kinaesthetic sensory modality

Item	f (%) Disagree	Neutral	f (%) Agree	M	SD
I like to make things with my hands	40 (16.7)	73 (30.4)	127 (52.9)	3,59	1,14
When I study, I have to take lots of breaks	59 (24.6)	58 (24.2)	123 (51.2)	3,43	1,17
I like to move around when I work	71 (29.6)	54 (22.5)	115 (47.9)	3,26	1,25
I enjoy building things	66 (27.5)	65 (27.1)	109 (45.4)	3,31	1,28
I like to take things apart to see how they work	63 (26.3)	57 (23.8)	120 (50%)	3,33	1,37
I enjoy sport	39 (16.3)	32 (13.3)	169 (70.4)	3,90	1,31
I love to learn by doing things	8 (3.3)	55 (22.9)	177 (73.8)	4.08	,89
I like to discover new things	8 (3.3)	27 (11.3)	205 (85.4)	4,38	,86
I often play with things in class like a pen or an eraser	66 (27.5)	52 (21.7)	122 (50.8)	3,37	1,35
I use my hands a lot when I talk	46 (19.2)	56 (23.3)	138 (57.5)	3,61	1,24
I am good at making things	58 (24.2)	81 (33.8)	100 (41.7)	3,26	1,14
I like it when teachers use activities in class	17(7.1)	31 (12.9)	192 (80)	4,18	1.0
I tap my foot or pencil when I am thinking	45 (18.8)	33 (13.8)	162 (67.5)	3,78	1,29
I like talking to my friends whilst working with them	29 (12.1)	46 (19.2)	165 (68.8)	3,84	1,14
I like going on field trips	11 (4.6)	37 (15.4)	192 (80)	4,27	,93

According to Table 5.8:

- 70.4% of the respondents enjoyed sport and were very positive towards this issue (a mean of 3.90),
- 73.8 % of the respondents indicated that they loved learning by doing things (a high mean of 4.08),
- 85.4% liked to discover new things and they were very positive about this (a mean of 4.38),
- 80% indicated that they liked teachers to use activities in class (a mean of 4.18),
- 80% liked going on field trips (a high mean of 4.27),
- 67.5% indicated that they tapped their feet or pencils when thinking,
- 68.8% liked talking to friends whilst working, and
- some items had SDs greater than 1 indicating that in those cases the students were divided on the various items.

The responses for the reading sensory modality are revealed in section 5.2.2.4.

5.2.2.4 Reading sensory modality preference

Table 5.9 indicates the descriptive statistics of a preference for a reading sensory modality.

Table 5.9: The frequencies, percentages, means and standard deviations of preference for a reading sensory modality

Item	f (%) Dis-agree	f (%) Neutral	F (%) Agree	M	SD
I remember my work better when I read my notes	14 (5.8)	45 (18.8)	181 (75.4)	4,06	0,94
I like receiving handouts from my teachers	45 (18.8)	79 (32.9)	116 (48.3)	3,45	1,15
I like to read	64 (26.7)	67 (27.9)	109 (45.4)	3,32	1,36
I do as much reading as possible	98 (40.8)	62 (25.8)	80 (33.3)	2,92	1,27
I often use the internet	12 (5)	31 (12.9)	197 (82.1)	4,26	0,94
I often read magazines or newspapers	69 (28.7)	65 (27.1)	106 (44.2)	3,21	1,19
I often use a dictionary or the internet to find the correct spelling of a word	40 (16.7)	45 (18.8)	155 (64.6)	3,75	1,19
I like using the library at school	137 (57.1)	66 (27.5)	37 (15.4)	2,38	1,13

Table 5.9 shows that:

- 75.4% of the respondents believed that they remembered their work better when they read their notes (a high mean of 4.06),
- 82.1% of the respondents indicated that they often used the internet (a high mean of 4.26),

- 64.6% of the respondents used the internet to find the correct spelling of a word, and
- there are certain items with low SDs (less than 1) indicating that the students were in agreement on these issues. Other items had SDs greater than 1 indicating that in those cases the students were divided on the rest of the items.

Preferences for *writing* as a sensory modality are show and briefly discussed in the next section.

5.2.2.5 Writing sensory modality preference

Table 5.10 indicates the descriptive statistics of a preference for a writing sensory modality.

Table 5.10: The frequencies, percentages, means and standard deviations of preference for a writing sensory modality

Item	f(%) Dis-agree	f(%) Neutral	f(%) Agree	M	SD
I remember best by writing things down	19 (7.9)	45 (18.8)	176 (73.3)	4,04	1,04
I like texting my friends	11 (4.6)	50 (20.8)	179 (74.6)	4,10	,97
I like writing stories	77 (32.1)	71 (29.6)	92 (38.3)	3,14	1,30
I write well	40 (16.7)	85 (35.4)	115 (47.9)	3,41	1,13
When I study for a test or an exam, I write a lot	29 (12.1)	52 (21.7)	159 (66.3)	3,90	1,15
I prefer writing to reading when I study	41 (17.1)	57 (23.8)	142 (59.2)	3,70	1,20
I like writing essays	106 (44.2)	71 (29.6)	63 (26.3)	2,72	1,22

According to Table 5.10:

- 73.3% of the respondents believed that they remembered best by writing things down (a high mean of 4.04),
- 74.6% of the respondents liked texting their friends (a high mean of 4.10),
- 66.3% wrote a lot when they studied for a test or exam, and
- there were certain items (such as 'I like texting my friends') with low SDs (less than 1) indicating that the students were in agreement on these issues. The rest of the items had SDs greater than 1 which shows that in those cases the students were divided.

Preferences for individual learning are shown in the next section.

5.2.2.6 Individual learning preference

Table 5.11 indicates the descriptive statistics of a preference for individual learning.

Table 5.11: The frequencies, percentages, means and standard deviations of preference for individual learning

Item	f(%) Disagree	f(%) Neutral	f(%) Agree	M	SD
I study best when I work on my own	15 (6.3)	58 (24.2)	167 (69.6)	4,02	1,04
I dislike working in a group	100 (41.7)	82 (34.2)	58 (24.2)	2,74	1,19
I can study on my own	9 (3.8)	36 (15)	195 (81.3)	4,18	0,90
I work better when I work alone	21 (8.8)	67 (27.9)	152 (63.3)	3,91	1,04
I like studying at home or in the hostel when I am by myself	18 (7.5)	38 (15.8)	184 (76.7)	4,12	1,01
I am happy when I work on my own	16 (6.7)	75 (31.3)	149 (62.1)	3,86	1.00
If I have a problem I will figure out what to do	20 (8.3)	84 (35)	136 (56.7)	3,70	0,98

Table 5.11 illustrates that:

- 69.6% of the respondents studied best when they worked on their own (a high mean of 4.02),
- 81.3% of the respondents indicated that they could study on their own (a high mean of 4.18),
- 63.3% of the respondents worked better when they worked individually,
- 76.7% of the respondents liked studying at home or in the hostel where they could study by themselves (a high mean of 4.12),
- 62.6% were happy to work on their own, and
- there were certain items (such as 'I can study on my own' and 'If I have a problem I will figure out what to do') with low SDs (less than 1) indicating that the students were in agreement on these issues. The rest of the items had SDs greater than 1 indicating that the students were somewhat divided on these items.

The respondents' preferences for group learning are given in Section 5.2.2.7.

5.2.2.7 Group learning preference

Table 5.12 indicates the descriptive statistics of a preference for group learning.

Table 5.12: The frequencies, percentages, means and standard deviations of preference for group learning

Item	f(%) Dis-agree	f(%) Neutral	f(%) Agree	M	SD
I study best with one or two friends	78 (32.5)	68 (28.3)	94 (39.2)	3,09	1,25
I try to share my ideas with other students when I think it may help them	29 (12.1)	48 (20)	163 (67.9)	3,80	1,05
I believe it is good if students help one another learn	13 (5.4)	50 (20.8)	177 (73.8)	3.97	,92
I like working in groups because we can support one another	50 (20.8)	77 (32.1)	113 (47.1)	3,34	1,18
I like working with other students because they can help me understand my school work	49 (20.4)	71 (29.6)	120 (50)	3,40	1,14
I enjoy being with friends when I study	97 (40.4)	77 (32.1)	66 (27.5)	2,79	1,25
I can learn from other students	29 (12.1)	66 (27.5)	145 (60.4)	3,62	1,05
I like working in groups in class	56 (23.3)	76 (31.7)	108 (45)	3,29	1,26

Table 5.12 shows that:

- 67.9% indicated that they tried to share their ideas with other students,
- 73.8% of the respondents believed it was good if students helped one another learn (high mean of 3.97),
- 60.4% of the respondents stated that they could learn from other students, and
- there were certain items (such as “I believe it is good if students help one another learn”) with SDs of less than 1, indicating that the students were in agreement on

this issue. The rest of the items had SDs greater than 1 indicating that in those cases the students were divided on the items.

To be able to compare the students' preferences for the seven learning styles when they are considered simultaneously, the statistics for these styles are given in the next section.

5.2.2.8 Descriptive statistics of the seven learning styles in total

Table 5.13 and Figure 5.6 illustrate the means and standard deviations of the seven learning styles for the whole sample.

Table 5.13: Means and standard deviations of the seven learning styles

	N	Mean	SD
Auditory sensory modality preference	240	3.51	.40225
Visual sensory modality preference	240	3.60	.46473
Kinaesthetic sensory modality preference	240	3.69	.56964
Reading sensory modality preference	240	3.26	.67822
Writing sensory modality preference	240	3.48	.73163
Individual learning	240	3.81	.77562
Group learning	240	3.36	.89553
Valid N (listwise)	240		

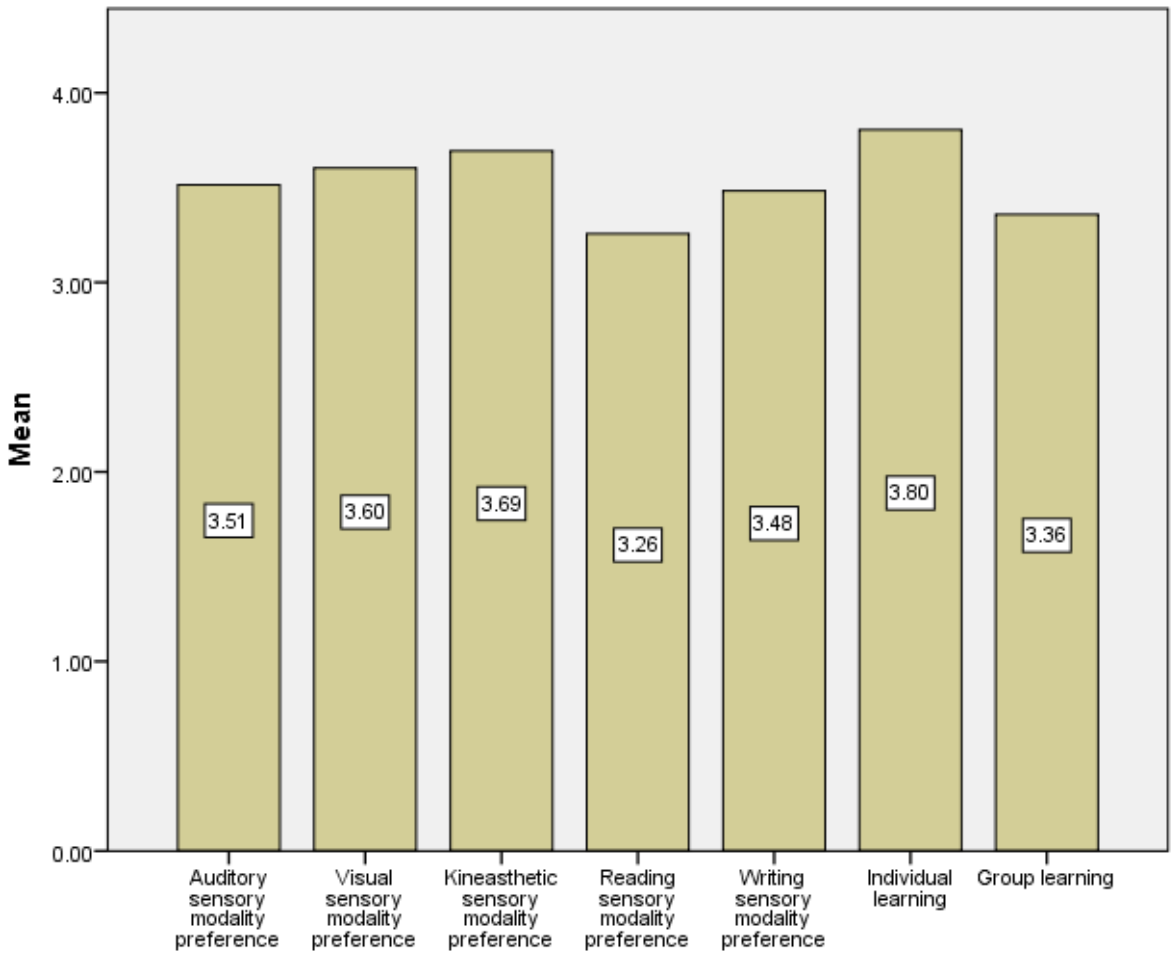


Figure 5.6: Means and standard deviations of the seven learning styles

Table 5.13 and Figure 5.6 show that the rank order of preference for the seven learning styles, as indicated by the means, is as follows:

- individual learning (3.81),
- kinaesthetic learning (3.69),
- visual learning (3.60),
- auditory learning (3.51),
- writing (3.48),
- group learning (3.36), and
- reading (3.26).

Table 5.14 shows a summary of the key findings for research question 1 (see section 5.2.2). The first column shows the specific learning style, the second column shows the rank order of preference for the learning style as indicated by the mean (see section 5.2.2.8), and the third column shows the key descriptive statements which scored over 60% (see section 5.2.2.1 to 5.2.2.7).

Table 5.14: Summary of results for research question 1

Learning style	Ranking order	Key descriptive statements
Individual	1st	I study best when I work on my own I can study on my own and I am happy when I work on my own I like studying at home or in the hostel when studying by myself
Kinaesthetic	2nd	I enjoy sport I love to learn by doing things I like discovering new things I like it when teachers use activities in class Like going on field trips I tap my foot or pencil when I am thinking I like talking to my friends whilst working with them
Visual	3rd	I like watching the teacher show them how to do something I love watching movies and television I like the teacher using audio-visual equipment like data projectors I like to use a highlighter pen when revising
Auditory	4th	I prefer the teacher giving me direct instructions I can easily follow instructions I understand when the teacher tell me what to do I like listening to stories I like to be told what to do when my teachers give me work
Writing	*5th*	I remember best by writing things down I like texting friends When I study for a test/exam, I write a lot
Group	6th	I try to share my ideas with other students when I think it may help them I believe it is good to help other students
Reading	*7th*	I remember my work better when reading notes I use the internet/dictionary to find the correct spelling of a word

The results of research question 2 are given next.

5.2.3 Research question 2

Research question 2 stated: ***What is the relationship between students' academic achievements in English and mathematics and their learning styles?***

The hypothesis states that there is a significant inter-relationship between students' academic achievements in English and mathematics and their learning styles. The results appear in Table 5.15.

Table 5.15: Pearson correlations between learning styles, achievement in English and achievement in mathematics

	Visual	Kinaes	Reading	Writing	Indiv	Group	English	Maths
Auditory	,41**	,28**	,09	,22**	,01	,34**	,10	.05
Visual		,43**	,28**	,31**	-,06	,36**	-,01	-.03
Kinaes			.02	-,06	-,22**	,43**	-,11	-,05
Reading				,26**	,12	-,00	,12	-,05
Writing					,16*	-,04	,07	-,13
Indiv						-.62**	,22**	,16*
Group							-,09	-,11
English								,48**

N = 206; **correlation significant on the 0.01 level (2-tailed); *correlation significant on the 0,05 level (2-tailed)

Regarding Table 5.15, the most important observations are:

- The correlation between achievements in English and mathematics is significant, positive and medium (0.48) - this implies that students who do well in English are also inclined to do well in mathematics, and vice versa.
- The correlation between visual and auditory learning is significant, positive and medium (0.41) which indicates that the more students are visual learners, the more they are also inclined to be auditory.

- The correlation between kinaesthetic and visual learning is also significant, positive and medium (0.43). Thus, the more students are kinaesthetic learners, the more they also tend to be visual learners.
- The correlation between group learning and kinaesthetic learning is 0.43 which is significant, positive and medium. Thus, the more the student is a group learner, the more he/she favours kinaesthetic learning.
- As expected, there is a significant negative and relatively high correlation between individual and group learning - thus the more students are group learners, the less they are individual learners.
- The other correlations were all low.

Table 5.16 shows a summary of the key findings for research question 2 (see section 5.2.3). The first column shows the correlations which are significant, the second column shows whether the correlation was high to low, and the third column shows whether the correlation was negative or positive.

Table 5.16 summarises the most important results of research question/hypothesis 2.

Table 5.16: Summary of results for research question 2

Learning styles or achievements	Strength	Direction
Individual & group learning	High	-
English & mathematics marks	Medium	+
Visual & auditory learning	Medium	+
Kinaesthetic & visual learning	Medium	+
Group & kinaesthetic learning	Medium	+
Individual & English learning	Low	+

In the next section the results of research question 3 are presented.

5.2.4 Research question 3

Research question 3 stated: ***How are students' learning styles influenced by age, form, nationality and gender?*** Two hypotheses were tested as indicated by sections 5.2.4.1 and 5.2.4.2. General Linear Modelling (GLM) was used to test the hypotheses as it gives an indication of effect size.

5.2.4.1 Hypothesis 3a

Hypothesis 3a stated that there is a significant difference in the learning styles of the following groups of students: those of different age, form, nationality and gender (for age, the 18 year and the 19 and older group have been combined because there were only five students older than 18 years). The results are presented in tables 5.17 to 5.23 (for age); tables 5.24 to 5.30 (for form); tables 5.31 to 5.37 (for nationality) and tables 5.38 to 5.44 (for gender).

(i) Age and the seven learning styles

Table 5.17: Average auditory learning styles of different age groups

Age	Mean	Std. Deviation	N
14 years and younger	3.6239	.46038	67
15 years	3.5240	.42443	50
16 years	3.3500	.35918	56
17 years	3.5659	.33058	43
18 +years	3.4778	.27217	24
Total	3.5142	.40225	240

Df=4; F=4,004; p<0.01

According to Table 5.17, young children (14 years and younger) are to a greater extent auditory learners than older students. Scheffe's post hoc tests show that these students (who are 14 years and younger) are significantly more inclined to be auditory learners than students who are 16 years old ($p<0.01$).

Table 5.18: Average visual learning styles of different age groups

Age	Mean	Std. Deviation	N
14 years and younger	3.7405	.49252	67
15 years	3.5662	.42269	50
16 years	3.5343	.50568	56
17 years	3.5957	.42535	43
18 +years	3.4744	.37250	24
Total	3.6035	.46473	240

Df=4; F=2,366; p>0.05

Table 5.18 shows that there were no significant differences between different age groups regarding a visual learning style ($p>0.05$).

Table 5.19: Average kinaesthetic learning styles of different age groups

Age	Mean	Std. Deviation	N
14 years and younger	3.8015	.52591	67
15 years	3.6914	.62744	50
16 years	3.5829	.58376	56
17 years	3.6877	.53838	43
18 +years	3.6667	.57517	24
Total	3.6937	.56964	240

Df=4; F=1,147; p>0.05

According to Table 5.19 there were no significant differences between different age groups regarding a kinaesthetic learning style (p>0.05).

Table 5.20: Average reading learning styles of different age groups

Age	Mean	Std. Deviation	N
14 years and younger	3.2463	.72379	67
15 years	3.2533	.75386	50
16 years	3.2470	.59881	56
17 years	3.2752	.64742	43
18 +years	3.2778	.66425	24
Total	3.2563	.67822	240

Df=4; F= .021; p>0.05

Table 5.20 shows that there were no significant differences between different age groups regarding their preference for ‘reading’ as a learning style (p>0.05).

Table 5.21: Average writing learning styles of different age groups

Age	Mean	Std. Deviation	N
14 years and younger	3.5224	.71120	67
15 years	3.4933	.73922	50
16 years	3.4494	.69116	56
17 years	3.5039	.82495	43
18 +years	3.3958	.73854	24
Total	3.4833	.73163	240

Df=4; F=0,172; p>0.05

There were also no significant differences between different age groups regarding their preference for 'writing' as a learning style (p>0.05) as shown in Table 5.21.

Table 5.22: Average individual learning styles of different age groups

Age	Mean	Std. Deviation	N
14 years and younger	3.7214	.87636	67
15 years	3.9300	.72538	50
16 years	3.7440	.77977	56
17 years	3.8333	.63204	43
18 +years	3.8681	.82089	24
Total	3.8049	.77562	240

Df=4; F=0,656; p>0.05

Table 5.22 shows that there were no significant differences between different age groups regarding having an individual learning style (p>0.05).

Table 5.23: Average group learning styles of different age groups

Age	Mean	Std. Deviation	N
14 years and younger	3.5352	.93854	67
15 years	3.1171	.92207	50
16 years	3.3240	.88881	56
17 years	3.4120	.79674	43
18 +years	3.3452	.84873	24
Total	3.3577	.89553	240

Df=4; F=1,638; p>0.05

There were also no significant differences between different age groups with regard to group learning styles (p>0.05) as shown in Table 5.23.

The above tables show that the only significant relationship between age and the seven learning styles is with the auditory learning style: *young children are to greater extent auditory learners than older students.*

(ii) Form and the seven learning styles

Tables 5.24 to 5.31 illustrate how students in the different forms differ with regard to the seven learning styles.

Table 5.24: Average auditory learning styles of students in different forms

Form	Mean	Std. Deviation	N
2	3.5508	.46189	42
3	3.6310	.51277	43
4	3.4546	.35538	61
5	3.4618	.33007	55
6	3.5128	.34067	39
Total	3.5142	.40225	240

Df=4; F=1,576; p>0.05

According to Table 5.24 there were no significant differences between the students of different forms with regard to their preferences for an auditory learning style.

Table 5.25 Average visual learning styles of students in different forms

Form	Mean	Std. Deviation	N
2	3.6923	.50313	42
3	3.6887	.51655	43
4	3.5649	.47624	61
5	3.5734	.38084	55
6	3.5168	.44468	39
Total	3.6035	.46473	240

Df=3; F=1,252; p>0.05

There were no significant differences between the students of different forms with regard to their preferences for a visual learning style (p>0.05 - see Table 5.25).

Table 5.26: Average kinaesthetic learning styles of students in different forms

Form	Mean	Std. Deviation	N
2	3.8057	.48016	42
3	3.7575	.62817	43
4	3.5937	.58256	61
5	3.6494	.51237	55
6	3.7216	.63946	39
Total	3.6937	.56964	240

Df=4; F=1,2; p>0.05

Table 5.26 illustrates that there were no significant differences between the students of different forms with regard to their preferences for a kinaesthetic learning style (p>0.05).

Table 5.27: Average reading learning styles of students in different forms

Form	Mean	Std. Deviation	N
2	3.2302	.76150	42
3	3.1667	.74269	43
4	3.3361	.65156	61
5	3.3636	.57296	55
6	3.1068	.67915	39
Total	3.2563	.67822	240

Df=4; F=1,237; p>0.05

Table 5.27 reveals that there were no significant differences between the students of different forms with regard to their preferences for reading as a learning style (p>0.05).

Table 5.28: Average writing learning styles of students in different forms

Form	Mean	Std. Deviation	N
2	3.4841	.77110	42
3	3.4884	.62084	43
4	3.6475	.71821	61
5	3.4212	.68932	55
6	3.3077	.85373	39
Total	3.4833	.73163	240

Df=4; F=1,44; p>0.05

Once again no significant differences were found between students of different forms with regard to using writing as learning style (p>0.05), as shown by Table 5.28.

Table 5.29: Average individual learning styles of students in different forms

Form	Mean	Std. Deviation	N
2	3.6190	.97481	42
3	3.7946	.69754	43
4	3.9973	.69488	61
5	3.7727	.65528	55
6	3.7607	.86416	39
Total	3.8049	.77562	240

Df=4; F=1,615; p>0.05

According to Table 5.29 there were no significant differences between the students of different forms with regard to their preferences for an individual learning style (p>0.05).

Table 5.30: Average group learning styles of students in different forms

Form	Mean	Std. Deviation	N
2	3.5646	.99022	42
3	3.4186	.85396	43
4	3.0468	.88091	61
5	3.4779	.80165	55
6	3.3846	.90181	39
Total	3.3577	.89553	240

Df=4; F=2,785; p<0.05

Table 5.30 illustrates that the youngest students (in Form 2) most preferred group learning, and the students in Form 4 least preferred group learning. However, the Scheffe post hoc tests show that this difference was not significant.

Table 5.24 to Table 5.30 (see above) show that there were no significant relationships between form and the seven learning styles.

(ii) Nationality and the seven learning styles

Tables 5.31 to 5.37 indicate how the different nationalities differ with regard to the seven learning styles.

Table 5.31: Average auditory learning styles of different nationalities

Nationality	Mean	Std. Deviation	N
South African	3.5268	.39495	132
Botswana	3.5133	.47541	20
Zimbabwean	3.4952	.46731	35
Malawian	3.4912	.37331	19
Total	3.5168	.41145	206

Df=3; F=,082; p>0.05

Table 5.31 shows that there were no significant differences in auditory learning styles between the different nationalities (p>0.05).

Table 5.32: Average visual learning styles of different nationalities

Nationality	Mean	Std. Deviation	N
South African	3.5862	.45637	132
Botswana	3.7538	.44826	20
Zimbabwean	3.6418	.52136	35
Malawian	3.6599	.41687	19
Total	3.6187	.46343	206

Df=3; F=.860; p>0.05

Table 5.32 illustrates that there were no significant differences in visual learning styles between the different nationalities (p>0.05).

Table 5.33: Average kinaesthetic learning styles of different nationalities

Nationality	Mean	Std. Deviation	N
South African	3.7098	.59615	132
Botswana	3.6143	.54615	20
Zimbabwean	3.6245	.59971	35
Malawian	3.6880	.47453	19
Total	3.6840	.57938	206

Df=3; F=0,304; p>0.05

According to Table 5.33 there were no significant differences in kinaesthetic learning styles between the different nationalities (p>0.05).

Table 5.34: Average reading learning styles of different nationalities

Nationality	Mean	Std. Deviation	N
South African	3.2159	.69767	132
Botswana	3.5667	.69753	20
Zimbabwean	3.2238	.54073	35
Malawian	3.4035	.60938	19
Total	3.2686	.67061	206

Df=3; F=1,923; p>0.05

Table 5.34 shows that the nationalities are similar with regard to a reading learning style (p>0.05).

Table 5.35: Average writing learning styles of different nationalities

Nationality	Mean	Std. Deviation	N
South African	3.4205	.65817	132
Botswana	3.8000	.73469	20
Zimbabwean	3.6905	.76605	35
Malawian	3.8684	.57890	19
Total	3.5445	.69516	206

Df=3; F=4,4; p>0.05

According to Table 5.35, the South Africa and the Malawian students were the most different regarding the writing learning style - Malawian students were more inclined to use this style than the South African students. However, post hoc tests indicated that this was not a significant difference.

Table 5.36: Average individual learning styles of different nationalities

Nationality	Mean	Std. Deviation	N
South African	3.7891	.78251	132
Botswana	3.8583	.81520	20
Zimbabwean	3.9476	.75923	35
Malawian	3.8596	.69890	19
Total	3.8293	.77134	206

Df=3; F= 0.409; p>0.05

Table 5.36 illustrates that there were no significant differences in individual learning styles between the different nationalities (p>0.05).

Table 5.37: Average group learning styles of different nationalities

Nationality	Mean	Std. Deviation	N
South African	3.3864	.86163	132
Botswana	3.5000	.99137	20
Zimbabwean	3.2531	.93169	35
Malawian	3.2632	.92737	19
Total	3.3634	.88891	206

Df=4; F=0,443; p>0.05

The different nationalities do not differ significantly regarding their preference or not for group learning (p>0.05).

In conclusion, Table 5.31 to Table 5.37 show that there were no significant differences between the nationalities for any of the seven different learning styles.

(iv) Gender and the seven learning styles

Tables 5.38 to 5.44 indicate how male and female students differ with regard to the seven learning styles.

Table 5.38: Average auditory learning styles of different genders

Gender	Mean	Std. Deviation	N
Male	3.4611	.37233	107
Female	3.5569	.42133	133
Total	3.5142	.40225	240

Df=1; F=3,399; p>0.05

Table 5.38 shows that male and female students did not differ significantly with regard to being auditory learners (p>0.05).

Table 5.39: Average visual learning styles of different genders

Gender	Mean	Std. Deviation	N
Male	3.4508	.42072	107
Female	3.7264	.46342	133
Total	3.6035	.46473	240

Df=1; F=22,766; p<0.01

The results in Table 5.39 show that female students are significantly more visual learners than male students - on the 1%-level of significance (p<0.01).

Table 5.40: Average kinaesthetic learning styles of different genders

Gender	Mean	Std. Deviation	N
Male	3.7221	.55112	107
Female	3.6708	.58519	133
Total	3.6937	.56964	240

Df=1; F=0,481; p>0.05

Table 5.40 shows that male and female students did not differ significantly with regard to being kinaesthetic learners (p>0.05).

Table 5.41: Average reading learning styles of different genders

Gender	Mean	Std. Deviation	N
Male	3.0981	.66033	107
Female	3.3835	.66792	133
Total	3.2563	.67822	240

Df=1; F=10,931; p<0.01

According to the data in Table 5.41, female students are significantly more inclined than male students to have a learning style influenced by reading - on the 1%-level of significance (p<0.01).

Table 5.42: Average writing learning styles of different genders

Gender	Mean	Std. Deviation	N
Male	3.3380	.74376	107
Female	3.6003	.70291	133
Total	3.4833	.73163	240

Df=1; F=7,836; p<0.01

Table 5.42 shows that similar to reading, female students are significantly more inclined to have a learning style influenced by writing - also on the 1%-level of significance (p<0.01).

Table 5.43: Average individual learning styles of different genders

Gender	Mean	Std. Deviation	N
Male	3.6573	.80805	107
Female	3.9236	.73010	133
Total	3.8049	.77562	240

Df=1; F=7.167; p<0.01

Table 5.43 shows that on the 1%-level of significance (p<0.01), female students are significantly more inclined than males students to have an individual learning style.

Table 5.44: Average group learning styles of different genders

Gender	Mean	Std. Deviation	N
Male	3.4553	.91644	107
Female	3.2793	.87391	133
Total	3.3577	.89553	240

Df=1; F=2,303; p>0.05

Although male students were more inclined to be group learners than female students (M=3.5 versus 3.3), the difference was not significant as shown in Table 5.44.

The above tables show that female students are significantly more inclined to be visual learners than male students (see Table 5.39), female students are significantly more inclined than male students to have a learning style influenced by reading (see Table 5.41) and writing (see Table 5.42), and female students are significantly more inclined to have an individual learning style (see Table 5.43).

Table 5.45 shows a summary of the key findings for research question 3a (see section 5.2.4).

Table 5.45: Summary of results for research question 3a

Learning style	Age	Form	Nationality	Gender
Auditory	Students younger than 14 yrs significantly more	**n.s.d.**	**n.s.d.**	**n.s.d.**
Visual	**n.s.d.**	**n.s.d.**	**n.s.d.**	Female students significantly more
Kinaesthetic	**n.s.d.**	**n.s.d.**	**n.s.d.**	**n.s.d.**
Reading	**n.s.d.**	**n.s.d.**	**n.s.d.**	Female students significantly more
Writing	**n.s.d.**	**n.s.d.**	**n.s.d.**	Female students significantly more
Individual	**n.s.d.**	**n.s.d.**	**n.s.d.**	Female students significantly more
Group	**n.s.d.**	**n.s.d.**	**n.s.d.**	Male students more

n.s.d. = no significant difference

Table 5.45 illustrates that the only significant differences found were as follows:

- the young children (14 years and younger) were to a greater extent auditory learners than older students, and
- female students were more inclined than male students to be visual, reading, writing and individual learners; male students were more group learners even though the results of the post hoc tests were not statistically significant.

5.2.4.2 Hypothesis 3b

This hypothesis stated: *There is a significant difference in the academic achievements in English and mathematics of the following groups of students: those of different age, form, nationality and gender* (for age, the 18 and 19 year and older group have been combined because there were only five students older than 18 years).

The results are presented in the following eight tables: Tables 5.46 and 5.47 (age); tables 5.48 and 5.49 (form); tables 5.50 and 5.51 (nationality) and tables 5.52 and 5.53 (gender).

(i) Age and achievement

Table 5.46 illustrates the results for English and mathematics for the different age groups.

Table 5.46: Average scores and significance of differences in average achievements in English of different age groups

Age	Mean	Std. Deviation	N
14 years and younger	64.1642	10.31782	67
15 years	63.5800	10.42777	50
16 years	62.0714	9.92079	56
17 years	59.8837	12.49897	43
18 +years	59.1250	10.87703	24
Total	62.2833	10.79686	240

Df=4; F=1,761; Sig>0.05

Table 5.46 reveals that for English, the average achievements deteriorated from young to older students. However, there were no significant differences between the age groups in their average achievements.

Table 5.47: Average scores and significance of differences in average achievements in mathematics of different age groups

Age	Mean	Std. Deviation	N
14 years and younger	59.4851	18.57029	67
15 years	68.6900	16.49332	50
16 years	55.6250	20.90525	56
17 years	50.8023	20.07964	43
18 +years	42.2292	16.28949	24
Total	57.2208	20.18661	240

Df=4; F=1.184; p<0.01

There were significant differences between the age groups in their average achievements in mathematics since $p<0.01$. From Table 5.47 it is clear that the students' mathematics results deteriorated as they got older. Scheffe's post hoc tests revealed where the significant differences were:

- The 14 year and younger students achieved significantly better than the 18 plus students ($p<0.01$);
- The 15 year students achieved significantly better than the 16 year olds ($p<0.05$), and the 17 and 18 plus students ($p<0.01$).

It can be concluded that there was more of a significant difference between the age groups in their academic achievements in mathematics than in English. This was especially true amongst the 14 years and younger, 15 years and 16 year age groups.

(ii) Form and achievement

The results for form and achievement are presented in Tables 5.48 and 5.49.

Table 5.48: Average scores and significance of differences in average achievements in English of different forms

Form	Mean	Std. Deviation	N
2	61.9881	10.93188	42
3	67.6977	8.17454	43
4	59.0328	9.57595	61
5	66.8182	9.72224	55
6	55.3205	11.02359	39
Total	62.2833	10.79686	240

Df=4; F= 12,633 ; p<0.01

Table 5.48 illustrates that there are significant differences in English achievement. According to Scheffe's post hoc tests, the significant differences were in the following instances:

- Form 3 students did significantly better in English than Form 4 and 6 students ($p<0.01$) and
- Form 5 students did significantly better in English than Form 4 and 6 students ($p<0.01$).

Table 5.49: Average scores and significance of differences in average achievements in mathematics of different forms

Form	Mean	Std. Deviation	N
2	58.5119	18.09072	42
3	63.8140	18.32674	43
4	63.5574	20.42121	61
5	50.3091	21.25887	55
6	48.3974	16.53472	39
Total	57.2208	20.18661	240

Df=4; F=6.762; p<0.01

According to Table 5.49 there were significant differences in mathematics achievement between students of different forms. Scheffe's post hoc tests indicated that the significant differences were as follows:

- Form 3 students achieved significantly better in mathematics than Form 5 and Form 6 students ($p<0.05$);
- Form 4 students achieved significantly better in mathematics than Form 5 students ($p<0.05$) and Form 6 students ($p<0.01$).

It can be concluded that there were significant differences in both English and mathematics achievement between the different forms. The Form 3 students achieved significantly better (than any other form) in both English and mathematics. The worst performing form was Form 6 in both subjects.

(iii) Nationality and achievement

Table 5.50 and 5.51 reveal the results for English and mathematics for the four nationalities.

Table 5.50: Average scores and significance of differences in average achievements in English of different nationalities

Nationality	Mean	Std. Deviation	N
South African	62.8485	11.00571	132
Botswana	57.9250	11.51575	20
Zimbabwean	61.6000	9.47116	35
Malawian	63.2368	10.70873	19
Total	62.1942	10.80994	206

Df=3; F=1,301; p>0.05

According to Table 5.50 the rank order for achievement in English (from highest to lowest) was Malawian, South African, Zimbabwean and Botswanan. However, the differences were not significant.

Table 5.51: Average scores and significance of differences in average achievements in mathematics of different nationalities

Nationality	Mean	Std. Deviation	N
South African	59.0530	19.41386	132
Botswana	43.1000	16.94775	20
Zimbabwean	57.7714	18.98813	35
Malawian	54.8684	21.88216	19
Total	56.9005	19.78349	206

Df=3; F=4,025; p<0.01

Table 5.51 and Scheffe's post hoc tests showed that for mathematics the South African students achieved the best. These students achieved significantly better than the students from Botswana who achieved the poorest (on the 1%-level).

In conclusion it can be stated that there was no significant differences in the achievements in English across the four different nationalities. However, significant differences did appear with regards to mathematics where South African students achieved the best results.

(iv) Gender and achievement

Tables 5.52 and 5.53 illustrate the results for English and mathematics for the two genders.

Table 5.52: Average scores and significance of differences in average achievements in English of different genders

Gender	Mean	Std. Deviation	N
Male	60.1963	11.06707	107
Female	63.9624	10.31210	133
Total	62.2833	10.79686	240

Df=1; F=7,408; p<0.01

Table 5.52 reveals that the female students achieved significantly better in English than the male students (64% versus 60.2%), and that this difference was significant on the 1%-level (p<0.01).

Table 5.53: Average scores and significance of differences in average achievements in mathematics of different genders

Gender	Mean	Std. Deviation	N
Male	55.9439	20.69059	107
Female	58.2481	19.79034	133
Total	57.2208	20.18661	240

Df=1; F= 0.772; p>0.05

Table 5.53 shows that the female students achieved better than the male students (58.3% versus 55.9%). However, according to the Scheffe post hoc tests, this difference was not significant (p>0.05).

In conclusion, female students performed significantly better than male students in English but not in mathematics.

Table 5.54 summarises the findings for research question 3b (see section 5.2.4).

.**Table 5.54: Summary of results for research question 3b**

	English	Mathematics
Age	n.s.d.	Results deteriorated as students got older
Form	Form 3s performed the best whilst Form 6 performed the worst in both subjects	
Gender	Females performed better	n.s.d.
Nationality	n.s.d.	South Africans produced best results

n.s.d. = no statistically significant difference

Table 5.54 illustrates that significant differences were found with mathematics in particular where the results deteriorated as the students got older. However, the Form 3s performed the best in mathematics whilst Form 6s performed the worst and the South African students produced the best mathematics results. With regard to English, the only significant findings were with the Form 3s who performed the best of all the forms with the Form 6s producing the worst academic marks. Female students also performed significantly better in English than the male students.

5.3 QUALITATIVE RESULTS

In this section of the chapter the results of the individual interviews are discussed with regard to answering all the research questions, but in particular the last research question that asks: *How do students learn mathematics and English?* The main reason for doing these individual interviews was to shed more light on the quantitative data (see section 5.2).

5.3.1 Details of participants

Details of the students who were interviewed are given in Table 5.55.

Table 5.55: Details of participants who were interviewed

Student	Form	Gender	Nationality	Age	Preferred learning styles		
					1st	2nd	3rd
Student A	2	female	South African	14	Read	Kinaesthetic	Individual
Student B	3	female	South African	15	Kinaesthetic	Individual	Write
Student C	3	female	South African	16	Read	Kinaesthetic	Visual
Student D	4	female	South African	16	Individual	Kinaesthetic	Visual
Student E	4	male	Botswana	15	Individual	Read	Kinaesthetic
Student F	5	male	South African	17	Read	Individual	Kinaesthetic
Student G	5	male	South African	17	Individual	Visual	Kinaesthetic
Student H	6	male	South African	19	Individual	Write	Kinaesthetic
Student I	6	male	South African	19	Individual	Write	Group
Student J	6	female	South African	17	Individual	Write	Read

According to Table 5.55, half of the participants were female. Most of the participants were South African as this was the nationality which registered the highest number of top academic students in English and mathematics at the school. The most predominant learning style amongst this group was individual.

The results from each of the questions asked in the individual interviews are discussed in the next section. Full details of the responses are given in Appendix I.

5.3.2 How English was learned

When the students were probed on how they learned English, their responses indicated that they relied heavily on r*eading* as a learning style (this was the most common learning preference to be identified in this section). To learn English they mainly read the following:

- study guides (and examined the comments and examiner's tips in these books),
- notes given by the teacher in class,
- comments given by teachers when their essays were marked,
- mark schemes published by the examining authority, and
- the internet.

It was clear that many students had different approaches to learning the language section of English as compared to the literature section as seen in the following quotes:

> *Regarding the learning of language, I read over my notes. When learning literature, I try to understand the author, the time period, themes and quotes.* (Student H)

> *When learning literature, I learn key quotes, the purpose of the poems and I investigate the context of each short story on the internet. However, when learning for language I just read novels.* (Student J)

There were only two references to using *writing* as a learning style when studying English. In order to learn English and develop her creative skills, Student A indicated that she wrote stories in her own time. Another student stated:

> *With regards to learning English literature, I go through the text and then develop ideas in my mind. I then write a few notes and also do research on the internet about the authors*. (Student F)

A common factor that all the students seemed to apply when learning English was that they used *individual learning* (no references were made to group learning). Some of the students also indicated that when learning English, they could be considered *self-regulated learners* as they took control of and evaluated their learning. In one example a student narrated:

> *One way I learn literature is by doing research on the internet. I also look at the Cambridge mark schemes. I also learn quotes. I practise answers and the mark them myself.* (Student I)

When memorisation was used, this was mainly to memorise suitable quotes or language notes and was an example of *behavioural learning*.

5.3.3 The kinds of teaching that worked best in the English class

The students were asked what kinds of teaching worked best for them in the English class. A common thread which was emphasised through most of the students' responses was that they liked English teachers who gave good thorough explanations (especially when difficult concepts were involved), gave helpful criticism, went over the work with the students and explained work in depth. This implies that these students liked information which was heard or spoken - in short, they relied heavily on their *auditory* learning styles as a way of understanding English work.

One student (Student E), when asked what types of teaching worked best for him in English replied: "I like English teachers who do individual consultation and are open to private lessons". Thus, this student indicated that he preferred *individual learning*. Several students also indicated their preference for *kinaesthetic* learning when stating what types of teaching worked for them in the English class. These students indicated a strong liking for a 'hands on' experience which is an example of *kinaesthetic learning*. An example of one of the students' narrations is as follows:

> *I like English lessons which incorporate movies and videos of plays which we are studying. I then like being allowed to act out the play*. (Student D)

References were also made to *constructivist* learning when the students were asked what worked for them in their English classes. Many students indicated that they developed (constructed) their own ideas from the teacher's instructions that required of them to reflect on work. An example was given by one student:

> *The teacher gives us a broader perspective on the work and asks: 'What do you feel?' He then engages in conversations with the students which we like*. (Student H)

Another student reaffirmed the above when he reported the following:

> *I like the English teacher because he does not give the answer straight away…. He allows us to talk and discuss the issues. He challenges us on points and feeds us pointers which give us directions to build our arguments… He looks at sections of the work and asks for our opinions.* (Student I)

One reference was made to *visual* learning. A student commented:

> *I also like it when the English teacher uses YouTube videos to help explain a play being studied.* (Student E)

5.3.4 The kinds of teaching which did not work well in the English class

When the students were asked about what types of teaching do not work well for them in their respective English classes, they gave the following responses:

- very little marking is done by the teacher,
- the syllabus is not being taught,
- the teacher constantly gossips in class about the state of the school and as a result very little work is done in class, and
- very little homework is given.

These responses showed that the *classroom climate and the learning environment* in some of the English classes was poor. This inhibited the opportunity for constructivist learning. As such, the students' academic achievements that could build their self-esteem were probably negatively affected. Only self-regulated students would be able to work and achieve results in such an atmosphere as they would be able to work independently. They would identify a problem and would then be able to come up with their own solutions.

Another student relayed the following story about the kinds of teaching which did not work well for him in the English class:

> *The teacher reads one line and then tells you what it means … then she reads the next line and so on. I find this boring*. (Student H)

This teacher used behaviourist teaching methods which relied on the transmission of knowledge. Student I, who was also taught by the same teacher and had had similar complaints, suggested that this teacher should pick up on overall themes rather than 'plough their way' through each line of a poem if they were to improve their delivery of the English literature syllabus.

When asked how the teaching of English could be improved, the students suggested that the English teachers:

- explain difficult concepts better (thus appealing to their *auditory learning styles*),
- put more notes on the whiteboard so as to help the students construct their knowledge better and improve their understanding of the work (thus allowing for *constructivist learning* to happen),
- use PowerPoint presentations and other audio visual aids (thus appealing to their *read learning styles)*, and
- encourage students to form discussion groups and allow them to discuss issues and express their personal views (thus allowing for *constructivist learning* to happen).

5.3.5 How mathematics was learned

When the students were probed on how they learned mathematics, their responses indicated that they relied heavily on r*eading* as a learning style (this was the most common learning preference to be identified in this section). To learn mathematics they primarily read their notes in their exercise books and textbooks, revisited concepts which they struggled with in class and investigated alternative methods for doing algebra on the internet. The students also indicated that they relied on *writing* as a learning style. To learn mathematics, they re-did exercises from their notebooks, practised examples in and topics from their textbook and practised past papers.

When learning mathematics, many students used a combination of *reading and writing* learning styles. One student shared the following:

> *I read through my exercise book and then I practise the sums I do not understand in class*. (Student B)

Another student stated:

> *I read over the notes in my notebook and then practise examples.* (Student D)

The respondents also mentioned that they mostly approached the learning of mathematics as *individuals* since only one reference was made to *group learning.* This particular student stated:

> *I learn mathematics with a boarder friend*. (Student E)

Several references were also made to *self-regulated learning*. These students indicated that they took control of and evaluated their own learning. In one example a student narrated:

> *I go over questions which I struggled with in class*. (Student G)

When memorisation was used, this was mainly to memorise formulas (this is a form of *behavioural learning*).

5.3.6 The kinds of teaching which worked best in the mathematics class

The students were asked as to what kinds of teaching worked best for them in the mathematics class. A common thread which was emphasised through most of the students' responses was that they liked mathematics teachers who gave them detailed explanations and good examples and ensured that they understood all the work. This implied that these students liked information which was heard or spoken - in short, they relied heavily on their *auditory* learning styles as a way of understanding work and building (constructing) knowledge. This was emphasised in a statement given by one student who also gave some reference to *group* learning:

> *I like mathematics teachers who ask students to explain concepts in front of the class. I found this helped me understand better*. (Student H)

There were comments on the use of *writing* as a learning style when studying mathematics. Student E indicated that he liked mathematics teachers who give quizzes on work done in class. Student F and G both said that they liked mathematics teachers who gave exercises, worksheets and past papers.

Mention was also made of *self-regulatory learning*. Many students indicated that they took the initiative to practise their learning and develop a deep understanding of their subject matter. Comments were also made about teaching styles that facilitated *constructivist learning*. Two students stated:

> *I like mathematics teachers who know where possible problems are and go over the weak areas* (Student J)

> *I like teachers who take time to go over assignments in class thereby sharing their knowledge.* (Student I)

This indicated that the students wanted to interact with the teacher when trying to sort out problem areas in mathematics. The teacher would then be able help them improve their current performance through the sharing of their knowledge with the students and thus supporting them to develop better insight into mathematics.

5.3.7 The kinds of teaching which did not work in the mathematics class

When the students were asked about the types of teaching which did not work well for them in the mathematics class, their responses indicated overwhelmingly that they did not enjoy teachers who created a negative learning environment by being moody, unsupportive, impatient, sarcastic, judgemental and arrogant. Such behaviour by the teacher affected the self-esteem of the students. Two students stated:

The mathematics teacher makes the students feel dumb. (Student C)

I am scared to ask questions as the teacher replies 'I do not want to explain that again'. (Student H)

Students also indicated that the following types of teaching in the mathematics classes did not work for them:

- poor explanations and explanations given which only the teacher can understand (makes a student who relies on an *auditory learning style* very frustrated),
- moving too fast through the work before the student can understand the work (unsupportive of constructivist learning),
- boring teachers who talk continuously in a monotonous tone and keep reading the same material (also makes a student who relies on an *auditory learning style* very frustrated*),*
- homework not being checked so that the students do not know where they were going wrong (unsupportive of constructivist learning),
- no work pressure being applied, and
- teachers who do nothing about the poor marks in their class.

When asked how the teaching of mathematics could be improved, the students suggested the mathematics teachers create more positive learning environments in their different classes. This could be achieved by:

- being more patient,
- building the self-esteem of the students,
- giving better explanations,
- being more supportive (e.g. open to questions),
- ensuring the classes are more relaxed, and
- dealing with lazy students and demoting them if necessary.

Interestingly, the students also suggested that peer tutoring be promoted, which is a form of *group learning,* and that students are encouraged to use the website - examsolutions.com - which facilitates a form of *visual* learning.

5.3.8 Subjects which entailed the most learning

The students who were interviewed identified the following subjects as the ones which required the most amount of learning:

- Student A – science
- Student B – French
- Student C – biology
- Student D – biology and economics
- Student E – physics
- Student F – economics and business studies
- Student G – biology
- Student H – economics
- Student I – history
- Student J - biology

The most common subjects to be named were biology and economics.

5.3.9 How subjects which entailed a lot of learning were studied

When the students were probed on how they learned the particular subjects which they had selected, their responses indicated that they looked on the internet for extra notes; they completed past exam papers; and they read over their textbooks, notebooks, own notes and study guides. In short, they relied heavily on r*eading* as a learning style (this was the most common learning preference to be identified in this section).

References were also made by the students to using *writing* as a learning style when asked how they studied these various subjects. Student A indicated that she made her own notes without looking at the textbook. Other students stated:

> *When I learn history, the teacher supplies us with 'fill in the blank word' notes. I find these very useful.* (Student I)
> *When learning economics and business studies I practise lots of questions.* (Student F)
> *When learning physics I do the exercises in the textbook*. (Student E)

A common factor was that all the students seemed to approach the learning of these different subjects as *individuals* since there was no reference made to group learning. The students also made reference to *self-regulated learning* when asked how they learned their selected subjects. Two students stated:

> *I read notes and use the textbook for clarification*. (Student D)

> *I make my own notes when I learn biology because the teacher does not provide us with notes*. (Student G)

5.3.10 The kinds of teaching which worked best in subjects that required a lot of learning

The students were asked what kinds of teaching worked best for them in subjects which required a lot of learning. A common thread which was emphasised through most of the students' responses was that they liked teachers who used experiments, observations, games, videos and slideshows indicating *kinaesthetic learning*. One student stated:

> *I like the history teacher as he plays lots of games in class. These games are always related to the notes*. (Student I)

This is an example of *kinaesthetic learning*.

5.3.11 The kinds of teaching which did not work well in subjects that required a lot of learning

When the students were asked about the types of teaching which did not work well for them in their selected subject, their responses indicated overwhelmingly that they did not enjoy teachers who created a poor learning environment by rushing through the work and covering too many pages in one lesson, as well as those teachers who left too much of the work to the students to study on their own. The students added that teachers who did this also did not supply them with additional notes. The students therefore did not know if they had written the correct information.

The students highlighted the following teaching methods which created poor learning environments in their specific chosen subjects:

- teachers wasting time by talking about their personal lives in class,
- teachers not giving enough notes (this would particularly frustrate a reading learner),
- teachers who do not teach according to the syllabus,
- teachers who give incorrect information,
- teachers who give few tests (this would particularly frustrate a *writing* learner),
- teachers who create a lazy ‘vibe’ in the class, and
- teachers who have to ‘phone a friend’ when they need help with the subject material.

When asked how the teaching of those subjects which required a lot of learning could be improved, the students suggested the following:

- encourage self-study in science (*self-regulatory learning*),

- motivate the students by offering them rewards for good work (*behavioural learning)*,
- encourage students to do past exam papers (a *writing learning style*), and
- encourage teachers to engage with their students and make learning fun (*constructivist learning*).

5.3.12 Respondents' suggestions for the overall improvement of teaching and learning in the school

When the respondents were asked how the teaching and learning in the school could be improved, they mostly suggested areas where the classroom climate could be improved. They suggested that positive relationships between teachers and students be encouraged so that students feel confident to seek help from their teachers. The students also suggested that the learning environment in the school also be improved. This could be done by improving the general lack of work ethic and avoiding laziness which pervades the school at present, removing distractions like iPads and TVs from the students and encouraging competition among the students. They also suggested that under-performers should be dealt with by the school management.

During the interview process one particular student was asked how she had managed to become the top academic student at the school. She narrated the following informative story of her success:

> *I just sit down and study. I concentrate and study for a while and then watch some TV and then go back to my studies. Where I lived before I had to look after myself as my parents were at work all day long. There was nothing to do so I learned how to learn. My parents pressure me now. They ignore me when I do not do well. My sister does bad things but gets away with it but when my marks are not good I get gated and I do not like it. My mother wants me to become*

a doctor and I do not want to study medicine. I want to go to university far away from my parents. (Student J)

Student J exhibited many of the attributes that other top achievers have alluded to in the interviews. She displayed the traits of a *self-regulated learner* as she took control of her learning. Accordingly, she was able to learn on her own and monitor and direct her actions towards learning. There were also elements of *behavioural learning* as she was motivated towards achieving top marks to avoid punishment from her parents. She also wanted to do well so that she could enrol in a university far away from her parents.

Table 5.56 summarises the findings from the qualitative study.

Table 5.56: Summary of findings from qualitative study

Types of learning	**Subjects**		
	English	**Mathematics**	**Other**
Visual	X	X	
Auditory	X	X	
Read	X	X	X
Write	X	X	X
Kinaesthetic	X	X	X
Individual	X	X	X
Group		X	
Behavioural learning	X	X	X
Constructivist learning	X	X	X
Self-regulatory learning	X	X	X

It is apparent from Table 5.56 that the academic achievers at the school used a variety of learning styles to study English, mathematics and another subject. Points to note are that visual and auditory learning styles were only used in English and mathematics, and group learning was only referred to with regard to mathematics.

In the next section the quantitative and qualitative results are discussed and compared with the results of the literature review.

5.4 DISCUSSION OF QUANTITATIVE AND QUALITATIVE RESULTS

The purpose of this study was to investigate and explain the relationship between learning styles and academic achievement. In order to do this, it was necessary to investigate what the learning style preferences were of the students at the school, the relationship between the students' academic achievements in English and mathematics and their learning styles, and how learning styles were influenced by the students' nationality, gender, form and age. In order to investigate these problems, the researcher embarked on a quantitative study (consisting of a structured questionnaire), followed by a qualitative study (consisting of structured interviews with 10 top academic achievers).

In this section the results of both the quantitative and the qualitative phases of the study are discussed in order to answer the research questions stated above and in section 1.2.

5.4.1 The learning styles of the whole sample

In section 1.2 the following research question was stated:

What are the learning style preferences of students?

In the literature review it was stated that the predominant learning style amongst students was *visual* followed by *auditory* and *kinaesthetic* (Amran *et al*. 2011:333, see

section 3.4.2.2). According to Nel and Nel (2012:35) visual learners are generally the largest group in a classroom. Regarding group and individual learning (see section 3.4.1.3), the literature states that students generally preferred group learning even though individual learning often results in higher grades (Peters *et al*. 2008:164). However, the results of the quantitative study showed that the most preferred learning style of the students was *individual learning*, followed by *kinaesthetic* and *visual* learning (see section 5.2.2.8). *Group learning* was not popular amongst the students and was only ranked six out of the seven preferred learning styles (see section 5.2.2.8).

When the preferred learning styles of the top achievers in English and mathematics were further examined, it was found that their preferential learning style was also *individual* (see section 5.3.1) which concurred with the results of the quantitative phase of the study. In the qualitative phase of the study, more details about the students' use of individual learning were explored. Those students who were interviewed indicated that they use only individual learning (and not group learning) when studying English (see section 5.3.2) and their other learning subject (section 5.3.8). Regarding mathematics, all the students except one indicated that they learnt as individuals (see section 5.3.5). However, some students suggested that in order to improve the learning of mathematics, peer tutoring should be used (this is a form of group learning) (see section 5.3.6). Thus, some students understood the merits of group learning.

When the results of the qualitative study were further interrogated, it became evident that students used not only their preferential learning style, but a whole host of other learning styles and learning behaviours when learning English, mathematics and other subjects. Examples of these learning styles included *behavioural* and *constructivist learning,* as well as *self-regulation* (see Table 5.56). The literature review indicated that behavioural learning resulted from an individual's experiences with stimuli and the effects which follow (Isman 2011:137; Ormrod 2014:34-35) (see section 2.3.1). There were examples of student behavioural learning in English and mathematics when memorisation was used (see section 5.3.2 and section 5.3.5), and in the other learning

subject when a student suggested that the teacher tried to motivate the students in order to achieve better results (see section 5.3.10).

In the literature review it was explained that constructivist learning theory views students as active participants in constructing their own understanding (O'Donnell *et al*. 2012:269). Students construct their knowledge bases by being actively engaged with the topic and the teacher (Hartle *et al*. 2012:32). The teacher becomes the 'guide on the side' and the instruction is student-centred (Dymoke 2011:50) (see section 2.3.3). There were many examples of constructivist learning in the learning of English. Students indicated that they liked a particular teacher who allowed them to develop their own ideas from his thoughts (see section 5.3.2). There was also evidence of constructivist learning occurring in mathematics. Students indicated that they liked teachers who explained the work and shared their knowledge with the class. This allowed the students to construct a solid knowledge base developed from the teacher's knowledge (see section 5.3.5). Constructivist learning was also apparent in other learning subjects. One student suggested that in order to improve learning in these subjects, the teacher needed to engage actively with the students and make learning fun (see section 5.3.10).

Certain aspects concerning self-regulatory learning were identified in the literature review. It was noted that self-regulatory learning occurs when students become active participants in the process of monitoring their own learning and controlling their cognition, motivation and behaviour towards successfully completing academic goals (Rowe & Rafferty 2013:591) (see section 2.3.2.3). This concept was identified throughout the qualitative phase of the study. The top achievers who were interviewed revealed that they were unquestionably self-regulated learners in all the subjects. One student gave an example of being a self-regulated learner in English. He took the initiative by doing research on the internet, practised questions and then marked them himself (see section 5.3.2). In mathematics many of these students practised questions independently which they had struggled with in class as they wanted to be able to understand the work (see section 5.4.5) - yet another characteristic of a self-regulated

learner. In the other learning subjects students indicated that they compiled their own study notes as the teacher did not help them in this regard (see section 5.3.9). These students revealed that they were independent and self-regulated learners.

Even though a visual learning style was identified as the third most preferred learning style in the quantitative phase of the study, it did not surface strongly in the qualitative phase of the study. Similarly, a preference for group learning was not identified in either the quantitative or the qualitative phases of the study as being significant (see Table 5.14 and Table 5.56).

In conclusion, it can be stated that the top learning style of the sample was individual. This result was confirmed in both the quantitative and qualitative study.

In the next section the relationship between students' academic achievements in English and mathematics and their learning styles will be discussed.

5.4.2 The relationship between students' academic achievements in English and mathematics and their learning styles

In section 1.2 the following research question was stated:

What is the relationship between students' academic achievements in English and mathematics and their learning styles?

In the literature review it was stated that studies have shown that when learning styles are taken into account during the learning process, the academic success of students is greatly improved (Elci *et al*. 2012:145) (see section 3.4.1). Moreover, students who have a specific learning preference have significantly higher academic scores than students who do not exhibit such a preference. In some literature reports it was stated that a preference for an aural learning style was a predictor of academic success

(Khanal *et al*. 2014:7) whilst in other articles it was stated that visual learners were high achievers (Aliakbari & Qasemi 2012:276) (see section 3.4.1.2). However, in the main, many studies indicated that no relationship exists between learning style and academic achievement (see section 3.4.1.4).

With regard to English, the results of the quantitative phase showed firstly that there was a statistically significant positive correlation between the students' achievements in English and in mathematics. In other words, those students who did well in English also tended to do well in mathematics and vice versa (see section 5.2.3). The only other positive relationship of any significance was found between achievement in English and mathematics, and an individual learning style. In other words, those students who achieved academically well in English and mathematics were students who were individual learners. This result corroborated with the findings reported in the literature which stated that individual learners often achieved higher grades (Peters *et al*. 2008:164) and high achievers did not favour group learning (Aliakbari & Qasemi 2012:276) (see section 3.4.1.4).

The qualitative phase of the study revealed further that students relied heavily on *reading* as a learning style in English (see section 5.3.2). Every student interviewed indicated that they used this specific learning style (see Appendix I). At least half of those students interviewed indicated that they also use an *auditory* learning style in their English classes and this greatly enhanced their learning of the language. The students further indicated that they were *self-regulatory learners* (see section 5.3.2). Another key finding was that the top academic students preferred English teachers who did not simply provide them with the answer but rather requested that they develop their own ideas. These students thus referred to *constructivist learning* (see section 5.3.2). In conclusion, the top academic achievers indicated that they used a variety of learning styles to achieve their high academic marks in English - these styles included reading and auditory learning as well as constructivist learning strategies. In addition, they were self-regulatory learners.

Regarding the learning of mathematics, the top achievers indicated that in addition to using *individual learning strategies*, they largely used *reading and writing learning* styles (see section 5.3.5). At least half of the students indicated that they also used an *auditory* learning style (see section 5.3.5). References were also made to constructivist learning (see section 5.3.5).

With reference to the learning of another subject that required a lot of learning from them, the students indicated that they mostly used *individual* as well as *reading and writing* learning styles (see section 5.3.8). *Behavioural, constructivist and self-regulatory* learning strategies were also mentioned (see section 5.3.8 and 5.3.10) as well as a *kinaesthetic* learning style (see section 5.3.9). With regard to the last three mentioned learning styles, the literature review revealed that high achievers (like the students interviewed in this research) were expected to use learning strategies in accordance with constructivist theory. Moreover, they were expected to be self-regulatory learners as these approaches to learning allowed for the development of critical thinking skills and a longer retention of learning, thus enhancing academic achievement (Narayan *et al*. 2013:169) (see section 2.3.3). Bell and Pape (2014:24) also stated that self-regulated learners were more likely to attain higher levels of academic achievement as they possess the knowledge, skills and disposition to accomplish the academic goals they set for themselves (see section 3.3.3.3).

In conclusion it can be stated that the learning style that was most significantly related to academic achievements in English and mathematics was individual learning. The results of the qualitative study added to this by revealing that the top achievers used a plethora of learning styles such as reading, writing, an auditory and a kinaesthetic style, in addition to several learning strategies such as self-regulation and constructivist learning. Such learning styles could be considered to be the hallmarks of an academically successful student.

In the next section the influence which nationality, gender, form and age have on a student's learning styles will be examined in depth.

5.4.3 The influence nationality, gender, form and age have on students' learning styles

In section 1.2 the following research question was stated:

How are students' learning styles influenced by nationality, gender, form and age?

The answers to this question are given in sections 5.4.3.1 to 5.4.3.3.

5.4.3.1 The influence of nationality on students' learning styles

In the literature review differences were presented between the learning styles of different nationalities. Ramburuth and McCormick (2001:345) found cultural differences when using the VARK model. Barmeyer (2004:586) found cultural differences between the learning styles of French, German and Quebecois students. Other studies conducted by Joy and Kolb (2009:72) and Mestre (2010:811) also concluded that learning styles differed amongst different nationalities (see section 3.4.3.1 and 3.4.3.2). However, the results from this study revealed no significant differences between the different nationalities that were included in the sample regarding learning style (see section 5.2.4).

In the qualitative study a detailed account was given of the different learning styles each of the students from different nationalities used when learning English, mathematics and another learning subject. This information is presented in Table 5.57.

Table 5.57: The learning styles of the students in English, mathematics and another subject that requires a lot of learning

Student	Age	Form	Nationality	Gender	Learning styles						
					Visual	Auditory	Read	Write	Kinaesthetic	Individual	Group
A	14	2	South African	F		x	x	x	x	x	
B	15	3				x	x	x		x	
C	16	3				x	x	x		x	
D	16	4				x	x	x	x	x	
E	15	4	Botswana	M			x	x	x	x	x
F	17	5	South African				x	x		x	
G	17	5					x			x	
H	19	6					x	x	x	x	
I	19	6					x	x	x	x	
J	17	6		F		x	x	x		x	

Table 5.57 shows that the two nationalities represented in this group, namely South African and Botswana students, did have slightly different learning styles when studying English, mathematics and another learning subject which required a lot of learning. The auditory learning style was not used by the Botswana student (Student E) but was used by South African students. The second difference was with regard to group learning, which was only preferred by the Botswana student (Student E) and not by any other student. This student only preferred group learning when studying mathematics (see section 5.3.6).

5.4.3.2 The influence of gender on students' learning styles

The literature review revealed that male and female students use different learning styles (Ahmad *et al*. 2011:276) (see section 3.3.3.2 and 3.4.2.1). Research has shown that males tend to be more visual and kinaesthetic whereas females were more auditory-oriented (Ren 2013:24) (see section 3.4.2.2). Other studies found that females preferred reading followed by visual, auditory and kinaesthetic learning styles whereas males preferred a visual style, followed by a kinaesthetic, reading and auditory style (Dobson 2010:199) (see section 3.4.2.2).

Results from this study showed that the male and female students had different learning styles. The female students were more inclined than the male students to be visual learners, and had learning styles influenced by reading and writing. Female students were also more inclined than the male students to be individual learners (see section 5.2.4.1).

In the qualitative study a more detailed account was given of the different learning styles each of the genders used when learning English, mathematics and another learning subject. This information was presented in Table 5.57. This table showed that the two genders represented in this group had different learning styles when studying English,

mathematics and another learning subject. The one difference was with regard to the auditory learning style which was used by all the female students but not by any of the male students. Another difference was also found with regard to kinaesthetic and group learning: more male than female students indicated that they used kinaesthetic learning. In addition, one male student indicated that he enjoyed group learning. All top achieving male and female students used the reading learning style and individual learning, but not visual learning.

In conclusion, the results from the quantitative study were more closely aligned to the results of other studies: males were more inclined to be kinaesthetic learners than females whilst females were tended to prefer an auditory learning style.

5.4.3.3 The influence of age and form on students' learning styles

In the literature review it was reported that learning styles change with age. According to Murphy *et al*. (in Khanal *et al*. 2014:4) there were significant differences in preferences for a visual and a reading/writing learning style between students of different ages. However, other studies found very little evidence of significant relationships between age and learning style (see section 3.4.4).

Results from this study showed that the only significant relationship between age and learning style was amongst the younger respondents who were, to a greater extent, auditory learners (see section 5.2.4.1). The results of the qualitative study also concurred with these results. The majority of the younger students, as compared to the older students, were auditory learners (see Table 5.57). However, these students were similar to the older students in that they also used reading, writing and individual learning styles.

Regarding the relationship between form and learning styles, the results of the quantitative study showed that there were no significant differences between the learning styles of students of different forms. The qualitative phase of the study confirmed that the younger students (who were in Forms 2 to 4) were auditory learners. However, these students were similar to the older students in that they also used reading, writing and individual learning.

5.4.4 The relationship between age, form, nationality and gender and the students' academic achievements in English and mathematics

In section 1.2 the following research question was stated:

What is the relationship between age, form, nationality and gender and the students' academic achievements in English and mathematics?

The answer to this question appears in sections 5.4.4.1 to 5.4.4.3.

5.4.4.1 The influence of age and form on the students' academic achievements

In the literature review the influence of age in academic achievement was explored (see section 3.3.3.2). It was noted that mature students generally achieved marginally better degree outcomes than younger students (Barrow *et al*. in Nyikahadzoi *et al*. 2013:2). Results from this study showed that average achievements in mathematics deteriorated as the students got older (see section 5.2.4.2). In the qualitative part of the study, the more senior students (aged 15 years and older) offered some reasons as to why this may have happened. Their answers mostly revolved around the poor classroom climate and learning environment found in these senior classes. Student H said that the mathematics teachers did not apply any work pressure to the students and these teachers did nothing about the poor marks. Student I also added that the mathematics

teachers missed out basic steps in their explanations which disadvantaged the weaker students (see section 5.3.6). All these reasons could explain the deterioration of the mathematics marks in higher forms, in addition to the fact that the work was more complex than in previous forms.

When the influence of form on the students' academic achievements was explored in the quantitative study, it was found that the best performing form was the Form 3s whilst the worst achievers were the Form 6 students (see section 5.2.4.2). This could have been because the work in Form 6 was definitely more difficult whilst the work in Form 3 was easier. Other comments from the more senior students could also lend some more clarity to this issue. Some Form 6 students indicated that the work ethic and learning environments in some of their classes were poor. They stated that there was a "lazy vibe" in the school, students were distracted by iPads and cell phones, few tests were being written and teachers appeared incompetent as they would "have to phone a friend" for help regarding their subject (see section 5.3.10). These points were also highlighted in the literature review as factors which could influence learning and academic achievement (see section 3.3.2.1 and 3.3.2.4).

5.4.4.2 The influence of nationality on the students' academic achievements

Barmeyer (2004:586), as well as Joy and Kolb (2009:69) stated that culture could be related to the development of learning style (see section 3.4.3). In this study it was found that there was no significant difference in the achievements in English across four particular nationalities. However, significant differences were found regarding mathematics where South African students achieved the best results (see 5.2.4.2).

In the qualitative phase of the study the non-South African student (Student E) differed from the South African students in that he preferred group learning (see Table 5.57). It

was not within the scope of this study to investigate the effect of this particular learning style on achievement in mathematics.

5.4.4.3 The influence of gender on the students' academic achievements

In the literature review the influence of gender on academic achievement was explored (see section 3.3.3.2). It was noted that the female students generally outperform their male counterparts (Ahmad *et al*. 2011:265-266). It was believed that this could be due to their superior linguistic skills, better work habits, more effective study skills and better class attendance (Bhatti & Bart 2013:4). It was also noted that female students outperformed their male counterparts in languages and in mathematics (Ahmad *et al*. 2011:266) and this was mainly because the instruction and assessment methods that teachers use favour the learning styles of female rather than male students, according to some authors (Dahlan *et al*. 2010:18) (see section 3.3.3.2).

Results from this study showed that the female students in the sample outperformed male students in English but not in mathematics (see section 5.2.4.2). This result differed from what was stated in the literature with regard to other samples. When the results of the qualitative phase of the study were examined in more depth, reasons for the above mentioned finding became apparent: Most of the male students (namely Students F, G, H, I), complained about how their English teachers conducted the classes (see section 5.3.4), whereas the female students only vocalised minimal complaints about their teachers. These complaints showed a possible learning and teaching style mismatch between the teachers and the male students. According to the literature review (see section 3.3.2.5), matching teaching and learning styles is vital for effective student learning and academic achievement (Zhou 2011:73) (see section 3.3.2.5).

Further examination of the findings from the qualitative phase of the study also showed that all the female students used auditory learning styles (see Table 5.57) whereas none of the male students did. As stated in the literature review, female students often outperform their male counterparts as they possess superior linguistic skills (Bhatti & Bart 2013:4) (see section 3.3.3.2). Having linguistic skills would probably indicate that a student preferred auditory learning (see section 2.4.6.2) which would account for female students performing better in English than their male counterparts. In the literature review it was also stated that having an aural preference was a predictor of final examination scores (Khanal et al. 2014:7) (see 3.4.1.2). This could also explain why female students performed better in English than male students as they had an aural learning style preference.

Findings from the qualitative phase also showed that the majority of the male students who were interviewed were kinaesthetic learners whereas a minority of the females used this type of learning style (see Table 5.57). This finding was also noted in the literature review where Honigsfeld and Dunn (in Aliakbari & Qasemia 2012:276) stated that male students were more inclined to be kinaesthetic learners than female students (see 3.4.2.2). This finding may also explain why the male students outperformed the female students in mathematics.

5.5 CONCLUSION

In this chapter the results of the quantitative and qualitative phases of the study were presented and discussed. The results gave answers to what the learning style preferences of students were, thus answering research question 1. The study also answered research question 2, namely what the relationship was between students' academic achievements in English and mathematics and their learning styles. Thereafter followed the results of research question 3 which investigated how students' learning styles, and their academic achievements in mathematics and English, were

influenced by nationality, gender, form and age. Integrated into the above, was the qualitative question of how top performing students study mathematics, English and any subject that involves a lot of learning.

In the next chapter, the conclusions from the results are presented in this chapter and the recommendations and limitations of the study are given.

CHAPTER SIX

CONCLUSIONS, RECOMMENDATIONS AND LIMITATIONS

6.1 INTRODUCTION

In the previous chapter the results were presented, discussed and interpreted against the background of the theoretical framework. In this chapter the conclusions, in line with the major results and recommendations of the study are presented, and the limitations of the research project are highlighted.

The main purpose of this study was to explore the relationship between the academic achievement of students and their learning styles in a multicultural senior school. The roles played by nationality, gender, age and grade/form in shaping these learning styles were also examined (see section 1.2).

The sub-questions (see section 1.2) which emanated from the main research question were:

- What are the learning style preferences of students?
- What is the relationship between students' academic achievements in English and mathematics and their learning styles?
- How are students' learning styles, and their academic achievements in mathematics and English, influenced by nationality, gender, form and age?

To shed further light on the above, the way in which a group of top-performing students learnt mathematics, English and subjects that involved a lot of learning material was also investigated qualitatively, and the findings were integrated into the results of the three (quantitative) sub-questions.

To answer the above mentioned research questions, the study was conducted in an independent multicultural senior school in the North West Province, South Africa. Using a mixed-methods design, the data was gathered using structured questionnaires (which were completed by 240 participants) and individual interviews with 10 top-achieving academic students were also conducted (see section 4.5). The conclusions that can be drawn from this research follow in the next section.

6.2 CONCLUSIONS

6.2.1 Research question 1

What are the learning style preferences of the students?

The results presented in section 5.2.2.8 indicate that the most preferred learning style of the students was individual learning followed by a kinaesthetic and a visual learning style. Group learning was not popular amongst the students. When the preferred learning style of the top achievers in English and mathematics was examined in more depth, it was found that their preferential learning style was also individual (see section 5.3.1). However, the top achievers indicated that in addition to an individual learning style, they used an array of other styles such as behavioural and constructivist learning styles, as well as self-regulation (see section 5.4.1).

6.2.2 Research question 2

What is the relationship between students' academic achievements in English and mathematics and their learning styles?

It can be concluded from the results in section 5.4.2 that the learning style that was most significantly related to academic achievements in English and mathematics of the

sample was an individual learning style. However, top achievers did not use only one learning style. Other learning styles that they implemented as needed were reading, writing, an auditory and a kinaesthetic learning style. Top achievers were also self-regulated learners that actively constructed new knowledge - an indication of a constructivist learning style.

6.2.3 Research question 3a

How are students' learning styles influenced by nationality, gender, form and age?

The results in section 5.4.3.1 indicated that nationality does not significantly influence students' learning styles. Likewise, no significant differences were found between students of the different forms regarding their learning style preferences (see section 5.4.3.3).

With regards to gender, it can be concluded that the female students were more inclined to be visual learners and had learning styles influenced by reading and writing. Female students were also more inclined to be individual learners than male students. Differences were also found in the learning styles of the two genders when studying English, mathematics and another learning subject. Female students used the auditory learning style more in these subjects whilst male students used kinaesthetic learning to a greater extent. Both genders used reading and writing learning styles when studying these subjects (see section 5.4.3.2).

It can also be concluded that the only significant relationship between age and learning style was among the younger participants who were, to a greater extent than the older students, auditory learners (see section 5.4.3.3).

6.2.4 Research question 3b

What is the relationship between age, form, nationality and gender and the students' academic achievements in English and mathematics?

The results in section 5.4.4.1 showed that the average achievements in mathematics deteriorated as the students got older. When the influence of form on the students' achievements was explored, it was found that the best performing form was the Form 3s, and the worst performing was the Form 6s.

Regarding nationality, the results in section 5.4.4.2 showed that there was no significant difference in the achievements in English across four nationalities. However, significant differences were found regarding mathematics where South African students achieved the best results.

With regards to gender, the results in section 5.4.4.3 showed that female students outperformed male students in English but not in mathematics.

The recommendations that can be drawn from this research will be discussed in the next section.

6.3 RECOMMENDATIONS

6.3.1 Recommendations for teachers to improve learning

Based on the research which has been done and reported on in the previous chapter, many recommendations can be made as to how teachers can improve learning in the school. The first recommendation that will be discussed concerns how teachers in the school can utilise the concept of learning styles/preferences in order to improve learning and academic achievement.

6.3.1.1 Learning styles/preferences

In order to improve learning, teachers need to draw up learning style profiles for each of their students. Such profiles will show the students' top learning style preferences. Once this information is gathered, the students can be assisted by teachers to utilise their predominant learning style and to develop other learning styles.

In order to collect this information, teachers could firstly ask the students to complete the questionnaire in Appendix F. Once completed, the students can start to fill in the Student Learning Style Profile (see Figure 6.1). An example of how these forms can be filled out is given in Figure 6.1 (the information that the student fills in is written in blue).

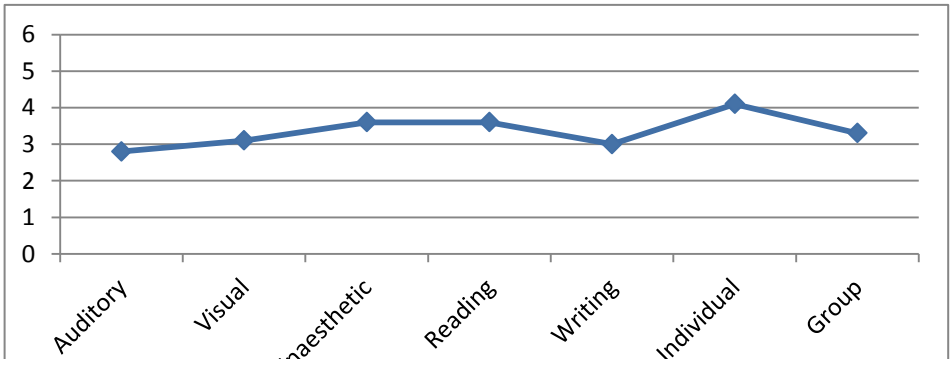
STUDENT LEARNING STYLE PROFILE

Name of school: ***JSSA*** Form: ***2***

Surname: ***Questionnaire*** First name: ***29***

Sensory Modality Preference	Question number	Total	Divide by	Average	Rank
Auditory	6-20	**43**	15	**2.8**	**7**
Visual	21-35	**47**	15	**3.1**	**5**
Kinaesthetic	36-50	**55**	15	**3.6**	**2**
Reading	51-58	**29**	8	**3.6**	**2**
Writing	59-65	**21**	7	**3**	**6**
Individual	66-72	**29**	7	**4.1**	**1**
Group	73-80	**27**	8	**3.3**	**4**

Plot the averages on to the graph and join up the points:



Indicate your learning style below and highlight in:

green - no. 1 preference

red – no. 2 preference

blue- no. 3 preference

Learning Style	Preference	Tips for helping you excel in class
Auditory	**7**	Follow text with your finger Memorise information by repeating it aloud Record your summarised notes and listen to them on tape Discuss with others in order to expand your understanding Explain your notes to your friends Attend classes, discussions, lectures and tutorials Participate in peer tutoring and group discussions Participate in musical activities Discuss topics with your teachers Leave spaces in your notes for later recall and collect additional notes from your textbook Practise writing answers to past papers
Visual	**5**	Make posters, graphs, flowcharts or slides with study notes on Underline key terms using highlighters Use textbooks which have lots of diagrams and pictures Sit at the front of the classroom Practise turning visuals back into words when preparing for a test

Kinaesthetic	**2**	Use real life examples in your summary to help with abstract concepts Redo lab experiments Use pictures to illustrate your ideas Go on field trips and tours Select teachers who give real-life examples Choose hands on subjects like computing and design and technology Write practice answers to exam questions
Reading	**2**	Organise diagram, charts and graphs into statements Use dictionaries, glossaries, handouts, textbooks, the library Read notes silently again and again Practise multiple choice questions Read novels
Writing	**6**	Write, write and rewrite your notes Reword main ideas to gain a deeper understanding Make lists Write essays Attend classes where teachers use words well and give lots of information Practise past paper questions
Individual	**1**	Work alone or with a peer
Group	**4**	Work in a group

Figure 6.1: Student learning style profile

Once the students have completed the learning style profile, they will need help from their teachers in order to understand and apply their strongest learning styles/preferences which have been identified in Figure 6.1.

Teachers can also assist in developing learning styles/preferences in their classes by creating a learning culture in their classes which is characterised by inclusiveness, self-discipline and respect for others. They can also publish the students' individual learning styles/preferences for their own reference and also for the benefit of other teachers. Such information would enable teachers to show students how to create their own learning materials simply and economically. Teachers would also be able to suggest alternative approaches when a common instructional strategy has been prescribed. They could help students develop secondary strengths and show them how to maintain concentration when they experience a mismatch of teaching and learning styles.

To further enhance the use of learning style profiles, teachers can compile a document of all the students' learning styles in each of their classes (see Figure 6.2 below).

STUDENTS' LEARNING STYLE PROFILE FOR TEACHER

Name of school: __*JSSA*_____

Teacher name: __*Adam Apple*_____

Form: __*4*_____

Subject: __*Economics*_____

Student Name	1st Preference	2nd Preference	3rd Preference
eg. John Smith	*Individual*	*Visual*	*Kinaesthetic*

Learning Preference/Style	No. of students with this learning style as a 1st preference	Tips for helping your students excel in your class
Auditory		Have students read aloud Allow students to explain concepts verbally Use beats/rhythms/songs to reinforce work Encourage group discussions, use of radios, discussion boards and web chat Give good thorough explanations
Visual		Use pictures, charts, labelled diagrams, handouts, maps, spider diagrams, graphs and flow charts to represent what could have been presented in words Organise information using colour codes Use models, puzzles, DVDs, demonstrations, mind games and patterns when teaching
Kinaesthetic		Give breaks frequently Let the student try something first before giving detailed instructions Allow students to move around Use games and projects Use demonstrations, simulations, case studies Give tasks to these students such as cleaning the board, opening the window etc. Break up lessons into manageable chunks Encourage cooperative learning activities Use pictures and photographs to illustrate concepts

Reading		Use PowerPoint, the internet, lists, diaries, dictionaries, google and Wikipedia, study guides, class notes, handouts Read novels Read examiner's tips Read mark schemes
Writing		Assign plenty of writing tasks Make lists Write essays Practise past papers
Individual		Do more one-on-one with students Allow students to work alone or with a peer
Group		Allow students to work in groups (check periodically that students are on task)

Figure 6.2: Student learning style profile for teachers

Teachers would initially fill in the top three learning style preferences of each member of their class (see Figure 6.2). Once this is complete, they would then add up the preferences and mark them on the table. From this chart they would be able to see which are the predominant learning styles are, and from there they would be able to use the information on the chart to plan their lessons.

Constructivist and self-regulatory learning also needs to be cultivated in the school as these were identified in the qualitative phase of the research as hallmarks of top academic achievers. In order to develop constructivist learning, teachers need to see students as active participants in the learning process ('sage on the stage') and themselves as the 'guide on the side'. Teachers should ask the students 'what do you think' instead of dictating and annotating work. This allows the students to construct their own ideas. In order to do this, teachers need to allow students to openly discuss issues, challenge them on their points and feed pointers to them so that they can develop arguments. The classroom climate and learning environment also has to be conducive for constructivist learning to work. In order to develop self-regulation, students need to learn how to work independently and take control of their own learning.

The next recommendation which will be discussed concerns how teachers in the school can improve the school and classroom climate in order to improve learning and academic achievement. These recommendations are based on the results of the quantitative and qualitative phase of the study.

6.3.1.2 School and classroom climate

Much of the research in the previous chapter indicates that the following recommendations can be made with regard to improving learning in the school by attending to the school and classroom climate in the following ways:

- develop a positive school climate and ethos which encourages the development of constructive relationships between students and teachers - this could help to ensure that students remain engaged and motivated,

- encourage self-respect amongst the students,
- build self-efficacy in the students so that they can help themselves set goals and monitor their own learning progress,
- encourage self-regulatory habits so that students resist distractions, manage their frustrations, focus their attention and persist at difficult tasks,
- deal with under-performing and lazy students, and
- motivate students to improve their work ethic so that they work harder.

The next recommendation that will be discussed concerns how teachers in the school can improve their own teaching in order to improve learning and academic achievement. All these recommendations are based on the results of the quantitative and qualitative phases of the study.

6.3.1.3 Teachers and teaching

Much of the research in the previous chapter indicates that the following recommendations can be made with regard to how managers can help to improve learning in the school by attending to teachers in the following ways:

- ensure that all teachers are experienced and competent and have good subject knowledge so they can give suitable, thorough explanations and helpful criticism,
- encourage teachers to use relevant teaching styles that can accommodate a variety of learning style preferences,
- encourage teachers to give competent guidance and counselling, exhibit positive modelling, show teaching efficacy, motivate students, provide a relaxed atmosphere within the class and effectively use rewards and punishments,
- ensure that homework and classwork is regularly given and this work is marked frequently and feedback is provided,
- encourage teachers to move around the class,

- ensure that teachers use appropriate teaching methods that are learner-focused so that students can take control of their learning,
- encourage teachers to incorporate fun activities in their class and use innovative teaching and audio visual aids such as experiments, observations, games, slideshows and videos when teaching,
- ensure that teachers show sensitivity to individual differences and needs and include students in decision-making,
- foster the concept of deep learning that encourages students to try to understand key concepts, the underlying meaning of the materials and relate new learning with previous relevant knowledge and personal experience,
- encourage teachers to help students set goals and motivate them so that they can sustain their interest in learning the material,
- ensure that the students are given notes (as many of these students are read/write learners),
- encourage the students to use study guides, mark schemes, past papers and the internet when studying,
- timeously close gaps in the students' knowledge,
- ensure that everyone understands the work before progressing,
- check study notes,
- give regular tests,
- reward good work,
- engage with the students, and
- remove distractions like cell phones and TVs.

The last recommendation that will be discussed next concerns how the teachers can encourage the students in the school in order to improve learning and academic achievement. All these recommendations are based on the results of the quantitative and qualitative phase of the study.

6.3.1.4 Students

Much of the research in the previous chapter indicates that the following recommendations can be made with regard to improving learning in the school. Teachers can encourage the students in the following ways in order to accommodate diverse learning styles:

- to study individually and continuously,
- to take notes in class,
- to ask questions in class,
- to read the material before and after class,
- to talk about work with other students,
- to pay attention in class,
- to raise their views,
- to ask for feedback regarding assignments, and
- to practise mathematics.

6.3.2 Recommendations for further research

Further research could be conducted into the following areas.

6.3.2.1 The mismatch between teaching styles and student learning styles and its effects on learning and academic achievement

An interesting area that could be further researched is the mismatches that can occur between learning and teaching styles. This point was raised during the individual interviews. The respondents replied that certain teaching styles did not fit their learning styles. In one case, the teacher used behaviourist teaching methods which the students found boring (see section 5.3.4).

In another case the student reported that the teacher did not explain well which hampered their use of auditory learning and that another teacher moved too fast through the work, thus preventing them from using constructivist learning (see section 5.3.7). It would also be interesting to study the extent of the mismatch in these different subjects and how learning and academic achievement could be improved if such mismatches were addressed.

6.3.2.2 How to turn a poor performer into a top achiever using learning styles theory

Many of the respondents in the individual interviews offered their views as to what type of teaching does not work for them in the different subjects and how the teaching could be improved. Students indicated that different teachers prevented them from using constructivist learning as these teachers were creating poor classroom climates and learning environments (see section 5.3.4). These students made various suggestions as to how learning styles theory could be incorporated into teaching such as the teacher giving better explanations (thus appealing to an auditory learning style) and using PowerPoint presentations (thus supporting a read/write learning style). It would be worthwhile to explore if the suggestions made by these top achievers could assist the poor performers to become better academic achievers.

6.3.2.3 Investigating to what extent students are unimodal, bimodal and trimodal and linking this to gender, nationality, age and academic achievement

Another area of research that could be explored further is the extent to which students in the school are unimodal, bimodal and trimodal (see section 2.4.6). Many of the top achievers stated in the qualitative phase of the study that they use multiple learning styles (see section 5.3) when learning English, mathematics and another subject.

It would be useful to investigate if students combined learning style preferences and which ones were combined for different subjects. Such data could be analysed through variables like gender, age and nationality and then linked to academic achievement.

The limitations of the study are presented next.

6.4 LIMITATIONS OF THE STUDY

The study was limited by the following:

- The significant reliance on a self-report questionnaire. Students are not always 'objective' when they report on themselves and often give the perceived 'correct' answer.

- The information that was obtained in the research is specific to the students at this particular school - it therefore makes generalising the results difficult. Future researchers could use greater samples from a larger variety of schools, including public schools. This would enhance the external validity of the research.

- The researcher was also challenged to obtain the completed consent and assent forms from all the students who participated in the quantitative phase of the study. It required much follow-up from the researcher which was time-consuming.

6.5 CONTRIBUTION OF THE STUDY TO NEW KNOWLEDGE

This study on learning styles and academic achievement is the first of its kind in many ways in South Africa. An original instrument was designed and used to determine learning style preferences. The study involved 240 students of different ages, forms, genders and nationalities. The students' learning style preferences were explored. Relationships between learning style preferences and academic

achievements of different groups of students were explored. Top academic achievers were also interviewed to investigate how they use learning styles in their learning. The results are significant for identifying which strategies teachers can use to improve learning and academic achievement at the school.

The findings that are of particular significance include the following:

- The most preferred learning style preference was individual, followed by kinaesthetic and visual learning. Group learning was not popular. The learning style which was most significantly related to academic achievements in English and mathematics was also individual learning;
- Differences were found between the learning styles of the different genders. In general, female students were more inclined to be individual and visual learners. However, when learning English and mathematics, female students used auditory learning whereas male students were more kinaesthetic. Again, teachers would need to take cognisance of such information when planning and executing their lessons;
- Some differences were also found between age and learning styles. The younger respondents were found to be auditory learners.

Teachers should take cognisance of such information when planning and executing their lessons if they want to improve learning and academic achievement in their classes.

Based on the findings, the study also recommended ways to improve student learning and academic achievement. Thus, the research makes a valuable contribution to new knowledge with regard to teaching and learning in the South African context.

6.6 SUMMARY

Classrooms in South Africa have changed since 1994. There are now more students from different ethnic backgrounds as well as nationalities. In order to teach effectively in such an environment, teachers need to use strategies which meet the

needs of all the students whilst still considering each student as an individual. One way of addressing this predicament is to implement learning styles theory to improve learning and academic achievement in the classroom. This motivated the main research question of this study which was: *What is the relationship between students' academic achievement and students' learning style in a multicultural senior school?* The specific research questions that were investigated included:

- What are the learning style preferences of students?
- What is the relationship between students' academic achievements in English and mathematics and their learning styles?
- How are students' learning styles academic achievements in English and mathematics influenced by nationality, gender, form and age?

In order to answer these questions, the study used a mixed methods research design was used which was sequential explanatory. By means of questionnaires, the data was collected from a purposefully and a conveniently selected sample of 240 students from Form 2 to Form 6. Interviews were also held with 10 top academic achievers in the school to complement the above and indicate *how* students learn. The data was analysed by means of descriptive statistics (means and correlations) and inferential statistics (analysis of variance).

The results indicated that the majority of the students preferred an individual learning style. This particular learning style was also most significantly related to academic achievements in English and mathematics. Secondly, the study determined that nationality did not significantly influence students' learning styles but gender and age did: female students were found to be more inclined to be individual learners, and younger students were also found to be auditory learners. Regarding the studying of English and mathematics, it was found that female students used auditory learning styles whilst male students preferred kinaesthetic learning styles. Lastly, the study found that average achievements in mathematics deteriorated significantly as the students got older and the worst performing form was the Form 6s.

Various recommendations as to how learning and academic achievement could be improved in the school were made. Recommendations for further study were also delineated and the limitations of this research were highlighted.

LIST OF REFERENCES

Abd-Elmotaleb, M. & Saha, S.K. 2013. The role of academic self-efficacy as a mediator variable between perceived academic climate and academic performance. *Journal of Education and Learning*, 2(3):117-129.

Ahanbor, Z. & Sadighi, F. 2014. The relationship between multiple intelligences, learning styles and gender. *Modern Journal of Language Teaching Methods*, 4(1):176-184.

Ahmad, N.A., Jelas, Z.M. & Ali, M.M. 2011. The relationship between learning styles and strategies with academic achievement based on gender and type of school*. The International Journal of Learning*, 17(10):265-278.

Al Muhaidib, N.S. 2011. Different learning styles used by Saudi female English second language learners. *Ekev Academic Review*, 15(46):435-449.

Al-Saud, L.M.S. 2013. Learning style preferences of first-year dental students at King Saud University in Riyadh, Saudi Arabia: Influence of gender and GPA. *Journal of Dental Education*, 77(10):1371-1378.

Aliakbari, M. & Qasemi, N. 2012. On the relationship between Iranian EFL learners' learning style preference and their gender, proficiency level and achievement score. *International Journal of Pedagogies and Learning,* 7(3):275–283.

Allcock, S.J. & Hulme, J.A. 2010. Learning styles in the classroom: Educational benefit or planning exercise? *Psychology Teaching Review,* 16(2):67-79.

Amran, N., Bahry, F.D.S., Yusop, Z.M. & Abdullah, S. 2011. Learning styles of non-science and non-technology students on technical courses in an information management program. *Education for Information*, 28(2):325-339.

Anderman, E.M. & Anderman, L.H. 2014. *Classroom motivation.* (2nd edition). New Jersey: Pearson.

Awang, M.M., Ahmad, A.R., Abu Bakar, N., Ghani, S.A., Mohd, A.N., Ibrahim, Y.M.A.H., Ramalu, J.C., Saad, C.P. & Rahman, M.J.A. 2013. Students' attitudes and their academic performance in nationhood education. *International Education Studies,* 6(11):21-28.

Azevedo, R.E. & Akdere, M. 2010. Measuring the effects of learning styles: Is a little knowledge dangerous for excellence in management education? *Journal of Leadership & Organizational Studies,* 2010 17(2):192-200.

Babalis, T., Tsoli, K., Artikis, T.C., Mylonakou-Keke, I. & Xanthakou, Y. 2013. The impact of social and emotional learning programs on the emotional competence and academic achievement of children in Greek primary schools. *World Journal of Education*, 3(6):54-63.

Babbie, E. 2010. *The practice of social research*. Belmont: Wadsworth.

Bandura, A. 1977. *Social learning theory*. Englewood Cliffs: Prentice Hall.

Banks, J.A. 2003. Series Foreword. In: *Educating teachers for diversity: Seeing with a cultural eye*, edited by J.J. Irvine. New York: Teachers College Press:ix-xii.

Barmeyer, C.I. 2004. Learning styles and their impact on cross-cultural training: An international comparison in France, Germany and Quebec. *International Journal of Intercultural Relations*, 28:577-594.

Bas, G. & Beyhan, O. 2013. Effects of learning styles based instruction on academic achievement, retention level and attitudes towards English course. *Journal of Faculty of Educational Sciences,* 46(2):133-158.

Bell, C.V. & Pape, S.J. 2014. Scaffolding the development of self-regulated learning in mathematics classrooms. *Middle School Journal*, 45(4):23-32.

Bennett, T. 2013. *Teacherproof*. Oxon: Routledge.

Bhatti, R. & Bart, W.M. 2013. On the effect of learning style on scholastic achievement. *Current Issues in Education,* 16(2):1-6.

Blaxter, L., Hughes, C & Tight, M. 2008. *How to research.* (3rd edition). Berkshire: Open University Press.

Bjornebekk, G., Diseth, A. & Ulriksen, R. 2013. Achievement motives, self-efficacy, achievement goals and academic achievement at multiple stages of education: A longitudinal analysis. *Psychological Reports: Human Resources & Marketing,* 112(3):771-787.

Bostrom, L. 2012. Do ten-year-old children in Sweden know how they learn? A study of how students believe they learn compared to their learning style preferences. *International Education Studies*, 5(6):11-23.

Breckler, J., Teoh, C.S. & Role, K. 2011. Academic performance and learning style self-predictions by second language students in an introductory biology course. *Journal of the Scholarship of Teaching and Learning*, 11(4):26-43.

Briley, D.A., Harden, K.P. & Tucker-Drob, E.M. 2014. Child characteristics and parental educational expectations: Evidence for transmission with transaction. *Developmental Psychology*, 50(12):2614–2632.

Brown, N.R., Terry, R., & Kelsey, K.D. 2013. The impact of learning styles on learning outcomes at FFA Camp: What campers retain over time. *Journal of Agricultural Education*, 54(4):206-220.

Bruner, J. 1966. *Toward a theory of Instruction*. New York: W.W. Norton.

Bryant, L.C., Vincent, R., Shaqlaih, A. & Moss, G. 2013. Behaviourism and behavioural learning theory. In: *The Handbook of Educational Theories,* edited by B.J. Irby, G. Brown, R. S. Lara-Aleci & S. Jackson. Charlotte: Information Age Publishing. Charlotte: 91-103.

Buka, P. 2013. Promoting academic achievement through positive relationships. *Journal of Educational and Social Research,* 3(3):323-328.

Cagiltay, N.E. 2008. Using learning styles in engineering education. *European Journal of Engineering Education*, 33(4):415-424.

Caprara, G.V., Vecchione, M., Alessandri, G., Gerbino, M. & Barbaranelli, C. 2011. The contribution of personality traits and self-efficacy beliefs to academic achievement: A longitudinal study*. British Journal of Educational Psychology,* 81(1):78–96.

Castro, O. & Peck, V. 2005. Learning styles and foreign language learning difficulties. *Foreign Language Annals,* 38(3):401-409.

Cavas, B. 2010. A study on pre-service science, class and mathematics teachers' learning styles in Turkey. *Science Education International,* 21(1):47-61.

Cerna, M.A. & Pavliushchenko, K. 2015. Influence of Study Habits on Academic Performance of International College Students in Shanghai. *Higher Education Studies*, 5(4):42-55.

Chase, P.A., Hilliard, L.J., Geldhof, G.J., Warren, D.J.A. & Lerner, R.M. 2014. Academic achievement in the high school years: The changing role of school engagement*. Journal of Youth Adolescence,* 43(6):884-896.

Cheung, C.S & McBride-Chang, C. 2008. Relations of perceived maternal parenting style, practices, and learning motivation to academic competence in Chinese children. *Merrill-Palmer Quarterly*, 54(1):1-22.

Choudhary, R., Dullo, P. & Tandon, R.V. 2011. Gender differences in learning style preferences of first year medical students. *Pakistan Journal of Physiology*, 7(2):42-45.

Clark, V.L. & Creswell, J.W. 2008. *The mixed methods reader*. Thousand Oaks: Sage Publications.

Clark, R.E., Kirschner, P.A. & Sweller, J. 2012. Putting students on the path to learning: the case for fully guided instruction. *American Educator,* 36(1):6-11.

Coffield, F., Moseley, D., Hall, E. & Ecclestone, K. 2004. *Learning styles and pedagogy in post-16 learning: A systematic and critical review*. London: Learning and Skills Research Centre.

Cohen, L., Manion, L., Morrison, K., & Wyse, D. 2010. *A guide to teaching practice* (5th edition). Oxon: Routledge.

Cooper, L.Z. 2013. Student reflections on an LIS internship from a service learning perspective supporting multiple learning theories. *Journal of Education for Library and Information Science*, 54(4):286-298.

Cutolo, A. & Rochford, R.A. 2007. An analysis of freshmen learning styles and their relationship to academic achievement. *College Quarterly,* 10(2):1-17.

Creswell, J.W. 2003. *Research design: Qualitative, quantitative and mixed methods approaches*. (2nd edition). Thousand Oaks, California: Sage.

Creswell, J.W. 2012. *Educational research: Planning, conducting, and evaluating quantitative and qualitative research*. (4th edition). Boston: Pearson.

Creswell, J.W. & Clark, V.l.P. 2011. *Designing and conducting mixed methods research*. (2nd edition). Thousand Oaks: Sage.

Daghani, G. & Akkoyunlu, B. 2012. An examination through conjoint analysis of the preferences of students concerning online learning environments according to their learning styles*. International Education Studies,* 5(4):122-138.

Dahlan, N.A., Noor, N.A.M. & Hashim, K.S. 2010. Exploring the gender gap in achievement in Malaysia: A case for learning styles*. The International Journal of Learning,* 17(4):15-27.

Davies, M. & Hughes, N. 2014. *Doing a successful research project using qualitative and quantitative methods*. (2nd edition). Basingstoke: Palgrave Macmillan

Dennick, R. 2012. Twelve tips for incorporating educational theory into teaching practices. *Medical Teacher*, 34(8):618–624.

Denscombe, M. 2007. *The good research guide for small-scale research projects*. (3rd edition). New York: Open University Press.

Dobson, J.L. 2010. A comparison between learning style preferences and sex, status and course performance. *Advances in Physical Education*, 34:197-204.

Donche, V., De Maeyer, S., Coertjens, L., Van Daal, T. & Van Petegem, P. 2013. Differential use of learning strategies in first-year higher education: The impact of personality, academic motivation, and teaching strategies*. British Journal of Educational Psychology*, 83:238–251.

Drake, K., Belsky, J. & Pasco Fearon, R.M. 2014. From early attachment to engagement with learning in school: The role of self-regulation and persistence. *Developmental Psychology*, 50(5):1350–1361.

Duman, B. 2010.The effects of brain-based learning on the academic achievement of students with different learning styles. *Educational Sciences: Theory & Practice,* 10(4):2077-2103.

Dunn, R. 1990. Understanding the Dunn and Dunn learning styles model and the need for individual diagnosis and prescription. *Journal of Reading, Writing, and Learning Disabilities International: Overcoming Learning Difficulties*, 6(3), 223-247.

Dunn, R. & Burke. K. 2005*. Learning style: The clue to you!* New York: Centre for the Study of Learning and Teaching Styles.

Dunn, R. & Griggs, S.A. 2007. Preface. In: *What if? Promising practices for improving schools*, edited by R. Dunn & S.A. Griggs. Maryland: Rowman & Littlefield: vii-xii.

Dunn, R., Honigsfeld, A., Doolan, L.S., Bostrom, L., Russo, K., Schiering, M.S., Suh, B. & Tenedero, H. 2009. Impact of learning-style instructional strategies on students' achievement and attitudes: perceptions of educators in diverse institutions. *The Clearing House,* 82(3):135-140.

Dupe, O.B. 2013. Predicting students' achievement in Physics using academic self-concept and locus of control scale scores*. International Journal of Social Science & Education*, 3(4):1149-1155.

Durmuscelebi, M. 2013. Examining candidate teachers' learning styles by some variables. *International Journal of Academic Research Part B,* 5(3):210-219*.*

Dymoke, S. 2011. An overview of learning in reflective teaching and learning in the secondary school. In: *Reflective teaching and learning in the secondary school*, edited by S. Dymoke. London: Sage: 47-73.

Eggen, P. & Kauchak, D. 2013. *Educational psychology: windows on classrooms.* (9th edition). New Jersey: Pearson.

Elci, A.N., Kilic, D.S. & Alkan, H. 2012. 4MAT model's impact on the learning styles, success and attitudes towards Mathematics. *Journal of Educational and Instructional Studies in the World*, 2(3):135-147.

Englander, F., Terregrossa, R.A. & Wang, Z. 2013. Testing the construct validity of the productivity environmental preference survey learning style inventory instrument. *International Journal of Education Research,* 8(1):107-115.

Ertmer, P.A. & Newby, T.J. 2013. Behaviourism, cognitivism, constructivism: comparing critical features from an instructional design perspective. *Performance Improvement Quarterly*, 26(2):43-71.

Evans, C., Richardson, J.T.E. & Waring, M. 2013. Field independence: Reviewing the evidence*. British Journal of Educational Psychology,* 83(2):210–224.

Farajolahi, S. & Nimvari, A.A.E. 2014. The relationship between student learning styles and their language learning strategies. *Modern Journal of Language Teaching Methods,* 4(1):157-175.

Fee, K. 2011. *101 learning and development tools*. London: Kogan Page Limited.

Felder, R.M. & Spurlin, J. 2005. Applications, reliability and validity of the Index of Learning Styles. *International Journal of Engaging Education*, 21(1):103-112.

Fiksl, M. & Abersek, B. 2014. Classroom climate as a part of contemporary didactical approaches. *Problems of Education in the 21st Century,* 61:28-36.

Fitkov-Norris, E. & Yeghiazarian, A. 2013. Assessing the learning style preferences postgraduate general business management students using VARK. *Proceedings of the 12th European Conference on Research Methods.* Academic Conferences Limited.

Fleming, N.D. & Mills, C. 1992. Not another inventory, rather a catalyst for reflection. *To Improve the Academy,* 11:137-155.

Fleming, N.D. 1995. I'm different: Not dumb. Modes of presentation (VARK) in the tertiary classroom. Research and Development in Higher Education, Proceedings of the 1995 Annual Conference of the Higher Education and Research Development Society of Australasia (HERDSA), HERDSA, 18:308-313.

Fleming, N. D. 2001. *Teaching and learning styles: VARK strategies*. Christchurch: N.D. Fleming.

Fleming, N. 2015. The VARK modalities. Available at: www.vark-learn.com. Accessed on 1 March 2015.

Formosa, S., Scicluna, S., Azzopardi, J., Pace, J.F. & Calafato, T. 2011. *The research road we make: statistics for the uninitiated*. Malta: National Statistics Office.

Gabe, K. 2002. Male and female college students' learning styles differ: an opportunity for instructional diversification. *College Student Journal*, 36(3):433-441.

Gappi, L.L. 2013. Relationships between learning style preferences and academic performance of students. *International Journal of Educational Research and Technology*, 4(2):70-76.

Garner-O'Neale, L.D. & Harrison, S. 2013. An investigation of the learning styles and study habits of chemistry undergraduates in Barbados and their effect as predictors of academic achievement in Chemical group theory. *Journal of Educational and Social Research,* 3(2):107-122.

Ghaedi, Z. & Jam, B. 2014. Relationship between learning styles and motivation for higher education in EFL Students. *Theory and Practice in Language Studies*, 4(6):1232-1237.

Given, B.K. 2000. *Learning styles: a guide for teachers and parents*. Learning Forum Publications.

Good, J.P., Ramos, D. & D'Amore, D.C. 2013. Learning style preferences and academic success of preclinical allied health students. *Journal of Allied Health*, 42(4): 81-90.

Graf, S., Kinshuk, & Liu, T. 2009. Supporting teachers in identifying students' learning styles in learning management systems: an automatic student modelling approach. *Educational Technology & Society*, 12(4):3-14.

Gray, C. & Macblain, S. 2012. *Learning theories in childhood*. London: Sage.

Gregorc, A. F. 1982. *An adult's guide to style*. Columbia: Gregorc Associates, Inc.

Gross, R. 2010. *Psychology: The science of mind and behaviour.* (6th edition). Oxon: Bookpoint.

Han, X. 2014. A study on the painful transition of adolescent in J.D. Salinger's writing. *Theory and Practice in Language Studies*, 4(11):2384-2388.

Hartle, R.T., Baviskar, S. & Smith, R. 2012. A field guide to constructivism in the college science classroom: Four essential criteria and a guide to their usage. *Bioscene*, 38(2):31-35.

Haughton, G. & Stevens, A. 2010. Quantitative data processing and analysis. In: *Practical research and evaluation: A start-to-finish guide for practitioners*, edited by L. Dahlberg & C. McCaig. London: Sage:191-218.

Hawk, T.F. & Shah, A.J. 2007. Using learning style instruments to enhance student learning. *Decision Sciences Journal of Innovative Education,* 5(1):1-19.

Heffernan, T., Morrison, M., Basu, P. & Sweeney, A. 2010. Cultural differences, learning styles and transnational education. *Journal of Higher Education Policy and Management*, 32(1):27-39.

Hergenhahn, B.R. & Olson, M.H. 2005. *An introduction to theories of learning.* (7th edition). New Jersey: Pearson Education.

Hermond, D. 2014. Determining the learning styles of prospective educational leaders. *National Forum of Educational Administration and Supervision Journal*, 32(1):47-58.

Hlawaty, H. 2009. *Lernen* and learning styles: A comparative analysis of the learning styles of German adolescents by age, gender, and academic achievement level. *European Education,* 40(4):23–45.

Honey, P. & Mumford, A. 1992. *The manual of learning styles*. Maidenhead: Peter Honey.

Howe, W.A. & Lisi, P.L. 2014. *Becoming a multicultural educator*. Thousand Oaks, California: Sage.

Illeris, K. 2009. Introduction. In: *Contemporary theories of learning*, edited by K. Illeris. Oxon: Routledge: Sage: 1-6.

Isman, A. 2011. Instructional design in education: new model. *The Turkish Online Journal of Educational Technology,* 10(1):136-142.

Jebson, S.R. & Moses, A.N. 2012. Relationship between learning resources and student's academic achievement in Science subjects in Taraba State Senior Schools. *Ife Psycholog1A*, 20(1):87-102.

Jenlink, P.M. & Austin, S.F. 2013. Introduction In: *The Handbook of Educational Theories,* edited by B.J. Irby, G. Brown, R.S. Lara-Aleci & S. Jackson. Charlotte: Information Age Publishing. Charlotte: 87-90.

JilardiDamavandi, A., Mahyuddin, R., Elias, H., Daud, S.M. & Shabani, J. 2011. Academic Achievement of Students with Different Learning Styles. *International Journal of Psychological Studies*, 3(2):186-193.

Johnson, B. & Christensen, L. 2008. Educational *research: Quantitative, qualitative and mixed approaches.* (3rd edition). Thousand Oakes: Sage.

Joo, Y.J., Kim, N., Kim, S., & Chung, A. 2011. Verification of internal variables affecting Korean community college students' academic achievement. *KEDI Journal of Educational Policy*, 8(2):259-278.

Joy, S. & Kolb, D.A. 2009. Are there cultural differences in learning style? *International Journal of Intercultural Relations*, 33(1):69-85.

Juskeviciene, A. & Kurilovas, E. 2014. On recommending Web 2.0 tools to personalise learning. *Informatics in Education,* 13(1):17-31.

Kablan, Z. & Kaya, S. 2013. Science achievement in TIMSS cognitive domains based on learning styles. *Eurasian Journal of Educational Research,* 13(53):97-114.

Kasirye, I. 2009. *Determinants of learning achievement in Uganda*. Kampala: Economic Policy Research Centre, Uganda.

Khanal, L., Shah, S. & Koirala, S. 2014. Exploration of preferred learning styles in medical education using VARK modal. *Russian Open Medical Journal,* 3:1-8.

Kelly, M.G. 2013. Using learning preferences to direct teaching and balance academic performance. *Journal of College Science Teaching*, 42(5):20-28.

Kinshuk, Liu, T. & Graf, S. 2009. Coping with mismatched courses: students' behaviour and performance in courses mismatched to their learning styles. *Education Technology Research and Development*, 57(6):739–752.

Kolb, D.A. 1984. *Experiential learning*. Englewood Cliffs: Prentice Hall.

Krathwohl, D.R. 2009. *Methods of educational and social science research*. (3rd edition). Long Grove: Waveland Press.

Ku, D.T. & Chang, C. 2011. The effect of academic discipline and gender difference on Taiwanese college students' learning styles and strategies in web-based learning environments. *The Turkish Online Journal of Educational Technology*, 10(3):265-272.

Lau, W.W. & Yuen, A.H. 2010. Gender differences in learning styles: Nurturing a gender and style sensitive computer science classroom. *Australasian Journal of Educational Technology, 26(7):*1090-1103.

Leedy, P.D. & Ormrod, J.E. 2013. *Practical research: Planning and design*. (10th edition). New Jersey: Pearson Education.

Leite, W.L., Svinicki, M. & Shi, Y. 2010. Attempted validation of the scores of the VARK: Learning Styles Inventory with multitrait–multimethod confirmatory factor analysis models. *Educational and Psychological Measurement*, 70(2) 323-339.

Leman, J. 2010. Quantitative data collection. In: *Practical research and evaluation: A start-to-finish guide for practitioners*, edited by L. Dahlberg & C. McCaig. London: Sage:172-191.

Lemmer, E.M. 2002. Restructuring the system of education and training in South Africa. In: *Transforming education: the South African experience*, edited by N. Van Wyk & E. Lemmer. New York: Nova Science Publishers:23-47.

Leopold, L. 2012. Prewriting tasks for auditory, visual and kinaesthetic learners. *TESL Canada Journal*, 29(2):96-102.

Leung, A., McGregor, M., Sabiston, D. & Vriliotis, S. 2014. VARK learning styles and student performance in principles of Micro- vs. Macro-Economics. *Journal of Economic and Economic Education Research*, 15(3):113-120.

Li, Y.S., Yu, W.P., Liu, C.F., Shieh, S.H. & Yang, B.H. 2013. An exploratory study of the relationship between learning styles and academic performance among students in different nursing programs. *Contemporary nursing*, 48(2):229-239.

Liamputtong, P. 2013. *Qualitative research methods*. (4th edition). South Melbourne: Oxford University Press.

Lynch, A.D., Lerner, R.M. & Leventhal, T. 2013. Adolescent academic achievement and school engagement: An examination of the role of school-wide peer culture. *Journal Youth Adolescence*, 42(1):6–19.

McCaig, C. 2010. Research and evaluation design. In *Practical research and evaluation: A start-to-finish guide for practitioners*, edited by L. Dahlberg & C. McCaig. London:Sage:29-40.

McInerney, D.M., Cheng, R. W., Mok, M.M.C. & Lam, A.K.H. 2012. Academic self-concept and learning strategies: Direction of effect on student academic achievement. *Journal of Advanced Academics*, 23(3):249-269.

McMillan, J. & Schumacher, S. 2014. *Research in Education: Evidence-based inquiry*. (7th edition). Harlow: Pearson.

Mega, C., Ronconi, L. & De Beni, R. 2013. What makes a good student? How emotions, self-regulated learning, and motivation contribute to academic achievement. *Journal of Educational Psychology*, 106(1):121–131.

Mestre, L.S. 2010. Matching up learning styles with learning objects: what's effective? *Journal of Library Administration*, 50(7-8):808–829.

Morrissey, T.W. Hutchison, L., & Winsler, A. 2014. Family income, school attendance, and academic achievement in elementary school. *Developmental Psychology*, 50(3):741–753.

Morrison, G.S. 2006. *Fundamentals of early childhood education*. (4th edition). New Jersey: Pearson Education.

McCaig, C. 2010. Research and evaluation design. In *Practical research and evaluation: A start-to-finish guide for practitioners*, edited by L. Dahlberg & C. McCaig. London: Sage:29-40.

Mouton, J. 2001. *How to succeed in your Master's and Doctoral Studies*. Pretoria: Van Schaik.

Mukherjee, S. 2015. Learning styles of trainees: challenges in designing course curricula. Available at: www.slideshare.net /DrSrabanMukherjeePCC/learning-styles-of-trainees-learners. Accessed on 15 August 2015.

Naik, B. 2013. Influence of culture on learning styles of business students. *International Journal of Education Research*, 8(1):129-139.

Naimie, Z., Siraj, S., Ahmed Abuzaid, R. & Shagholi, R. 2010. Hypothesised learners' technology preferences based on learning style dimensions. *The Turkish Online Journal of Educational Technology,* 9(4):83-93.

Narayan, R., Rodriguez, C., Araujo, J., Shaqlaih, A. & Moss, G. 2013. Constructivism: Constructivist Learning Theory In: *The Handbook of Educational Theories,* edited by B.J. Irby., G. Brown, R., S. Lara-Aiecio & S. Jackson. Charlotte: Information Age Publishing. Charlotte: 169-184.

Nel, N. & Nel, M. 2012. Learning. In: *Learner support in a diverse classroom*, edited by N. Nel, M. Nel & A. Hugo. Pretoria: Van Schaik:25-44.

Neuman, W.L. 2006. *Social research methods: qualitative and quantitative approaches*. Boston: Pearson/Allyn and Bacon.

Ng, P., Pinto, J. & Williams, S.K. 2011. The effects of learning styles on course performance: A quantile regression analysis. *Academy of Educational Leadership Journal*, 15(1):15-37.

Nieto, S. 2009. Multicultural education in the United States: Historical realities, ongoing challenges, and transformative possibilities. In: *The Routledge international companion to multicultural education,* edited by J.A. Banks. New York: Routledge:79-96.

Njoroge, P.M. & Nyabuto, A.N. 2014. Discipline as a Factor in Academic Performance in Kenya. *Journal of Educational and Social Research,* 4(1):289-307.

Nyikahadzoi, L., Matamande, W., Taderera, E., & Mandimika, E. 2013. Determinants of students' academic performance in four selected accounting courses at University of Zimbabwe. *Research in Higher Education Journal*, 21:1-9.

Oakes, J., Lipton, M., Anderson, L., & Stillman, J. 2013.*Teaching to change the world.* (4th edition). Colorado: Paradigm.

O'Donnell, A.M., Reeve, J., & Smith, J.K. 2012. *Educational psychology: Reflection for action*. (3rd edition). Hoboken: John Wiley & Sons.

O'Neill-Blackwell, J. 2012. *Engage: the trainer's guide to learning styles*. San Francisco: John Wiley & Sons.

Olson, M.H. & Hergenhahn, B.R. 2013. *An introduction to theories of learning*. New Jersey: Pearson.

Orhun, N. 2007. An investigation into the mathematics achievement and attitude towards mathematics with respect to learning style according to gender. *International Journal of Mathematical Education in Science and Technology*, 38(3):321–333.

Ormrod, J.E. 2014. *Human learning*. (6th edition). Harlow: Pearson.

Otrar, M. 2007. The Validity and Reliability of the Marmara Learning Styles Scale (MLSS). *Educational Sciences: Theory and Practice*, 7(3):1402-1419.

Paciotti, K.D. 2013. Cognitivism: ways of knowing. In: *The Handbook of Educational Theories,* edited by B.J. Irby., G. Brown, R., S. Lara-Aleci & S. Jackson. Charlotte: Information Age Publishing. Charlotte: 105-113.

Palmer, L.K., Economou, P., Cruz, D., Abraham-Cook, S., Huntington, J.S., Maris, M., Makhija, M., Welsh, T. & Maley, L. 2014. The relationship between stress, fatigue, and cognitive functioning. *College Student Journal*, 198-211.

Papalia, D.E., Olds, S.W. & Feldman, R.D. 2006. *A child's world: infancy through adolescence.* (10th edition). New York: McGraw-Hill.

Pashler, H., McDaniel, M., Rohrer, D. & Bjork, R. 2009. Learning styles: Concepts and evidence. *Psychological Public Interest,* 9(3):105-119.

Peters, D., Jones, G. & Peters, J. 2008. Preferred 'learning styles' in students studying sports-related programmes in higher education in the United Kingdom. *Studies in Higher Education,* 33(2):155–166.

Peterson, E.R., Carne, S.S. & Freear, S.J. 2011. Teaching secondary teachers about style - should we do it? In: *Style differences in cognition, learning, and management*, edited by S. Rayner& E. Cools. New York: Routledge:160-172.

Piaget, J. 1970. *The science of education and the psychology of the child*. New York: Viking Press.

Platsidou, M. & Metallidou, P. 2009. Validity and reliability issues of two learning style inventories in a Greek sample: Kolb's Learning Style Inventory and Felder & Solomon's Index of Learning Styles. *International Journal of Teaching and Learning in Higher Education*, 20(3):324-335.

Prajapati, B., Dunne, M., Bartlett, H. & Cubbidge, R. 2011. The influence of learning styles, enrolment status and gender on academic performance of optometry undergraduates. *Ophthalmic & Physiological Optics*, 31:69–78.

Prashnig, B. 2006. *Learning styles and personalised teaching*. London: Network.

Pritchard, A. 2014. *Ways of learning: Learning theories and learning styles in the classroom*. London: Routledge Taylor & Francis.

Prithishkumar, I.J. & Michael, S.A. 2014. Understanding your student: Using the VARK model. *Journal of Postgraduate Medicine*, 60(2):183-186.

Ramburuth, P. & McCormick, J. 2001. Learning diversity in higher education: A comparative study of Asian international and Australian students. *Higher education*, 42(3):333-350.

Rassool, G.H. & Rawaf. S. 2007. Learning style preferences of undergraduate nursing students. *Nursing Standard,* 21(32):35-41.

Rayner, S. 2007. A teaching elixir, learning chimera or just fool's gold? Do learning styles matter? *Support for Learning*, 22(1): 24-30.

Reid, G. 2005. *Learning styles and inclusion*. London: Sage Publications.

Ren, G. 2013. Which learning style is most effective in learning Chinese as a second language. *Journal of International Education Research,* 9(1):21-32.

Rice, F.P.& Dolgin, K.G. 2008 *The adolescent: Development, relationships, and culture*. (12th edition). Boston: Allyn and Bacon.

Romanelli, F., Bird, E. & Ryan, M. 2009. Learning styles: A review of theory, application and best practices. *American Journal of Pharmaceutical Education*, 73(1):1-5.

Rowe, F.A. & Rafferty, J.A. 2013. Instructional design interventions for supporting self-regulated learning: Enhancing academic outcomes in postsecondary e-Learning environments. *MERLOT Journal of Online Learning and Teaching*, 9(4):590-601.

Sadeghi, N., Kasim, Z.M., Tan, B.H. & Abdullah, F.S. 2012. Learning styles, personality types and reading comprehension performance. *English Language Teaching*, 5(4):116-123.

Sahu, P.K. 2013. *Research methodology: A guide for researchers in Agricultural Science, Social Science and other related fields*. New Delhi: Springer.

Saljo, R. 2009. Learning, theories of learning and units of analysis in research. *Educational Psychologist*, 44 (3):202-208.

Santrock, J.W. 2001. *Adolescence.* (8th edition). Boston: McGraw-Hill.

Santrock, J.W. 2008. *Educational psychology.* (3rd edition). New York: McGraw-Hill.

Schunk, D.H. 2012. *Learning theories: An educational perspective*. Boston: Pearson.

Scott, C. 2010. The enduring appeal of 'learning styles'. *Australian Journal of Education,* 54(1):5-17.

Şengül, S., Katranci, Y.& Bozkus, F. 2013. Learning styles of prospective teachers: Kocaeli University case. *Journal of Educational and Instructional Studies in the world*, 3(2):1-12.

Shaffer, D.R. & Kipp, K. 2014. *Developmental psychology: Childhood and adolescence.* (9th edition). Belmont: Wadsworth.

Simsek, I. 2014. Developing decision support system to determine learning styles. *Journal of the Hasan Ali Yucel Faculty of Education*, 11(21):47-54.

Singh, R.S. 2013. *Research methods and statistical techniques*. New Delhi: Anmol Publications.

Skinner, F.B. 1968. *The technology of teaching*. New York: Appleton-Century-Crofts.

Slade, S. & Griffith, D. 2013. A whole child approach to student success. *KEDI Journal of Educational Policy,* 21-35.

Slavin, R.E. 2009. *Educational psychology: Theory and practice*. (9th edition). New Jersey: Pearson.

Smith, K. & Davies, J. 2010. Qualitative data analysis. In *Practical research and evaluation: A start-to-finish guide for practitioners*, edited by L. Dahlberg & C. McCaig. London: Sage:145-158.

Sosibo, L. & Nomlomo, V. 2014. Teachers' conceptions of standards in South African Basic Education and Training: A case study. *Perspectives in Education*, 32(1):73-87.

Sousa, D.A. 2011. *How the brain learns.* (4th edition). Thousand Oakes: Corwin.

Sparks, R.L. 2006. Learning styles - making too many 'wrong mistakes': A response to Castro and Peck*. Foreign Language Annals*, 39(3):520-535.

Sternberg, R.J. & Williams, W.M. 2010. *Educational psychology*. (2nd edition). New Jersey: Pearson Education.

Struwig, F.W. & Stead, G.B. 2013. *Research: Planning, designing and reporting*. (2nd edition). Cape Town: Pearson Education South Africa.

Suaalii, F. & Bhattacharya, M. 2007. Conceptual model of learning to improve understanding of high school chemistry. *Journal of Interactive Learning Research*, 18(1):101-110.

Tiedt, P.L. & Tiedt, I.M. 2010. *Multicultural teaching.* (8th edition). Boston: Allyn and Bacon.

Tileston, D. 2005. *10 best teaching practices: How brain research, learning styles, and standards define teaching competencies*. Thousand Oaks: Corwin Press.

Toren, N.K. 2013. Multiple dimensions of parental involvement and its links to young adolescent self-evaluation and academic achievement. *Psychology in the Schools*, 50(6):634-649.

Tuan, L.T. 2011. Matching and stretching learners; learning styles. *Journal of Language Teaching and Research*, 2(2):285-294.

Veloo, A., Hong, L.H. & Lee, S.C. 2015. Gender and ethnicity differences manifested in chemistry achievement and self-regulated learning. *International Education Studies*, 8(8):1-12.

Villavicencio, F.T. & Bernardo, A.B.I. 2013. Positive academic emotions moderate the relationship between self-regulation and academic achievement. *British Journal of Educational Psychology,* 83(2):329–340.

Vitaro, F., Brendgen, M., & Tremblay, R.E. 2014. Early predictors of high school completion. In: *Promoting school readiness and early learning*, edited by M. Boivin & K.L. Bierman, New York: The Guildford Press:15-45.

Vygotsky, L.S. 1978. *Mind and society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Wang, K.H., Wang, T.H. Wang, W.L. & Huang, S.C. 2006. Learning styles and formative assessment strategy: Enhancing student achievement in web-based learning. *Journal of Computer Assisted Learning,* 22(3):207–217.

Wellington, H. & Szczerbinski, M. 2007. *Research methods for the social sciences*. London: Continuum.

Wichadee, S. 2013. Facilitating students' learning with hybrid instruction: A comparison among four learning styles. *Electronic Journal of Research in Educational Psychology,* 11(1):99-115.

Wisker, G. 2001. *The postgraduate research handbook*. Hampshire: Palgrave.

Woodwell, D. 2014. *Research foundations*. Thousand Oaks: Sage.

Woolfolk, A. 2007. *Educational psychology*. (10th edition). Boston: Pearson.

Wu, D.C. 2014. Learning styles and satisfaction in distance education. *Turkish Online Journal of Distance Education*, 15(4):112-119.

Yetisir, M.I. 2014. A study on school performance in terms of some teacher characteristics*. Journal of Education and Future*, (5):13-24.

Yilmaz, K. 2011. The cognitive perspective on learning: Its theoretical underpinnings and implications for classroom practices*. The Clearing House*, 84(5): 204–212.

Yilmaz-Soylu, M. & Akkoyunlu, B. 2009. The effect of learning styles on achievement in different learning environments. *The Turkish Online Journal of Educational Technology*, 8(4):43-50.

Zhang, L., Sternberg, R.J. & Fan, J. 2013. Revisiting the concept of 'style match'. *British Journal of Educational Psychology*, 83(2):225–237.

Zhou, M. 2011. Learning Styles and Teaching Styles in College English Teaching. *International Education Studies*, 4(1):73-77.

Zimmermann, F., Schütte, K., Taskinen, P. & Köller, O. 2013. Reciprocal effects between adolescent externalizing problems and measures of achievement. *Journal of Educational Psychology*, 105(3):747–761.

Appendix A: Ethical clearance certificate

UNISA university of south africa

COLLEGE OF EDUCATION RESEARCH ETHICS REVIEW COMMITTEE

15 April 2015

Ref#:**2015/04/15/6600581/04/MC**
Student #:Mrs A Bosman
Student Number#:6600581

Dear Mrs Bosman,

Decision: Approved

Researcher
Mrs A Bosman
P O Box 201
Buhrmannsdrif
2867
+2718 3861240/+2773 6012487
wibosman@lantic.net

Supervisor
Prof. S Schulze
Department of Psychology of Education
+2712 8046113
Schuls@unisa.ac.za

Proposal: The relationship between student achievement and student learning styles in a multicultural senior school

Qualification: D Ed in Psychology of Education

Thank you for the application for research ethics clearance by the College of Education Research Ethics Review Committee for the above mentioned research. Final approval is granted for 2 years.

For full approval: *The application was reviewed in compliance with the Unisa Policy on Research Ethics by the CEDU ERC on 15 April 2015.*

The proposed research may now commence with the proviso that:

1) *The researcher/s will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.*
2) *Any adverse circumstance arising in the undertaking of the research project that is*

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relevant to the ethicality of the study, as well as changes in the methodology, should be communicated in writing to the College of Education Ethics Review Committee. An amended application could be requested if there are substantial changes from the existing proposal, especially if those changes affect any of the study-related risks for the research participants.

3) *The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study.*

Note:

The reference number [top right corner of this communiqué] should be clearly indicated on all forms of communication [e.g. Webmail, E-mail messages, letters] with the intended research participants, as well as with the College of Education RERC.

Kind regards,

Dr M Claassens
CHAIRPERSON: CEDU ERC

mcdtc@netactive.co.za

Prof VI McKay
ACTING EXECUTIVE DEAN

University of South Africa
Preller Street, Muckleneuk Ridge, City of Tshwane
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Appendix B - Permission to conduct research at International School of South Africa

20 February 2015

Att: Mr M. Williams
Headmaster/CEO International School of South Africa

Dear Mr Williams

Re: Request for permission to conduct research at International School of South Africa

I am currently busy with my DEd (Psychology of Education) studies at the University of South Africa. The title of my thesis is: **The relationship between student achievement and student learning styles in a multicultural senior school**. I would like to invite your school to participate in this research. The main aim of the study is to investigate and explain the relationship between learning styles and academic achievement amongst students in a senior school. Your school has been selected mainly because the school is highly multiracial and multicultural and is also a senior school.

The study will entail the completion of a structured questionnaire by the students, 10 individual face-to-face interviews with a selection of students and an analysis of the relevant students' marks.

The benefits of this study for the school will be:

- provision of a study programme for the students to help them with their learning based on their particular learning styles,
- provision of information on learning styles to the teachers to assist them with their teaching so that they can accommodate all learning styles in their classes, and
- possible improvement in the overall academic achievement of students attending the school.

There will be no risks involved to any of the participants. Participation is entirely voluntary and all information will be kept confidential. The names of the students and the school will not be revealed. No monetary rewards will be given to the participants. Participants are free to withdraw from the study at any point without being penalised. Participants are expected to indicate whether they agree or disagree to participate by completing a consent form. Permission will be obtained from the students' parents (or from the House Parents in the case of boarders). As required, the results of the study will be made available to the school. The results of the study will also be discussed with the participants in a special information sharing session.

This research is conducted under the supervision of Professor Salome Schulze at UNISA (Department of Psychology of Education). Professor Schulze can be contacted at schuls@unisa.ac.za. Should you be interested in participating in the research, or want more information, please feel free to contact me at 0736012487 or wjbosman@lantic.net .

Yours sincerely

ABosman

Anne Bosman (Mrs)

INFORMED CONSENT FROM THE HEADMASTER/CEO AND THE CHAIR OF THE BOARD OF GOVERNORS

I have been given the chance to read this consent form. I understand the information about this study. Questions that I wanted to ask about this study have been answered. My signature indicates my support for the study.

MALCOLM WILLIAMS
Headmaster/CEO (Print name)

SIGNATURE

DATE : 24/2/15

Nine James Michael O'Brien
CHAIR OF BOARD OF GOVERNORS

SIGNATURE

DATE: 25/02/2015

Appendix C – Parent consent letter

LETTER OF CONSENT

PARENTAL CONSENT FOR FAMILY MEMBER PARTICIPATION IN RESEARCH

Dear Parent

Your child is invited to participate in a study entitled: **The relationship between student achievement and student learning styles in a multicultural senior school**. I am undertaking this study as part of my doctoral research at the University of South Africa. The purpose of the study is to investigate and explain the relationship between learning styles and academic achievement amongst students in a senior school. The possible benefits of the study are the improvement of the students' overall academic achievement through the provision of study programmes to the students based on their learning styles, and the provision of information on learning styles to the teachers to assist them with their teaching so that they can accommodate all learning styles in their classes. Permission for the study has been given by the Ethics Committee of the College of Education, UNISA.

I am asking permission to include your child in this study because your child is a student at the International School of South Africa. I expect to have about 300 other children participating in the study.

If you allow your child to participate, I shall request him/her to:

- complete a structured questionnaire in a group in the presence of the class teacher, and
- possibly participate in an individual interview (only two students per grade will be interviewed).

Although the questionnaire is completed in a group context, any information that is obtained through this study and can be associated with your child will remain confidential. His or her responses will not be linked to his or her name or your name or the school's name in any written or verbal report based on this study. Such a report will be used for research purposes only.

There are no foreseeable risks to your child by participating in the study. The possible benefits to education may include an overall increase in the academic achievements of the students. Neither your child nor you will receive any type of payment for participating in this study.

Your child's participation in this study is voluntary. Your child may decline to participate or withdraw from participation at any time. Withdrawal or refusal to participate will not affect him/her in any way. Similarly you can agree to allow your child to be in the study now and change your mind later without any penalty.

The questionnaire completion will take place during one regular class period with the prior approval of the school and your child's teacher. However, if you do not want your child to participate, an alternative activity will be available. If your child is selected for an interview, which should last about 45 minutes, this will take place after hours at the school at a time that is convenient to the child.

In addition to your permission, your child must agree to participate in the study and you and your child will also be asked to sign the assent form which accompanies this letter. If your child does not wish to participate in the study, he or she will not be included and there will be no penalty. The information gathered from the study and your child's participation in the study will be stored securely on a password locked computer in my locked office for five years after the study. Thereafter, records will be erased.

If you have questions about this study please ask me or my study supervisor, Professor Salome Schulze, Department of Psychology of Education, College of Education, University of South Africa. My contact number is 018-3811102and my e-mail is wjbosman@lantic.net. The e-mail of my supervisor is Schuls@unisa.ac.za. Permission for the study has already been given by the Headmaster of the International School of South Africa (Mr M. Williams) and the Ethics Committee of the College of Education, UNISA.

You are making a decision about allowing your child to participate in this study. Your signature below indicates that you have read the information provided above and have decided to allow him or her to participate in the study. You may keep a copy of this letter.

Sincerely,

Anne Bosman (Mrs)

****

Printed Name of child: _____

_____	_____	_____
Parent/guardian's name (print)	Parent/guardian's signature:	Date:

_____	_____	_____
Researcher's name (print)	Researcher's signature	Date:

Appendix D – Child assent letter

Dear Student

I am doing a study on learning styles and academic achievement as part of my studies at the University of South Africa. My study supervisor at UNISA is Professor Schulze (Department of Psychology of Education) who can be contacted at Schuls@unisa.ac.za . Your Headmaster has given me permission to do this study in your school. I would like to invite you to be a very special part of my study. I am doing this study so that I can find ways that your teachers can help you to achieve better marks at school. This will help you and many other students of your age in different schools. The title of my research is: **The relationship between student achievement and student learning styles in a multicultural senior school.**

This letter is to explain to you what I would like you to do. There may be some words you do not know in this letter. You may ask me or any other adult to explain any of these words that you do not know or understand. You may take a copy of this letter home to think about my invitation and talk to your parents about this before you decide if you want to be in this study. Permission for the study has been given by the Ethics Committee of the College of Education, UNISA.

I would like you to complete a questionnaire during a school period while you are in one of your regular classes, about how you like to learn. This will take you about 40 minutes. The questionnaire does not count for any marks at school. You may also be asked to be interviewed where you will be asked further questions about how you learn. This will take you about 45 minutes.

I will write a report on the study but I will not use your name in the report. You do not have to be part of this study if you don't want to. If you choose to be in the study, you may stop taking part at any time. You may tell me if you do not wish to answer any of my questions. No one will criticise you. When I am finished with my study, I shall give a short talk about some of the things I found out in my study that may help you learn effectively.

If you decide to be part of my study, I ask you to sign the attached form. If you have any other questions about this study, you can talk to me or you can ask your parent or another adult to call me at 018-3811102 or email me at wjbosman@lantic.net. Do not sign the form until you have all your questions answered and understand what I would like you to do.

Thank you.

Anne Bosman (Mrs)

****

WRITTEN ASSENT

I have read this letter which asks me to be part of a study at my school. I understand the information about the study and I know what I will be asked to do. I am willing to part of the study.

Student's name (print) Student's signature Date:

Witness's name (print) Witness's signature Date:

(The witness is over 18 years old and present when signed.)

Parent/guardian's name (print) Parent/guardian's signature: Date:

Researcher's name (print) Researcher's signature: Date:

Appendix E - A letter requesting an adult to participate in an interview

Dear Student

This letter is an invitation to consider participating in a study I am conducting as part of my research as a doctoral student at the University of South Africa (Unisa). The research is entitled: **The relationship between student achievement and student learning styles in a multicultural senior school.** This research is conducted under the supervision of Professor Salome Schulze at UNISA (Department of Psychology of Education). Professor Schulze can be conducted at schuls@unisa.ac.za. Permission for the study has been given by the Ethics Committee of the College of Education, UNISA. I have purposefully identified you as a possible participant because of your valuable experience and expertise related to my research topic.

I would like to provide you with more information about this project and what your involvement would entail if you should agree to take part. The importance of learning styles and academic achievement in education is substantial and well documented. In this study I would like to have your views on this topic. This information can be used to improve the academic achievement of students.

Your participation in this study is voluntary. It will involve completing a questionnaire at school during a normal class period. This should take approximately 40 minutes. You may also be asked to participate in an interview at school at a time convenient to you. This should take about 45 minutes. With your permission the interview may be recorded and excerpts may be used anonymously in the report that will be written. You may decline to answer any of the questionnaire or interview questions if you so wish. Furthermore, you may decide to withdraw from this study at any time without any negative consequences.

All information you provide is considered completely confidential. Your name will not appear in any publication resulting from this study and any identifying information will be omitted from the report. However, with your permission, anonymous quotations may be used. Data collected during this study will be retained on a password protected computer for 12 months in my locked office. There are no known or anticipated risks to you as a participant in this study.

If you have any questions regarding this study, or would like additional information to assist you in reaching a decision about participation, please contact me at 018-3811102 or by e-mail at wjbosman@lantic.net .

If you accept my invitation to participate, I will request you to sign the consent form which follows.

Yours sincerely

Anne Bosman (Mrs)

****

CONSENT FORM

I have read the information presented in the information letter about the study concerning learning styles and academic achievement in education. I have had the opportunity to ask any questions related to this study, and to receive satisfactory answers to my questions. I am aware that I have the option of allowing my interview to be audio recorded to ensure an accurate recording of my responses. I am also aware that excerpts from the interview may be included in publications to come from this research, with the understanding that the quotations will be anonymous. I was informed that I may withdraw my consent at any time without penalty by advising the researcher. With full knowledge of all foregoing, I agree, of my own free will, to participate in this study.

Participant's Name (Please print): _____

Participant Signature: _____

Researcher Name (Please print) : _____

Researcher Signature: _____

Date: _____

Appendix F: Structured Questionnaire

Title of questionnaire: QUESTIONNAIRE ON STUDENT LEARNING STYLES

Dear respondent

This questionnaire forms part of my doctoral research entitled: **The relationship between student achievement and student learning styles in a multicultural senior school** for the DEd degree at the University of South Africa. The findings of the study will benefit you as it will assist in making your learning more worthwhile.

You are kindly requested to complete this questionnaire as honestly as possible and according to your personal views. No foreseeable risks are associated with the completion of the questionnaire which is for research purposes only. The questionnaire will take approximately 40 minutes to complete.

You are required to indicate your name as I want to relate your learning style to your academic achievement. However, your name will not be mentioned in any report that may be produced. You also need to indicate your age, gender, ethnic group and nationality as this will contribute to a more comprehensive analysis. All information obtained from this questionnaire will be used for research purposes only and will remain confidential. Your participation in this is voluntary and you have the right to omit any question if so desired, or to withdraw without penalty at any stage. After the completion of the study, an electronic summary of the findings of the research will be made available to you.

Permission to undertake this study has been granted by the Headmaster/CEO of the school and the Ethics Committee of the College of Education, UNISA. If you have any research-related enquiries, they can be addressed directly to me or my supervisor. My contact details are: 018-3811102, e-mail: wjbosman@lantic.netand my supervisor (Professor Schulze) can be reached at Department of Psychology of Education, College of Education, UNISA, e-mail: Schuls@unisa.ac.za .

By completing the questionnaire, you imply that you have agreed to participate in this research.

LEARNING STYLES

(V1)

This is not a test but a questionnaire for which there is no right or wrong answer – only your opinion. The answers to the questions will be treated as strictly confidential. Please answer all questions as honestly as possible. Read all options before answering. Thank you for your cooperation.

SECTION A – GENERAL INFORMATION

Surname	
First name	

Please circle the number on the right hand side to indicate your answer.

1 My age is: (V2)	
14 years and younger	1
15 years	2
16 years	3
17 years	4
18 years	5
19 years and older	6
2 My gender is: (V3)	
Male	1
Female	2
3 My ethnic background is: (V4)	
Black	1
Mixed race	2

Indian	3
White	4
4 My nationality is: (V5)	
South African	01
Botswana	02
Zimbabwean	03
Zambian	04
Malawian	05
Mozambique	06
Kenyan	07
Tanzanian	08
Nigerian	09
Other (please specify):	10
5 My form is: (V6)	
Form 2	1
Form 3	2
Form 4	3
Form 5	4
Lower 6th	5
Upper 6th	6

SECTION B – QUESTIONNAIRE

Please respond to each of the following statements by circling the number of your choice.

	Statement	Definitely disagree (1)	Disagree (2)	Neutral/ Unsure (3)	Agree (4)	Definitely agree (5)	
6	I enjoy listening to the teacher talk	**1**	**2**	**3**	**4**	**5**	**V7**
7	I prefer that teachers give me direct instructions	**1**	**2**	**3**	**4**	**5**	**V8**
8	I love it if students explain work to me	**1**	**2**	**3**	**4**	**5**	**V9**
9	I learn a lot from listening to groups of students talk	**1**	**2**	**3**	**4**	**5**	**V10**
10	I can follow directions given in class easily	**1**	**2**	**3**	**4**	**5**	**V11**
11	I often talk aloud to myself	**1**	**2**	**3**	**4**	**5**	**V12**
12	I enjoy listening to what others in a group say	**1**	**2**	**3**	**4**	**5**	**V13**
13	I learn a lot by listening to the teacher	**1**	**2**	**3**	**4**	**5**	**V14**
14	I understand when teachers tell me what to do	**1**	**2**	**3**	**4**	**5**	**V15**
15	I listen well in class	**1**	**2**	**3**	**4**	**5**	**V16**
16	I love listening to stories	**1**	**2**	**3**	**4**	**5**	**V17**
17	I like to learn from songs	**1**	**2**	**3**	**4**	**5**	**V18**
18	I learn best by listening to what others say	**1**	**2**	**3**	**4**	**5**	**V19**
19	I learn well by concentrating on what teachers say in class	**1**	**2**	**3**	**4**	**5**	**V20**
20	I like to be told what to do when my teachers give me work	**1**	**2**	**3**	**4**	**5**	**V21**
21	I like to watch the teacher show me how to do something	**1**	**2**	**3**	**4**	**5**	**V22**
22	I love watching TV	**1**	**2**	**3**	**4**	**5**	**V23**
23	I love watching a movie	**1**	**2**	**3**	**4**	**5**	**V24**
24	I like classes where the teacher uses the data projector or whiteboard explain	**1**	**2**	**3**	**4**	**5**	**V25**
25	I can easily understand diagrams or figures	**1**	**2**	**3**	**4**	**5**	**V26**
26	I enjoy looking at books.	**1**	**2**	**3**	**4**	**5**	**V27**
27	I like to draw when I study	**1**	**2**	**3**	**4**	**5**	**V28**

28	I like watching demonstrations or experiments	**1**	**2**	**3**	**4**	**5**	**V29**
29	I like using mind maps or diagrams when I study	**1**	**2**	**3**	**4**	**5**	**V30**
30	I like to use a highlighter pen when revising my work	**1**	**2**	**3**	**4**	**5**	**V31**
31	I like sitting at the front of the classroom	**1**	**2**	**3**	**4**	**5**	**V32**
32	I enjoy spelling	**1**	**2**	**3**	**4**	**5**	**V33**
33	I enjoy puzzles	**1**	**2**	**3**	**4**	**5**	**V34**
34	I love art	**1**	**2**	**3**	**4**	**5**	**V35**
35	I love playing video games	**1**	**2**	**3**	**4**	**5**	**V36**
36	I like to make things with my hands	**1**	**2**	**3**	**4**	**5**	**V37**
37	When I study, I have to take lots of breaks	**1**	**2**	**3**	**4**	**5**	**V38**
38	I like to move around when I work	**1**	**2**	**3**	**4**	**5**	**V39**
39	I enjoy building things	**1**	**2**	**3**	**4**	**5**	**V40**
40	I like to take things apart to see how they work	**1**	**2**	**3**	**4**	**5**	**V41**
41	I enjoy sport	**1**	**2**	**3**	**4**	**5**	**V42**
42	I love to learn by doing things.	**1**	**2**	**3**	**4**	**5**	**V43**
43	I like to discover new things	**1**	**2**	**3**	**4**	**5**	**V44**
44	I often play with things in class like a pen or an eraser	**1**	**2**	**3**	**4**	**5**	**V45**
45	I use my hands a lot when I talk	**1**	**2**	**3**	**4**	**5**	**V46**
46	I am good at making things	**1**	**2**	**3**	**4**	**5**	**V47**
47	I like it when teachers use activities in class.	**1**	**2**	**3**	**4**	**5**	**V48**
48	I tap my foot or pencil when I am thinking	**1**	**2**	**3**	**4**	**5**	**V49**
49	I like talking to my friends whilst working with them	**1**	**2**	**3**	**4**	**5**	**V50**
50	I like going on field trips	**1**	**2**	**3**	**4**	**5**	**V51**
51	I remember my work better when I read my notes	**1**	**2**	**3**	**4**	**5**	**V52**
52	I like receiving handouts from my teachers	**1**	**2**	**3**	**4**	**5**	**V53**
53	I like to read	**1**	**2**	**3**	**4**	**5**	**V54**
54	I do as much reading as possible	**1**	**2**	**3**	**4**	**5**	**V55**
55	I often use the internet	**1**	**2**	**3**	**4**	**5**	**V56**
56	I often read magazines or newspapers	**1**	**2**	**3**	**4**	**5**	**V57**
57	I often use a dictionary or the internet to find the correct spelling of a word	**1**	**2**	**3**	**4**	**5**	**V58**
58	I like using the library at school	**1**	**2**	**3**	**4**	**5**	**V59**

59	I remember best by writing things down	**1**	**2**	**3**	**4**	**5**	**V60**
60	I like texting my friends	**1**	**2**	**3**	**4**	**5**	**V61**
61	I like writing stories	**1**	**2**	**3**	**4**	**5**	**V62**
62	I write well	**1**	**2**	**3**	**4**	**5**	**V63**
63	When I study for a test or an exam, I write a lot	**1**	**2**	**3**	**4**	**5**	**V64**
64	I prefer writing to reading when I study	**1**	**2**	**3**	**4**	**5**	**V65**
65	I like writing essays	**1**	**2**	**3**	**4**	**5**	**V66**
66	I study best when I work on my own	**1**	**2**	**3**	**4**	**5**	**V67**
67	I dislike working in a group	**1**	**2**	**3**	**4**	**5**	**V68**
68	I can study on my own	**1**	**2**	**3**	**4**	**5**	**V69**
69	I work better when I work alone	**1**	**2**	**3**	**4**	**5**	**V70**
70	I like studying at home or in the hostel when I am by myself	**1**	**2**	**3**	**4**	**5**	**V71**
71	I am happy when I work on my own	**1**	**2**	**3**	**4**	**5**	**V72**
72	If I have a problem I will figure out what to do	**1**	**2**	**3**	**4**	**5**	**V73**
73	I study best with one or two friends	**1**	**2**	**3**	**4**	**5**	**V74**
74	I try to share my ideas with other students when I think it may help them	**1**	**2**	**3**	**4**	**5**	**V75**
75	I believe it is good if students help one another learn	**1**	**2**	**3**	**4**	**5**	**V76**
76	I like working in groups because we can support one another	**1**	**2**	**3**	**4**	**5**	**V77**
77	I like working with other students because they can help me understand my school	**1**	**2**	**3**	**4**	**5**	**V78**
78	I enjoy being with friends when I study	**1**	**2**	**3**	**4**	**5**	**V79**
79	I can learn from other students	**1**	**2**	**3**	**4**	**5**	**V80**
80	I like working in groups in class	**1**	**2**	**3**	**4**	**5**	**V81**

The next table is for office use only – to be completed by the teacher:

	ENGLISH	
Term 1 Mark Order 1		**V82**
Term 2 Mark Order 1		**V83**
	MATHS	
Term 1 Mark Order 1		**V84**
Term 2 Mark Order 1		**V85**

Appendix G: Interview assent for recording of interview and confidentiality agreement

I_____ grant consent/assent that the information I share during the interview may be used by the researcher, Anne Bosman, for research purposes. I am aware that the discussion will be digitally recorded and grant consent/assent for these recordings.

Participant‘s Name (Please print):

Participant Signature:

Researcher’s Name: (Please print):

Researcher’s Signature:

Date:

Appendix H: Interview Schedule

Date: _____

Name: _____

Grade: _____

1. How do you learn English?
2. What kind/s of teaching works best for you in the English class?
3. What kind/s of teaching does not work well for you in the English class?
4. What would you recommend with regard to English teaching for effective learning?
5. How do you learn maths?
6. What kind/s of teaching works best for you in the maths class?
7. What kind/s of teaching does not work well for you in the maths class?
8. What would you recommend with regard to maths teaching for effective learning?
9. Think of the subject that for you entails most learning e.g. Biology, Science, etc. Identify the subject.
10. How do you learn this subject?
11. What kind/s of teaching works best for you in this subject?
12. What kind/s of teaching does not work well for you in this subject?
13. What would you recommend with regard to teaching this subject for effective learning?
14. Anything you would like to add?

Appendix I: Results of the qualitative study[6]

Q1: Students' responses to the question on how they learn English

STUDENT	ANSWERS
A	• Uses a study guide to revise the language component of the syllabus • Writes stories in her own time so as to develop her creative skills
B	• Memorises language notes • Studies poetry by referring to answers given in class • Reads lots of novels
C	• Reads through exercise books
D	• Researches on internet for different answers • Uses 'Spark Notes' (a website that a student's brother used) • Reads teachers' notes and rereads answers given in class • Reads the study guide when learning language
E	• Researches on the internet for notes on literature and poetry analysis
F	• Reads novels when he has free time • With regards to literature, the student goes through the text and then develops ideas in his mind; writes a few notes; researches on the internet about authors
G	• Looks at notes in study guide, handouts and notes given in class • Look at the teacher's comments for essay questions • Examine the comments and examiners' tips from study guide

[6] Excludes answers to questions 4, 8, 9 and 13 - these answers are given in section 5.3

H	• Regarding language, the student reads over his notes • Regarding literature, the student tries to understand the author, time frame, themes and quotes
I	• Researches literature on the internet • Looks at Cambridge mark schemes • Learns quotes • Practices answers and then marks them himself
J	• For literature the student learns key quotes, the purpose of the poems and investigates the context of each short story on the internet • For language, the student reads lots of books

Q2: The kinds of teaching which work best in the English class

STUDENT	ANSWERS
A	• A teacher who gives lots of notes especially regarding language • A teacher who explains well especially difficult concepts
B	• Teachers who explain thoroughly • Teachers who really try to make sure everyone understands • Teachers with lots of energy • Teachers who give good criticism
C	• Teachers who explain thoroughly
D	• Teachers who explain the work • Teachers who go over the work with the students • Teaching which incorporates movies and videos of plays which are being studied • Being allowed to act out the play

E	• Teachers who apply real life stories to work • Teachers who use YouTube videos to help explain the play being studied • Teachers who do individual consultation and are open to private lessons
F	• Very little work is done in the class so cannot answer
G	• Very little work is done in the class so cannot answer
H	• Teachers who give a broader perspective on the work and ask 'what do you feel?' • Teachers who engage in conversations with the students
I	• Teachers who do not give answers straight away (this helps the weaker students) • Teachers who allow us to talk and discuss issues • Teachers who challenge us on points and feed us pointers which give us directions to build our arguments • Teachers who are different in each lesson • Teachers who look at a section and ask you for your opinion
J	• Teachers who explain in depth • Teachers who let us think about our own ideas

Q3: The kinds of teaching which do not work well for you in the English class

STUDENT	ANSWERS
A	• A teacher who just gives the answer straight away and does not allow us to work out the problem
B	• Use being made of the data projector as the light makes my eyes sore
C	• Inappropriate and irrelevant work being given just 'to keep us busy'
D	• A teacher who does not control the amount of noise in the class
F	• The teacher who does very little work in the class
G	• The teacher who does not give us a chance to copy down the notes he displays on the data projector • The teacher who spends much of the class time discussing the state of the school • The teacher who does very little marking so we do not know where we have gone wrong • The teacher who does not teach according to the syllabus
H	• A teacher who never moves around the classroom and just sits • Teachers who reads one line and then tell you what it means, then they read the next line and so on – this is very boring
I	• A teacher who analyses each line in a poem instead of picking up on overall themes
J	• A teacher who does very little work on the language part of the syllabus (this especially negatively impacts on the weaker students) • A teacher who gives no homework or classwork • A teacher who does no marking so we do not know where we have gone wrong • The teacher does not correct us straight away in the presentations we give so we do not know if we are 'on the right track'

Q5: The kinds of ways the students learn mathematics

STUDENT	ANSWERS
A	• Attend Kumon classes • Redo exercises from note book
B	• Goes through exercise book • Practises sums if I do not understand them in class • Father assists as he is good with mathematics
C	• Practise from exercise books • Memorise formulas
D	• Reads over note book • Practises examples
E	• Look for alternative methods concerning algebra on the internet • Learn maths with a boarder friend
F	• Go through notes and practise the work
G	• Go over notes which the teacher gives in class • Go over questions which I struggled with in class
H	• Practise past papers and examples given in class • Do topics from the textbook
I	• Practise questions from the textbook and past papers • Go over text book notes
J	• Practise past papers; go through notes from class; study formulas

Q6 and 7: The types of teaching which work well (and do not work) in the mathematics classes

WORKS WELL	DOES NOT WORK WELL
Student A: Good explanations from the teacher	**Student A**: Teachers who do not explain well
Student B: Good explanations from the teacher; lots of exercises **Student C**: A teacher who ensures everyone understands	**Student B**: Teachers who stand in front of the white board blocking the students' views; teachers who are judgemental when students ask questions Student C: Impatient teachers; teachers who make the students feel dumb
Student D: Teachers who give good examples **Student E:** Teachers who do not accept nonsense in class; give quizzes on work done in class	**Student D**: Teachers who move too fast through the work; teachers who insist that the student must write and listen at the same time; teachers who give an explanation which only they can understand Student E:Moody teachers or ones with a temper
Student F & G: Teachers who are funny; give plenty of examples, exercises and worksheets in class; explain well; give past papers; work according to the syllabus	**Student G:**Teachers who have classes in the evening
Student J: Teachers who ensure the student understands; goes through many different examples and ways to answer questions; gives homework and lots of tests; knows where possible problems	**Student I:** Teachers who move too fast so as to finish the syllabus; miss out basic steps so weaker students do not understand; make the students feel stupid;

are and go over the weak areas **Student I**: Teachers who take time to explain everything and go over assignments in class thereby sharing knowledge **Student H**: Teachers who are very involved and engage with the class; walk up and down and ask students to explain concepts in front of the class	**Student H**: Teachers who talk and talk in this monotonous voice and keep repeating the same stuff; do not check homework; do not apply pressure; do nothing about poor marks; arrogant teacher; I am scared to ask questions as the teacher replies 'I don't want to explain again'; impatient teachers

Q10: The ways the students learn their different subjects

Student	Subject	Responses
A	Science	Reads the chapters, makes her own notes without looking at the textbook and asks her parents to help with her work as they are both doctors.
B	French	Practise and go over work (especially grammar and vocabulary) continuously
C	Biology	Read notes in exercise book and gets someone to quiz her
D	Biology	Reading notes and memorising what been learned.
	Economics	Reads notes and uses the textbook for clarification
E	Physics	Reads through textbooks and does the exercises in the textbook
F	Economics & Business Studies	Reads through the notes given in class, makes use of the study guide and practises lots of questions.
G	Biology	Reading over the notes given in class (supplemented with own notes) and using the study guide
H	Economics	Studies notes given in class and own study notes and completes past paper questions.
I	History	Used the ‘fill in’ key word notes
J	Biology	Use the text book and a study guide and look on the internet for extra notes

Q11 and 12: The types of teaching which works (and does not work)

Student	Subject	Teaching which works	Teaching which does not work
A	Science	Teacher shows experiments	Teacher rushes through the work and covers too many pages in one go
B	French	The teacher explains well and interacts with the students.	/
C	Biology	/	/
D	Biology	Teacher does lots of experiments and observations	Teacher leaves much of the work to the students to study on their own. The teacher never checks these notes.
E	Physics	The teacher uses videos, slideshows and experiments.	The teacher is very vague when explaining.
F	Economics Business Studies	The textbook is very good in both subjects.	/
G	Biology	/	The teacher talks about his love life and wastes time. Very few notes are given by the teacher and the teacher insists that the students make their own notes.
H	Economics	PowerPoint presentations are used. The teacher engages with the class.	The overhead notes that were used were untidy and confusing.
I	History	Teacher plays lots of games in the class – these games are	The class is very large which is difficult for the

		related to the notes The teacher also involves the students in the lesson	teacher to control
J	Biology	The teacher enjoys the subject so he is full of energy and very vibrant.	The teacher does not stick to the syllabus. He does not check the self-study notes and never gives notes. His information he gives in class is incorrect. Few tests are written. There is a lazy vibe in the class. The teacher also 'phones a friend' when he needs help.

Q14: Respondents' suggestions as to how teaching can be improved

FORM	SUGGESTIONS
2	• students should be encouraged to reread chapters done in class • practise mathematics every day • ask teachers for help
3	• do more interesting topics in history
4	• teachers should encourage students to listen in class • teachers should encourage competition between students
5	• teachers should encourage all students to work harder • teachers should deal with nonperformers
6	• teachers should encourage students to sit down and study • teachers need to improve the general lack of work ethic and laziness in the school • remove distractions such as iPad and TVs

	• teachers should encourage students to have some ambition in life (‘intelligence without ambition is like a bird without wings’) • teachers should encourage students to work consistently • teachers should engage with the students • teachers should make teaching interesting and add ‘colour’ • teachers should do more one-on-one with students • teachers should fill gaps immediately