**THE RELATIONSHIP BETWEEN LEARNING MOTIVATION AND ACADEMIC ACHIEVEMENT AMONG SECOND YEAR PHYSICS STUDENTS**

by

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# DECLARATION

**STUDENT NUMBER: 2003 025 927**

I CLK Stofile, declare that the Master's Degree research dissertation that I herewith submit for the Master's Degree qualification **MASTER OF ARTS in HIGHER EDUCATION STUDIES** at the University of the Free State is my independent work, and that I have not previously submitted it for a qualification at another institution of higher education.

I hereby cede copyright of this dissertation in favour of the University of the Free State.

<u>02 June 2017</u>

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Signature                                                                                                Date

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## DEDICATION

I dedicate this work to the three men in my life: Avelamadoda, Soyama and Sdima Stofile. You are my joy.

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# LIST OF ABBREVIATIONS AND ACRONYMS

CHE - Council on Higher Education

SAIP - South African Institute of Physics

IOP - Institute of Physics

NFER - National Foundation of Educational Research

STEM - Science, Technology, Engineering and Mathematics

SMTPL - Students' Motivation Towards Physics Learning

SE - Self-efficacy

ALS - Active learning strategies

PLV - Physics learning value

PG - Performance goal

AG - Achievement goal

LES - Learning environment stimulation

# ABSTRACT

The aim of the research study was to determine the relationship between learning motivation and academic achievement among 2$^{nd}$ year physics students at the University of the Free State. The population consisted of 2$^{nd}$ year students studying physics at the Bloemfontein Campus of the University of the Free State. The sample consisted of 55 2$^{nd}$ year students who were enrolled for various BSc degree programmes but had a physics module either as a major or as an elective. Probability sampling in the form of simple random sampling was used to select respondents. Relevant literature indicated that learning motivation is related to students' academic achievement but very few has determined how learning motivation may influence the academic achievement of students in a particular subject such as physics. The data on student learning motivation was collected using a standardized questionnaire, namely the STUDENTS' MOTIVATION TOWARDS PHYSICS LEARNING (SMTPL) questionnaire. The students' first year final examination marks in physics were used to determine the academic achievement of students.

The empirical investigation established that learning motivation has no influence on the academic achievement of 2$^{nd}$ year physics students. The study however showed that self-efficacy may be the best construct of learning motivation to predict students' academic achievement.

Key words: motivation, intrinsic motivation, extrinsic motivation, learning motivation, self-efficacy, active learning strategies, science learning value, performance goal, achievement goal, learning environment stimulation, academic achievement.

**ABSTRAK**

Die doel van hierdie navorsingstudie was om die verhouding tussen leermotivering en akademiese prestasie onder tweedejaar- Fisikastudente aan die Universiteit van die Vrystaat te bepaal. Die deelnemers het bestaan uit tweedejaar- Fisikastudente van die Bloemfontein kampus van die Universiteit van die Vrystaat. Die steekproef het bestaan uit 55 tweedejaarstudente wat vir verskeie BSc-graadprogramme ingeskryf was, maar wat 'n Fisika-module òf as hoofvak, òf as 'n keusevak, gehad het. Waarskynlikheidseleksie in die vorm van eenvoudige ewekansige steekproefneming is gebruik om deelnemers te selekteer. Relevante literatuur het aangedui dat die aanleer van leermotivering verband hou met studente se akademiese prestasie, maar weinig navorsers het bepaal hoe die aanleer van leermotivering die akademiese prestasie van studente in 'n spesifieke vak soos Fisika kan beïnvloed. Data rondom die aanleer van leermotivering onder studente is versamel deur middel van 'n gestandaardiseerde vraelys, naamlik die Studente Motivering vir Fisiese Leer (SMFL)-vraelys. Die studente se eerstejaar finale eksamenpunte in Fisika is gebruik om hul akademiese prestasie te bepaal.

Die empiriese ondersoek het bevestig dat die aanleer van leermotivering geen invloed op die akademiese prestasie van tweedejaar-Fisikastudente gehad het nie. Die studie het egter getoon dat selfdoeltreffendheid moontlik die beste konsep vir die aanleer van leermotivering is ten einde studente se akademiese prestasie te voorspel.

Sleutelwoorde: motivering, intrinsieke motivering, eksintrieke motivering, aanleer van motivering, selfdoeltreffendheid, aktiewe leerstrategieë, waarde van wetenskaplike leer, prestasiedoelwit, suksesdoelwit, leeromgewing-stimulering, akademiese prestasie.

**CHAPTER 1: ORIENTATION AND BACKGROUND TO THE STUDY**

**1.1 INTRODUCTION**

The aim of this study is to determine the relationship between learning motivation and the academic achievement of 2nd year physics students at a South African higher education institution.

Students' academic achievement may be influenced by many factors that are student-related, educator-related and learning environment-related (*Tamuka,* 2016). Self-motivation is regarded as an example of a student-related factor. A student who does not strive to achieve academic success might simply not be motivated enough to exert effort in learning. Lacking motivation can thus play a role in the poor performance of students and may create an obstacle to reaching certain academic goals (*Tamuka,* 2016).

The decrease in qualified educators is an example of educator-related factors which may influence the academic performance of students. It is estimated that the African continent loses 20,000 skilled personnel a year to developed countries in search of better employment opportunities; these include educators. In South Africa, an estimated 15,000 qualified educators are needed at secondary and tertiary levels annually (*Tamuka,* 2016).

The increasing number of students who enroll in schools and tertiary institutions every year may be regarded as a learning environment-related factor which may influence the academic achievement of students. The large enrollment numbers are beyond what such institutions can accommodate. The result is that classes become overcrowded and educators have to spend more time on 'classroom' management than on actual teaching, which can have a negative effect on student performance (*Tamuka,* 2016).

Research has also shown that in addition to academic knowledge, a variety of cognitive and non-cognitive skills are essential to students' academic success (*Farrington, Roderick, Allensworth, Nagaoka, Keyes, Johnson & Beechum,* 2013). Cognitive factors include IQ and standardized test scores. An IQ score is obtained after the assessment of an individual's intelligence by means of a standardized test that is specifically designed to measure intelligence. According to Farrington *et al*. (2013), an individual with a high IQ score will be viewed as more intelligent than someone with a low IQ score. Non-cognitive factors that are associated with academic performance include

motivation, attitude, behavior, study skills, previous academic performance record, and an individual's background and family circumstances (*Farrington et al.*, 2013).

According to Farrington, Roderick, Allensworth, Nagaoka, Keyes, Johnson and Beechum (*2013*), academic achievement is influenced by both these cognitive and non-cognitive factors. Academic achievement is viewed as a cognitive behavior but the non-cognitive factors that are associated with academic achievement must be examined (*Farrington et al.,* 2013). Research done by Areepattamannil and Freeman (*2008:703*), states that "academic self-concept and learning motivation are the non-cognitive factors which have the most potential to influence academic achievement and should therefore be of primary concern". Students' changes in academic achievement are related to their learning motivation (*Areepattamannil & Freeman,* 2008).

A study done by Ormrod (*2011*) shows that students' learning motivation level is influenced by a specific subject and that they express different motivational traits in different subjects. Students behave differently toward a particular subject, thus influencing their academic achievement in that particular subject. It is therefore important to specifically determine the impact of learning motivation on the academic achievement of students in a particular subject (*Ormrod*, 2011). This is further emphasized by Farrington *et al.* (*2013:50*) who state that "when students are interested in a subject they are more likely to exhibit perseverant behaviors that make them likely to succeed academically".

Physics is important for developing mankind and also making them understand the universe they are populating. Not only are developments in physics today the technology of tomorrow, physics also plays a role in the growth of a knowledge-based economy (*CHE & SAIP,* 2015). Students who have majored and graduated in physics find employment in different work environments. These students are not limited to the practice of physics, but there are vast different employment opportunities associated with studying the course (*CHE & SAIP,* 2015).

Although there are many career advantages attributed to studying physics, according to the report done by the Council on Higher Education and the South African Institute of Physics (*CHE & SAIP*, 2015), physics education in South Africa is in an ill state of affairs. This state of affairs poses a challenge for science education researchers and educators all around the world. In South Africa for the past two decades, there has been a decrease of registered physics students at all tertiary

levels. The university departments that produced excellent physicists are affected by the decrease in physics student numbers as these departments currently only have about one or two 3rd year physics classes (*CHE & SAIP,* 2015). Although student enrolment at the different institutions keeps increasing annually, it does not guarantee that there will be post-graduate physics classes (*CHE & SAIP,* 2015).

Achieving success in physics can also be attributed to the positive attitudes or beliefs students have about this particular subject, resulting in high levels of learning motivation (*Pintrich & Maehr*, 2010). A study done by Tuan, Hsiao, Chin and Shieth (*2005*) showed that there are six main factors that can measure students' learning motivation, especially for science subjects. The purpose of the study by Tuan *et al.* (*2005*) was to analyze existing research in order to identify motivation domains in science learning and to develop a questionnaire namely Students' Motivation Towards Science Learning (SMTSL). They identified six categories, i.e. (A) self-efficacy, (B) active learning strategies, (C) science learning value, (D) performance goal, (E) achievement goal and (F) learning environment stimulation, as the key factors enabling the researcher to measure students' learning motivation in science (*Tuan et al*., 2005).  These key factors will be discussed in the paragraphs below:

### 1.1.1 Self-efficacy

According to Ormrod (*2011*), self-efficacy is the strength of an individual's capability to finish a set task and reach goals.  Self-efficacy is used as a measure to determine how students will perform in their academic environment (*Klassen, Krawchuk & Rajani,* 2008). It influences tasks, choices, level of effort, persistence, and resilience of students (*Klassen, Krawchuk & Rajani,* 2008). Students with high academic self-efficacy have a strong believe that they can attain a specific academic goal (*Institute for Applied Psychometrics,* 2008).  According to a study done by Chandler, Heffer and Turner (*2009*) to determine the influence of parenting styles, achievement motivation and self-efficacy on students' academic achievement, self-efficacy seemed to be a significant construct of students 'academic achievement.

### 1.1.2 Active learning strategies

Active learning strategies refer to students' involvement in tasks and activities and what they think about the tasks they are doing during the learning process (*Soltanzadeh, Hashemi & Shahi*, 2013).

These learning strategies are created and used to (a) involve students in thinking critically and creatively, (b) share information with other students or in a group, (c) express ideas through writing, (d) give and receive feedback, (e) enable a student to explore his/her own attitude and values and, (f) enable a student to reflect upon the learning process (*Eison*, 2010). Research that has been done on active learning strategies shows that this form of learning leads to improved student attitudes and increased learning outcomes (*Soltanzadeh, Hashemi & Shahi*, 2013).

**1.1.3 Science learning value**

The Institute of Physics (IOP) reports that students who have physics qualifications at an undergraduate level are intellectual students with many career opportunities (*IOP,* 2011). According to CHE and SAIP (*2015*), the value in learning physics lies in its development of a wide range of skills such as analytical and problem-solving abilities valuable in any workplace. These skills include team work, the ability to grasp complex concepts quickly, communication skills, and decision making skills. It is important to encourage physics uptake at school level in order for the country to have a strong physics education system with skilled individuals that companies need (*CHE & SAIP*, 2015).

**1.1.4 Performance goal**

Performance goal orientation is when students are more concerned with comparing themselves to others (*Senko*, *Hulleman & Harackiewics,* 2011). Performance goals are divided into two categories, namely, performance-approach goals and performance-avoidance goals. Performance-approach goals relate to students focusing on attaining success, and performance-avoidance goals relate to students focusing on avoiding failure. Students who believe they have a high academic ability and are performance goal driven, will enjoy outperforming their peers, and those students who believe their academic ability is low will avoid academic performance challenges (*Senko*, *Hulleman & Harackiewics*, 2011). According to research done by Pintrich (*2010*) performance avoidance goals predict students' lower intrinsic motivation and performance.

**1.1.5 Achievement goal**

Achievement goals have, in the educational field, received considerable attention for more than two decades (*Senko*, *Hulleman & Harackiewics*, 2011). Achievement goals are the purposes of

individuals' pursuits (*Roebken,* 2007). Achievement goal theory is used to understand and encourage adaptive behaviors in the learning environment (*Senkoa, Hullemanb & Harackiewiczc,* 2011). Students' behaviors, cognitions, and motivation in learning are best explained by students' achievement goals (*Fadlelmulaa*, 2010).

There are two types of achievement goals: mastery goals and performance goals (*Remedios, Kiseleva & Elliot*, 2008). Mastery goals relate to students who put effort in their academic tasks by trying to learn and understand the tasks given to them, and performance goals relate to students who are focused on outperforming other students (*Remedios, Kiseleva & Elliot*, 2008). Students who adopt mastery goals and those students who adopt performance goals view ability differently and also have different definitions of success and failure (*Senko*, *Hulleman, & Harackiewics,* 2011). Students will adopt one or either of these two types of achievement goals when they are faced with an academic activity (*Hulleman & Senko,* 2010).

**1.1.6 Learning environment stimulation**

When the environment of students is supportive and favorable, students' learning is optimal (*Murugan & Rajoo,* 2013). When a learning environment is enriched with enough learning facilities and a favorable climate, the students will be more comfortable, more focused on their academic activities and therefore their academic performance will be higher (*Mudassir & Norsuhaily,* 2015). Student's personal development and academic achievement is impacted by many personal, environmental, and instructional factors (*Delialioğlu*, 2012). Couros' (*2010*) research on academic achievement and environment has shown that the quality of the physical environment significantly affects student achievement and that a good quality design has flow-on effects on teacher and student behaviors, morale and practices and therefore learning outcomes. This confirms the belief that the academic achievement of students is always associated with so many components of learning and that there could be so many other factors that may influence academic achievement (*Lizzio, Wilson & Simons,* 2002).

## 1.2 CONCEPT CLARIFICATION WITHIN THE CONTEXT OF THIS STUDY

### 1.2.1 Motivation

Human motivation involves a collection of closely related beliefs, perceptions, values, interests, and actions, and because of this there are various approaches to human motivation that focus on cognitive skills and non-cognitive skills (*Ali*, 2011). Cognitive skills are associated with intelligence and the ability of problem-solving, and non-cognitive skills are a set of attitudes, behaviors, and strategies that are thought to result in behavioral success, such as motivation, perseverance, and self-control (*Gutman*, 2013).

Motivation denotes an individual's strength, desire or need to attain a specific set goal (*Schmidt, Palminteri, Lafargue & Pessiglione,* 2010). It refers to an internal state that initiates and maintains goal-directed behavior (*Mayer*, 2011) and largely involves complex learned social states which are constantly changed through many experiences that individuals go through (*Ferguson,* 2010). Motivation is when an individual chooses to set in motion the behavior that is appropriate with his desired outcomes (*Riley*, 2012).

### 1.2.2 Learning motivation

Learning motivation in this study refers to the quality involvement of 2nd year physics students in learning and their commitment to the process of learning to achieve academic success.

### 1.2.3 Academic achievement

Academic achievement in this study refers to the actual first year final results of 2nd year physics students who were registered in academic year 2015.

### 1.2.4 Student

The term student in this study refers to any person who is studying a subject or skill in a learning situation.

### 1.2.5 Physics

The term physics is the study of matter, energy, and the interaction between them, and is mainly asking fundamental questions and trying to answer them by observing and experimenting (*IOP*, 2011).

### 1.2.6 Lecturer

The term lecturer refers to any person who imparts knowledge to or instructs students.

### 1.3 STATEMENT OF RESEARCH FOCUS

Learning motivation is identified as a variable that could have an influence on the academic achievement of students. According to Farrington, Roderick, Allensworth, Nagaoka, Keyes, Johnson and Beechum (*2013*) there seems to be a relationship between students' motivation and academic achievement, however not a lot of research covers how a particular course can influence students' motivation. Students who are interested in a particular subject have higher chances in succeeding academically in that subject (*Farrington et al*., 2013). Students express different motivational traits in different subjects and their motivation level is influenced by a specific subject (Ormrod, *2011*). It is thus the aim of this study to investigate the relationship between learning motivation and academic achievement among 2nd year physics students at a South African university.

### 1.4 HYPOTHESES

The following hypotheses were tested in view of the above:

$H_0$ (null hypotheses): Motivation has no influence on the academic success of 2nd year physics students at a South African university.

$H_1$ (alternative hypotheses): Motivation has an influence on the academic success of 2nd year physics students at a South African university.

Based on the constructs, namely, self-efficacy, active learning strategies, science learning value, performance goal, achievement goal and learning environment, the following hypotheses are proposed:

$H_{0a}$: There is no significant relationship between self-efficacy and academic achievement.

$H_{1a}$: There is a significant relationship between self-efficacy and academic achievement.

$H_{0b}$: There is no significant relationship between students' learning strategies and academic achievement.

$H_{1b}$: There is a significant relationship between students' learning strategies and academic achievement.

$H_{0c}$: There is no significant relationship between students' perception of the value of physics and academic achievement.

$H_{1c}$: There is a significant relationship between students' perception of the value of physics and academic achievement.

$H_{0d}$: There is no significant relationship between students' performance goals and academic achievement.

$H_{1d}$: There is a significant relationship between students' performance goals and academic achievement.

$H_{0e}$: There is no significant relationship between students' achievement goals and academic achievement.

$H_{1e}$: There is a significant relationship between students' achievement goals and academic achievement.

$H_{0f}$: There is no significant relationship between learning environment and academic achievement.

$H_{1f}$: There is a significant relationship between learning environment and academic achievement.

## 1.5 AIM AND OBJECTIVES OF THE STUDY

The aim of the research study was to determine the relationship between learning motivation and academic achievement among 2nd year physics students.

In realization of the above aim, the following objectives were formulated:

- To determine the relationship between self-efficacy and academic achievement among 2nd year physics students.
- To determine the relationship between 2nd year physics students' learning strategies and academic achievement.
- To determine the relationship between 2nd year physics students' perception of the value of physics and academic achievement.
- To determine the relationship between 2nd year physics students' performance goals and academic achievement.
- To determine the relationship between 2nd year physics students' achievement goals and academic achievement.
- To determine the relationship between learning environment and academic achievement among 2nd year physics students.

## 1.6 RESEARCH DESIGN AND METHODOLOGY

The type of research question, whether it is descriptive or explanatory, will determine how researchers design their research studies. This will also in turn determine the type of information that is collected during the research process (*Fox*, 2007).

The aim of this research was to investigate the relationship between learning motivation and the academic performance among 2nd year physics students. The two variables of learning motivation and academic achievement have to be measured in order to determine if there is a relationship between them. The variables influencing learning motivation were measured using a questionnaire, while academic achievement was measured using the first year results of 2nd year physics students.

The study is embedded in a post-positivistic research paradigm using a quantitative non-experimental correlational survey design.

According to McMillan & Schumacher (*2010*) a quantitative research design study can be sub-classified as either being experimental or non-experimental. In an experimental, quantitative research design, the researcher can test a hypotheses by reaching valid conclusions about relationships between cause and effect variables. In a non-experimental quantitative research study, the researcher cannot demonstrate a true cause-and-effect relationship between variables and thus only relies on interpretation, observation or interactions in order to come to a conclusion (*McMillan & Schumacher*, 2010).

### 1.6.1 Population and sampling

Population is defined by Bless, Higson-Smith and Sithole (*2013:30*) as "the complete set of events, people or things to which the research findings are to be applied". Sampling occurs when a portion from a population of interest is selected and the results that are obtained from studying the sample can be generalized back to the population it was selected from (*Pelham & Blanton,* 2007).

In this study the population consisted of 2$^{nd}$ year students studying physics at the University of the Free State, Bloemfontein Campus. Probability sampling in the form of simple random sampling was used to select respondents from this population.

### 1.6.2 Data collection

Data was collected by means of a self-administered questionnaire, namely the Students' Motivation Towards Physics Learning (SMTPL). The researcher adapted the SMTPL questionnaire. This SMTPL questionnaire is an adaptation of the Students' Motivation Towards Science Learning (SMTSL) questionnaire developed by Tuan, Hsiao, Chin & Shieth (*2005*). Respondents were given the SMTPL questionnaire in the physics lecturing hall just before the lecture was due to start. They were asked to complete the questionnaire in their own time and to return it to the physics lecturer.

### 1.6.3 Data analysis

Descriptive and inferential statistical data analyses were used by means of Statistical Analysis Software (*SAS,* 2012) to analyze the data. A reputable statistician at the University of the Free State from the Department of Mathematics and Statistics was used to analyze the data.

### 1.6.4 Measuring instrument

The SMTPL questionnaire that was used to collect data. The SMTPL questionnaire is an adaptation of the Students' Motivation Towards Science Learning (SMTSL) questionnaire developed by Tuan, Hsiao, Chin & Shieth (2005). The SMTPL questionnaire consists of 35 questions and uses a 7-point Likert rating scale ranging from 1 to 7 to elicit the relevant data. SECTION 1 of the questionnaire elicited the biographical information of the respondents, while SECTION 2 elicited data regarding the following: (A) self-efficacy, (B) active learning strategies, (C) science learning value, (D) performance goal, (E) achievement goal and (F) learning environment stimulation.

### 1.6.5 Measures to ensure reliability and validity

Reliability in research is seen as "the degree to which a test is free from measurement errors, since the more measurement errors occur the less reliable the test" (*de Bruin,* 20103:54). Validity of a measuring instrument indicates if the instrument actually measures what it is meant to measure (*Cohen, Manion & Morrison*, 2011). In this particular study the instrument was subjected to construct validity as a form of measuring validity. According to De Vos, Strydom, Fouche & Delport (*2011:162*), construct validity "involves determining the degree to which an instrument successfully measures a theoretical construct". The Cronbach's alpha coefficient and construct validity are respectively used to ensure the reliability and validity of the SMTPL questionnaire. The Cronbach's alpha coefficient is 0.89 for the entire questionnaire. The construct validity of the measuring instrument ranges from 0.70 to 0.89 for each scale (*Tuan et al.,* 2005).

### 1.7 ETHICAL CONSIDERATIONS

Once the Ethics Board gave its permission for the study to be undertaken, the researcher requested permission from the Head of the Physics Department to use the 2nd year students' first year final examination marks in order to evaluate the academic performance of the students. The researcher commissioned the physics lecturer to distribute the SMPTL questionnaires during class time to his students after permission was granted by the head of The Physics Department. The researcher ensured that all the respondents included in the research gave their informed consent to participate. The students' privacy was protected as they were requested not to provide their names. They were only required to indicate their student numbers, age, gender, race and major subjects. Their student numbers were required in order to relate academic achievement scores to the appropriate student.

## 1.8 DEMARCATION OF THE STUDY

This study was limited to the University of the Free State, Bloemfontein Campus. The research was conducted at the faculty of Natural and Agricultural Sciences at the Department of Physics and the participants were 2nd year physics students.

## 1.9 SIGNIFICANCE OF RESEARCH

This study should enable lecturers in the Department of Physics at the University of the Free State to motivate students in a way that will optimize their academic achievement and aid with improving the throughput rate of physics students. New strategies on how lecturers can start teaching according to students' motivational needs can then be developed and implemented. This study will also help university administrators to provide a learning environment that will maximize the chances for students to be successful.

## 1.10 OUTLINE OF THE STUDY

The study has the following outline:

### Chapter 1: Orientation and background to the study

This chapter serves as an introductory orientation to the study. The research problem, aim of the research and the researcher's literature review are stated and briefly discussed. The research methodology is briefly explained and the terms relevant in the context of this study are defined.

### Chapter 2: The literature review

This chapter elaborates on the relationship between learning motivation and academic achievement. The effect of learning motivation on academic achievement is discussed in accordance with relevant literature and research done in this field.

### Chapter 3: The research design and methodology

Chapter 3 explains the research methodology and the design that were implemented in the study in more detail. The sample and selection procedure for the sample are discussed. The procedure for collecting data as well as issues around validity and reliability relating to data collection is also explained. This chapter also elaborates on the statistical analysis procedures that were implemented to analyze the data.

**Chapter 4: Presentation, analysis and interpretation of results**

In chapter 4 the researcher presents and discusses the results.

**Chapter 5: Conclusions, implications and limitations of the study**

In chapter 5 the researcher presents the conclusions emanating from the findings of the hypotheses that were tested in the study. This chapter also addresses the implications of the relations which were found to be significant. Implications based on the findings of the study are made. The limitations of the study are indicated and briefly discussed.

## 1.11 SUMMARY AND CONCLUSION OF THE CHAPTER

In this chapter, the researcher discusses the orientation and the background to the research study. This chapter briefly outlines the research hypotheses and the null hypotheses to be tested in this study. This chapter also discusses the aim and the research objectives of the study which is followed by the discussion of the research methodology to be implemented in this study.

In the next chapter, Chapter 2, the literature review is discussed in detail. The chapter covers the conceptual analysis of motivation in general and the theories based on motivation. Learning motivation is discussed in detail also emphasizing on the most important theories of learning motivation. The chapter also includes: the relationship between learning motivation and other concepts, factors that have an influence on learning motivation and the challenges in assessing learning motivation. The chapter also discusses academic achievement and elaborates on the relationship between learning motivation and academic achievement.

# CHAPTER 2: LITERATURE REVIEW

## 2.1 INTRODUCTION

Chapter 1 served as orientation and background to this research study. The researcher inter alia discussed the aim of the research, and the primary and subsidiary research questions. The hypotheses that were tested in this research study were also discussed. The researcher also briefly discussed the research methodology to be implemented in this study.

In this chapter the focus is on the relationship between learning motivation and academic achievement among 2nd year physics students. The effects of learning motivation on academic achievement, as derived from literature, are discussed. In this regard the three most appropriate theories explaining students' learning motivation for academic achievement are used as a theoretical framework.

## 2.2 MOTIVATION: A CONCEPTUAL ANALYSIS

Motivation may be regarded as a force that energizes, directs, and sustains behavior (*Mubeen & Reid,* 2014). Newton's 2nd law of physics states that "[a] body will remain at rest until an unbalanced force acts on it" (*Lucas*, 2014). This law may read as follows, if applied to students' learning motivation: "[a] student will remain at rest until an unbalanced motivational force acts on him or her". More or less the same definition is provided by Ferguson (*2000:8*) who states that motivation is "a dynamic internal process that energizes and directs action and action tendencies and this process pushes or pulls the individual". An individual that is highly motivated will be more alert and responsive and will put effort into actions (*Ferguson*, 2000:8).

Motivation may also be regarded as a decision-making process, through which the individual chooses the desired outcomes and sets in motion the behavior appropriate to the outcomes (*Riley*, 2012). Shorter definitions are those of Broussard and Garrison (*2004:106*) who define motivation as "the attribute that moves us to do or not to do something" and Guay, Chanal, Ratelle, Marsh, Larose and Boivin (*2010:712*) who views motivation as "the reasons underlying behavior".

According to Ali (*2011:5*), motivation "involves a constellation of beliefs, perceptions, values, interests, and actions which are all closely related". As a result, various approaches to motivation focus on cognitive factors such as monitoring and strategy use and non-cognitive factors such as perceptions, beliefs, and attitudes, or both (*Ali*, 2011).

Academic self-concept and learning motivation are the non-cognitive factors that have the most potential to influence academic achievement (*Areepattamannil & Freeman*, 2008). It is thus important to determine the relationship between students' learning motivation and academic achievement (*Sikhwari,* 2004). Much research (*Pintrich & Maehr,* 2004; *Larson*, 2000; *Hardré & Reeve,* 2003), has been done on how learning motivation can influence the academic success of students. According to Pintrich and Maehr (*2004*), learning motivation may determine the specific goals toward which students strive, and will affect the choices they make, for instance, whether to enroll in physics or studio art, whether to spend an evening completing a challenging task or socially engaging with other students. This study also found that learning motivation increases the amount of effort and energy that students expand in activities directly related to their needs and goals, and that it determines whether they pursue a task enthusiastically and wholeheartedly or apathetically and lackadaisically.

Another study, conducted by Larson (*2000*), indicates that learning motivation increases students' time spent on a task, an important factor affecting their learning and achievement. Students are more likely to begin and complete a task they actually want to do. They will continue working on the particular task until they have completed it, even if the task is challenging, difficult and time consuming (*Larson*, 2000).

Learning motivation affects what students will pay attention to and how effectively they process information. Students who are motivated put effort into understanding what they are learning, and even challenge themselves to think beyond understanding, considering how they might use what they are learning in their lives (*Pintrich & Schunk*, 2002; *Pugh & Bergin*, 2006).

Hardré and Reeve (*2003*) also conducted a study on the relationship between students' learning motivation and academic achievement, showing that students who are the most motivated to learn and excel in educational activities tend to be the highest achievers, and conversely, students who

have little interest in academic achievement are at high risk of dropping out before they graduate from university.

According to this study, learning motivation determines which consequences are reinforcing and which are punishing. When students are motivated to achieve academic success, any outcome will be important. To a student who aims to pass a course, obtaining a 50% pass mark will not appear to be of concern to him. To a student who is determined to pass with distinction and who has set this standard, receiving a mark below a distinction could be distressing (*Hardré & Reeve*, 2003).

Learning motivation has also been linked to critical thinking abilities such as analyzing arguments, making inferences, using inductive or deductive reasoning, judging or evaluating and making decisions or solving problems (*Facione, P., Facione, N. & Giancarlo,* 2000). The need to think critically has been defined as the "consistent internal motivation to engage problems and make decisions by using critical thinking" (*Facione, et al.*, 2000). Critical thinking also entails attitudes or habits of mind, and these include factors such as open and fair mindedness, a drive to seek reason, inquisitiveness, a desire to be well-informed, flexibility, and respect for and willingness to entertain diverse viewpoints. These are all qualities that will enable any individual, including students, to flourish in many different aspects of life. When these qualities are gained by students during the learning period, they will be successful, resourceful and elite employees or employers (*Facione, et al.,* 2000).

According to a study done by Ormrod (*2011*), not much research has been done on how students perform in different subjects. He stated that students' learning motivation level is actually influenced by a specific subject and students will express different motivational traits in different subjects. Students behave differently toward a particular subject, thus influencing their academic achievement in that subject. It is therefore important to specifically determine the impact of learning motivation on the academic achievement of students in a particular subject (*Ormrod*, 2011).

This research study aims to determine the relationship between learning motivation and academic achievement among 2nd year physics students.

## 2.3 THEORIES ON MOTIVATION

Motivation is a well-studied psychological issue since it can be seen as the driving force behind all types of behavioral choices and motivational traits. Motivational theories are concerned with the energization and direction of behavior. In other words, motivational theories attempt to answer questions about what gets individuals moving and toward what activities or tasks (*Pintrich & Schunk,* 2002). Higgins & Kruglanski (*2000*), suggested that what motivates individuals comes down to a central question of what individuals want and whether there are basic needs that define what people want.

There are theories that have been postulated to explain the concept of motivation. In the next few paragraphs the researcher will explain and elaborate on the most common theories of motivation. These theories include the following: the expectancy-value theory, the self-efficacy theory, the social cognitive theory, the attribution theory, the self-determination theory and Maslow's hierarchy of needs theory.

The most relevant theories for the purpose of this research are the theories used in educational psychology. These theories focus specifically on students' learning motivation. The Attribution theory, Self-determination theory and Maslow's hierarchy of needs theory are the three most appropriate theories in educational psychology's theories of learning (*Gianfranco*, 2016).

### 2.3.1 Expectancy-value theory

This theory can aid in understanding how individuals make decisions regarding various behavioral alternatives, and why they pursue these decisions (*Schunk*, 2014). An expectancy is an individual's judgment of their own capabilities (*Schunk*, 2014). Expectancy answers the question:  "Can I do this task?" A value is an individual's beliefs about the importance of something or the reasons why they may engage in certain tasks. Value answers the question:  "Do I want to do this task and why?" In the expectancy-value theory, both expectancies and values play an important role in predicting an individual's future decisions, engagement, persistence, and achievement (*Schunk,* 2014).

There are three variables within the expectancy theory: Expectancy (E), Instrumentality (I) and Valence (V). These are core variables to the expectancy-value theory and they determine why individuals would choose one behavioral pattern over another (*Call, Green, Price, Trahan*, n.d.).

According to Call, et al. (*n.d.),* Expectancy (E) is usually based on an individual's past experience, self-confidence and the perceived difficulty of the performance standard or goal. It is a belief that one's desired performance is a result of one's effort toward the goal achieved. Instrumentality (I) is the belief that a person will receive a reward if the performance expectation is met. The reward may be in the form of a pay increase, promotion, recognition or sense of accomplishment. Valence (V) is a form of value an individual places on the rewards of an outcome. If the desired outcomes of individuals are understood, a reward system that is satisfactory to the individuals can be designed and built (*Call, et al*. n.d.).

### 2.3.2 Self-efficacy theory

Self-efficacy measures one's own competence to complete tasks and reach goals (*Ormrod,* 2006). According to Ormrod (*2006*) it affects every area of human endeavor, and determines the belief a person holds regarding his or her power to affect situations. Self-efficacy is one of the strongest factors that can predict the performance of individuals in domains as diverse as sports, business, and education (*Bandura,* 2004).

### 2.3.3 Social cognitive theory

Social cognitive theory (SCT) aims at understanding peoples' behavioral changes by dealing with their cognitive, emotional, and behavioral aspects. There is an assumption within this SCT, namely that people are able to influence their own behavior and environment in a way that is goal-orientated and purposeful (*Bandura,* 2001).

### 2.4 THEORIES BASED ON LEARNING MOTIVATION

In the above paragraphs, different theories associated with the concept of motivation have been briefly outlined. In educational psychology, the focus is specifically on learning motivation. The Attribution theory, Self-determination theory and Maslow's hierarchy of needs theory are the three most appropriate theories on learning motivation (*Gianfranco*, 2016).

The Attribution theory examines students' beliefs about why certain events occur and correlates those beliefs to subsequent motivation, and it also provides an important method for examining and understanding motivation in academic settings. The Self-determination theory explores the motivational traits as well as the extrinsic and intrinsic motivation of students. Maslow's hierarchy of needs theory shows the importance of understanding and meeting the basic needs of students before any expectations can be put on them. These three theories based on learning motivation will be discussed in the paragraphs below:

### 2.4.1 Attribution theory

Weiner's attribution theory of 1935 is mainly about achievement. This theory is based on internal and external attributions, and on the notion that an individual's causal attributions of achievement may affect subsequent behaviors and motivation (*Weiner*, 1972). Based on Weiner's theory, the most important factors affecting attributions are ability, effort, task difficulty, and luck. The basic principle of the attribution theory, as it applies to motivation, is that a person's attributions for success or failure determines the amount of effort the individual will spend on the task (*Call, Green, Price & Trahan,* n.d.). Attribution theory assumes that people try to determine why they do what they do, that is, interpret causes to an event or behavior. It is a theory about how people explain things based on their behavior (*Call, et al*. n.d.).

### 2.4.2 Self-determination theory

Ryan & Deci (*2000*) introduced the theory of self-determination in the field of motivation. According to them, the theory of self-determination "categorizes and tells apart diverse types of motivation in accordance with the different rationales, causes or targets which strengthen a deed or an achievement" (Ryan & Deci, 2000:54). Based on this theory, motivation toward learning may arise from intrinsic or extrinsic factors (*Mubeen & Reid,* 2014).

### 2.4.2.1 Intrinsic motivation

Intrinsic motivation is related to intrinsic value. Intrinsic motivation is driven by individual's personal interest, pleasure and fulfillment (*Guay et al.,* 2010). An individual who is intrinsically motivated performs an activity because he finds doing the activity being fulfilling in itself (*Brown*, 2007). An intrinsically motivated person believes that performing an activity for personal fulfilment opens an opportunity for learning and growth potential (*Coon & Mitterer*, 2010).

When students have confidence and purpose in what they learn and perceive what they learn to have value, motivation will be intrinsic, bringing considerable benefits (*Deci and Ryan,* 2000). Students who have intrinsic motivation are inclined to stay with intricate and complicated problems and gain knowledge from their slip-ups and mistakes (*Walker, Greene, & Mansell*, 2006).

Intrinsic motivation is increased by certain factors namely: (i) challenge, (ii) curiosity, (iii) control, and (iv) cooperation and competition (*Cherry*, 2016).

(i) Challenge: people are more motivated in pursuing goals that are challenging and attainable but not necessarily certain.

(ii) Curiosity: intrinsic motivation is increased when a task stimulates an individual to learn more while performing it.

(iii) Control: individuals who are intrinsically motivated only pursue tasks that they have control over and,

(iv) Competition: individuals who find pleasure in helping others and can favorably compare their performance to others have high intrinsic motivation (*Cherry*, 2016).

Intrinsic motivation is what will sustain students over the long run. It will encourage them to make sense of and apply what they are studying, increasing the odds of them continuing to read and learn more about academic subjects long after they have left their formal education behind (*Mubeen & Reid,* 2014). According to Cherry (*2016*), unfortunately not a lot of students find learning to be interesting thus they have to be extrinsically stimulated into educational activities (*Cherry, 2016*).

### 2.4.2.2 Extrinsic motivation

Extrinsic motivation is when an individual's desire to perform a task is driven by an external source (*Vansteenkiste, Lens, & Deci*, 2006). Extrinsic motivation is dependant on external rewards (*Mubeen & Reid,* 2014). Extrinsic motivation can be manipulated by providing rewards after an outcome has been achieved. The rewards that are given are either tangible e.g. in the form of money or intangible e.g. in the form of praise (*Mubeen & Reid,* 2014).

Extrinsic motivation is what educators are most familiar with when dealing with students. This form of motivation can be established easier by educators once they know what the students are

willing to work for (*Ecology of Education*, 2012). Extrinsically motivated students participate in learning tasks because they expect a desirable outcome like a form of reward (*Ecopine*, 2014).

According to Cherry (*2016*), extrinsic motivation is not necessarily a poor quality. External rewards can induce interest amongst students who initially had no desire to perform in academic activities. Such rewards can be used to motivate the students to acquire new skills and knowledge. Once these early skills have been learned, the students may then become more intrinsically motivated to pursue the activity.

External rewards can also be a source of feedback, allowing people to know when their performance has achieved a standard deserving of reinforcement (*Cherry*, 2016). Extrinsic motivation can also be a tool that can be used towards students in order for them to have discipline in their learning and have a successful learning outcome (*Vansteenkiste & Deci,* 2003). Lecturers can for example motivate students to attend class regularly by keeping attendance registers in order to qualify students to write examinations.

Research done by Rackauskiene, Kasnauskiene and Virbalienė (*2013*) on extrinsic motivation shows that extrinsic rewards have an influence on intrinsic motivation. When a reward in a form of praise is offered to a student for performing better that others, it can improve intrinsic motivation of that student. However, rewarding a student for performing a task with minimal work can decrease intrinsic motivation of students (*Rackauskiene et al.,* 2013).

It is evident from the above findings that some students will respond best to intrinsic motivation, and will meet any obligation of an area of their passion while other students will respond better to extrinsic motivation, provided there is a reward upon completion of the task. It is often helpful to know what interests students have in order to connect these interests with an appropriate type of motivation to achieve success in students' academic learning (*DeLong & Winter*, 2002:163).

### 2.4.3 Maslow's hierarchy of needs theory

Maslow's hierarchy of needs is a theory proposed by Abraham Harold Maslow. According to this theory, the needs of people are what motivates them to address their concerns. People's needs differ in many ways and should thus be ranked in terms of how important they are towards each person (*Tay & Diener* 2011). Maslow thus proposed a five-level hierarchy of needs (see Fig. 1).

The arrangement of these needs is expressed in the name of the theory whereby lower level needs must be satisfied first before individuals can be expected to be concerned by higher level needs (*Kenrick, Griskevicius, & Neuberg,* 2010).

According to Maslow, each person has a different set of needs at different points of time in his/her life (*Koltko-Rivera*, 2006). He states that all needs of humans could be arranged in a hierarchy and each person is said to move through the hierarchy by fulfilling each level of needs. The main premise of this theory is that people will not seek to satisfy higher needs such as self-actualization needs, unless the lower needs are met, however, some people may have dominant needs at a particular level and thus never move through the entire hierarchy (*Koltko-Rivera*, 2006).
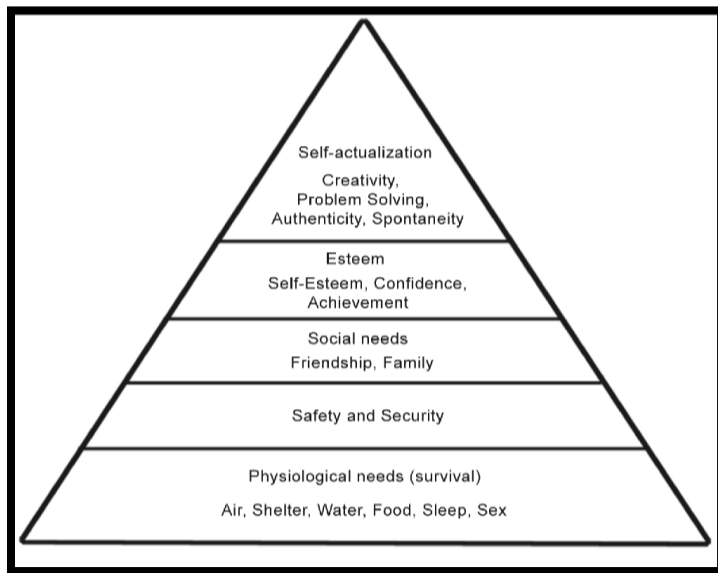


Figure 1: Maslow's Hierarchy of Needs (*Kenrick*, 2010)

Maslow's hierarchy of needs, as depicted by figure 1 above, lists the following five levels of needs, namely, physiological needs, safety and security needs, social needs, esteem needs and self-actualization.

1. Physiological needs

Physiological needs, which constitute the lowest level, deal with the basic necessities of human survival such as food, clothing and shelter. A student whose physiological needs are not met will

not have the drive or energy to engage in activities. The best that the student will do is to study to pass and not necessarily achieve good academic results (*Sago,* 2003).

2. Safety needs

According to Maslow, safety is a fundamental need (*Tay & Diener* 2011). Once the physiological needs have been satisfied, a person feels the need to have security in life. A need of a student is to feel safe emotionally and physically. This includes the need to feel accepted in order to progress and reach his full academic potential. This means that the academic environment must be safe and conducive for students.

3. Social needs

According to Cherry (*2016*), social needs include the need to have family and friends. An individual needs to have a sense of belonging whether it be in a social group or amongst any other relationships. Relationships such as friendships and families help fulfill this need for companionship and acceptance, as does involvement in social, community, or religious groups (*Cherry*, 2016). A student needs to have a strong family structure in order to feel secure and supported throughout his/her academic life. A strong family support system will help the student to be able to face the challenges that come with being a student, such as academic and social peer pressures (*Cherry*, 2016).

4. Esteem needs

Self-esteem, achievement, mastery, independence, status, dominance and prestige are examples of esteem needs (*McLeod,* 2016). Student with low self-esteem have a sense of helplessness and will not have the confidence to participate in group academic activities. Such students' self-esteem needs to be strengthened first for them to be able to can progress academically (*McLeod,* 2016).

5. Self-actualization needs

Self-actualization represents the highest level in Maslow's hierarchy and refers to the need to maximize one's potential and becoming the best one can be. Once a student aspires to self-

actualization, he will realize his full potential, will seek experiences that leads to growth and will be self-fulfilled (*McLeod*, 2016).

Maslow's hierarchy of needs theory is an important theory included in the educational psychology theories of learning. Lecturers should be aware of the needs of students and take these needs into consideration when developing plans to motivate them. For example, a student that is hungry will unlikely be motivated by esteem needs; and a physics student with very low self-esteem will unlikely see the need to know and understand physics and its concepts or any academic matter. This leads to the low motivation of the student, affecting his/her academic achievement.

From my experience as a student, it is my opinion that lecturers must try and understand students' needs as thoroughly as possible and either work around them or take them into consideration when developing motivational strategies and course content. The institution also plays a role in helping to meet some of the needs outside of the reach of lecturers, such as the basic needs for food and safety.

Most of the students' needs such as family problems, social problems and financial problems come from areas outside of the lecture room or academic settings. This makes it difficult for lecturers to deal with these extraneous problems. Lecturers may not know which of a student's needs go unsatisfied, and even if they know, they might not be able to fulfill those needs. This shows that it is impossible to satisfy the needs of students completely.

## 2.5 OVERVIEW OF LEARNING MOTIVATION

Motivation in learning is probably the most important factor that educators can target in order to improve learning and help students achieve academic success (*Williams*, 2013). According to Williams, human beings in general are complex, but students in particular are more complicated with complex needs and desires. Students need to be consistently motivated in order for learning to be a continuous consistent process (*Williams*, 2013).

With reference to the conclusion made above by Williams (*2013*), I am of the opinion that all students are motivated in one way or another. One student may be interested in a particular subject and participate actively in that subject's course work and earn high marks. Another student may

be more concerned with the social side of university life, interacting frequently with other students and attending extracurricular activities almost every day. Still another student may, because of an undetected learning disinterest or a shy temperament, be motivated to avoid academics and even social situations. However, the ultimate goal of any learning institution should be to transform its students by providing opportunities that will increase students' knowledge and skills and by building character and instilling virtues.

There should be a clear focus from institutions in order to have overall academic success (*Tinto*, 2005). Institutions must focus on (i) student learning, (ii) stronger connections between courses and faculties and (iii) building student communities. According to Tinto (2005), when all these factors are connected, they will help in assisting students to be motivated. Research done by Alarcon, Edwards and Jean (*2013)* showed that motivation had a stronger impact on student retention than ability and suggested that programs targeting both abilities and the motivation of students would likely be effective and persistent. While standardized test results were validated as logical predictors of academic performance, various analyses of research data showed that "motivation factors were consistently the stronger predictors of retention" (*Alarcon, Edwards & Jean,* 2013:56).

Based on a study done by Broussard and Garrison (*2004*), research on student motivation is in fact organized around the following three questions:

1. Can I do this task?
2. Do I want to do this task?
3. What do I have to do to succeed in this task?

In the following paragraphs the researcher will be explaining the above three questions.

### *Can I do this task?*

This question is linked to the theory regarding self-efficacy, attributions, and self-worth. Bandura's social cognitive theory states that "self-efficacy belief influences the decisions people make and the courses of action they pursue" (*Pajares & Schunk*, 2001). Self-efficacy plays a role in determining how individuals feel, think and motivate themselves, which then ultimately affects

the behavior and the outcome (*Bandura*, 2002). Bandura (2002:2) also states that "other factors which serve as guides and motivators, are rooted in the core belief that individuals have the power to produce desired effects by their actions, otherwise they would have no will to act or to persevere in the face of difficulties".

The concept of attribution provides an important method for examining and understanding motivation in academic settings. It examines individuals' beliefs about why certain events occur and correlates those beliefs to subsequent motivation (*Anderman,* 2009). Attribution is closely related to the concept called locus of control. Individuals should be more motivated to the extent that they feel they are in control of their own successes or failures (*Eccles & Wigfield,* 2002).

There are three characteristics of attribution theory, which are classified along three causal dimensions: locus, stability, and controllability (*Anderman,* 2009). All these dimensions have an effect on learners' subsequent motivation toward a task or activity. The locus dimension refers to whether the cause of an event is perceived as internal to the individual or external (*Anderman,* 2009). For example, if a student believes that he or she failed an exam because of lack of ability, the student is choosing an internal cause because ability is internal to the student. In contrast, if a student believes that he or she failed an exam because of an incompetent lecturer, the student is choosing an external cause because the lecturer's incompetence is external to the student.

The stability dimension refers to whether the cause is stable or unstable across time and situations (*Anderman,* 2009). For example, if a student believes that he failed a science exam because he lacks ability in science, then his cause is stable. However, if a student believes that he failed the exam because he was ill at the time of the exam, then the cause is unstable in cases in which the illness is a temporary factor.

The controllability dimension refers to whether the cause of the event is perceived as being under the control of the individual (*Anderman,* 2009). For example, if a student believes that he failed an exam because he did not get enough practice before it, the cause is controllable because he could have decided to spend more time practicing; in contrast, if the student feels that he failed the exam because he simply lacks ability then the cause is uncontrollable.

Self-worth is related to self-efficacy and locus of control. Students who believe that they are academically strong have a positive self-worth (*Eccles & Wigfield,* 2002). These students will

maximize their self-worth by increasing their sense of competence and control (*Eccles & Wigfield,* 2002).

*Do I want to do this task?*

Broussard and Garrison (*2004*) have dealt with this question under the expectancy-value theory, intrinsic motivation theory, and self-determination theory. Individuals hold certain values in order for them to participate in different activities (*Eccles & Wigfield,* 2002). These values are the reason why individuals will participate or engage in an activity. The value of a given task or activity that an individual participates in has four components, namely: (i) attainment value, (ii) intrinsic value, (iii) utility value, and (iv) cost value.

Attainment value is an individual's personal value for performing well on a task. Intrinsic value is when an individual finds joy in performing a certain task. Utility value is when an individual perceives to what extent the completion of the task will facilitate set goals. Cost value is the disadvantage that comes with engaging in a given task such as stress, anxiety and fear of failing in the task (*Eccles & Wigfield,* 2002).

Values are closely related to interests. According to Hidi and Harackiewicz (*2000:152*), values are "interests which refer to an interactive relation between an individual and certain aspects of his or her environment". The interests will lead to individuals being persistent and focused at a task and still being able to learn and enjoy the task (*Hidi & Harackiewicz,* 2000).

*What do I have to do to succeed in this task?*

According to a study done by Broussard and Garrison (*2004*), the self-regulatory theory was developed from the question: "What do I have to do to succeed in this task?" This theory tries to relate motivation and cognition. According to this theory, individuals can strengthen their own motivation by having plan of actions that are designed to succeed in set goals (*Schunk & Zimmerman,* 2007). Linnenbrink and Pintrich (*2002*) also showed a model that related motivation and cognition. According to the model, learning motivation was both affecting and being affected by cognition. This model also depicted that both learning motivation and cognition were affected

by social context and that these two components also affected students' learning and academic achievement (*Linnenbrink & Pintrich*, 2002).

## 2.6 RELATIONSHIP BETWEEN LEARNING MOTIVATION AND OTHER CONCEPTS

Learning Motivation is related to other factors in academics (*Tamuka,* 2016). The factors are skills that are especially important in the 21<sup>st</sup> century in preparing students for the workforce and lifelong learning. These are profound skills that students can acquire throughout life. According to Tamuka (*2016*), these skills are not only limited to tertiary institutions but can carry the students through this lifelong learning journey in different aspects of their lives. The skills that have been found to relate to the learning motivation of students are: critical thinking, metacognition, self-control and drives and desires.

The following paragraphs will explain more about how the above-mentioned skills are related to students' learning motivation.

### 2.6.1 The relationship between learning motivation and critical thinking

According to Willingham (*2007)* learning motivation is linked to critical thinking, and the main components of critical thinking are: analyzing arguments, making conclusions based on evidence, being able to judge or evaluate, and being able to make decisions and solve problems. Critical thinking is defined as "the consistent internal motivation to engage problems and make decisions" (*Facione, P., Facione, N. & Giancarlo, C.*, 2000:65). Students who are not motivated are unlikely to analyze, judge, solve problems and make decisions in their learning process (*Facione, P., Facione, N. & Giancarlo, C., 2*000).

### 2.6.2 The relationship between learning motivation and metacognition

Metacognition is defined by Martinez (*2006:696*) as "the monitoring and control of thought". In terms of metacognition, motivation is defined as "the beliefs and attitudes that affect the use and development of cognitive and metacognitive skills" (*Schraw, Crippen & Hartley*, 2006:112). Metacognition is divided into two parts namely: metacognitive knowledge and metacognitive regulation (*Vrugt & Oort*, 2008). Metacognitive knowledge is about having self-knowledge. This

includes knowing one's own strategies, why to use them and when to use them (*Martinez,* 2006). Metacognitive regulation is about monitoring ones cognition (*Vrugt & Oort,* 2008). This includes planning of tasks, monitoring task performance and also determining the ability of the monitoring processes and strategies to produce desired or intended outcomes (*Vrugt & Oort,* 2008).

## 2.6.3 The relationship between learning motivation and self-control

The self-control of motivation is increasingly understood as a subset of emotional intelligence; a person may be highly intelligent according to a more conservative definition, yet unmotivated to dedicate this intelligence to certain tasks (*Oaten & Cheng,* 2006). When students are emotionally intelligent, they can take sober decisions in their academic lives and not be influenced by a variety of external factors they are confronted with on a day-to-day basis. This may eliminate student anxiety and confusion (*Kokkonen,* 2002). Self-control is crucial for success in many domains in life. Students with high self-control have better psychological adjustment, better interpersonal relationships, and better performance on achievement-related tasks (*Tangney, Baumeister & Boone,* 2004). Self-control appears to be a better predictor of academic performance than even intelligence (*Duckworth & Seligman*, 2006).

## 2.6.4 The relationship between learning motivation and drives and desires

Drives and desires can be described as a deficiency or need that activates behavior that is aimed at a goal or an incentive (*McCullough & Willoughby*, 2009). According to McCullough (*2009*), these drives and desires originate within the individual and may not require external stimuli to encourage the behavior. These drives could be activated by deficiencies such as hunger, which motivates a person to seek food; whereas more subtle drives might be the desire for praise and approval, which motivates a person to behave in a manner pleasing to others (*McCullough* & Willoughby, 2009). Thus, personal drives and desires are motivating tools for students throughout their career, and these tools will determine the students' outcomes (*Taylor*, 2012).

## 2.7 FACTORS WHICH MAY INFLUENCE STUDENTS' LEARNING MOTIVATION

According to Howey (*2008*), intrinsic goal orientation, extrinsic goal orientation, task value, control of learning beliefs, and self-efficacy for learning and performance are amongst specific motivational factors that have been identified in educational research. In a study done by Tuan, Hsiao, Chin & Shieth (*2005*), self-perception of ability, effort, intrinsic goal orientation, task value, self-efficacy, test anxiety, self-regulated learning, task orientation and learning strategies were the factors that influenced students' learning motivation.

However, Ormrod (*2011*) showed that students behave differently toward a particular subject, thus influencing their academic achievement in that subject. It is therefore important to specifically determine the factors that influence the learning motivation of students in a particular subject (*Ormrod*, 2011).

Tuan, Hsiao, Chin, & Shieth (*2005*) did a study to analyze and identify motivation domains in science learning. This study was done in order to determine which factors have an influence on learning motivation, particularly in science subjects (*Tuan et al*., 2005). This was done by developing a questionnaire called Students' Motivation Towards Science Learning (SMTSL). The questionnaire has six scales, which according to Tuan *et al*., are the key factors that have an influence on learning motivation, specifically in science subjects. These factors are: (A) self-efficacy, (B) active learning strategies, (C) science learning value, (D) performance goal, (E) achievement goal and (F) learning environment stimulation (*Tuan et al*., 2005). These factors will be explained in detail in the following paragraphs, as they are in line with the research aim of this study to determine the relationship between learning motivation and academic achievement among 2<sup>nd</sup> year physics students.

### 2.7.1 Self-efficacy

Self-efficacy is the measure of one's own competence to complete tasks and reach goals (*Ormrod,* 2006). According to Bandura (*2001*) self-efficacy played a role in determining how individuals felt, thought and motivated themselves, which then ultimately affected the behavior and the outcome. Self-efficacy thus strongly influences both the power with which a person has to face challenges and the choices a person is most likely to make in a given situation (*Bandura*, 2004).

Self-efficacy influences choice of activities, level of effort, individual persistence and success (*Schunk,& Zimmerman,* 2007).

Klassen, Krawchuk and Rajani (*2008*) believe that self-efficacy strongly influences a person's task, choice, level of effort, persistence, and resilience. Individuals are more inclined to engage in tasks which they feel competent and confident in, and will shun those that they do not (*Klassen, Krawchuk & Rajani, 2008*). Moreover, self-efficacy acts as mediation on the influence of other variables that predict academic achievement. In other words, it acts as a filter between variables such as previous achievement and mental ability on academic achievement (*Pajares & Schunk,* 2001).

In academic settings, self-efficacy is a strong predictor of students' performance (*Klassen, et al.,* 2008). Other researchers (*Chandler, Heffer & Turner*, 2009; *Strelnieks*, 2005) also suggest that self-efficacy correlates highly with students' academic achievement; it has therefore been referred to as an essential component for successful learning.

Chandler, Heffer and Turner (*2009*), assessed the influence of parenting styles, achievement motivation and self-efficacy on students' academic achievement. These results indicated that self-efficacy was a significant predictor of one's academic achievement. Students with high self-efficacy will approach difficult tasks as challenges to be triumphed rather than as threats to be avoided and students who doubt their capabilities may believe that the matter is too difficult to accomplish (*Chandler, Heffer & Turner*, 2009).

Strelnieks (*2005*) conducted a study to determine whether self-efficacy had an influence on students' academic achievement. From the study, it was found that the influence of self-efficacy on academic achievement depended on external factors such as psychological and socio-environmental factors (Strelnieks, *2005*). According to Strelnieks (*2005*), self-efficacy could accurately predict females' academic achievement but it was inaccurate to predict how males performed academically. The findings also showed that self-efficacy could only predict the academic achievement of students with higher socio-economic status (*Strelnieks,* 2005).

**2.7.2 Active learning strategies**

Active learning strategies are activities that are used to involve students in doing things and thinking about the things they are doing (*Eison,* 2010). Active learning is any instructional method that engages students in the learning process and requires students to do meaningful learning activities and think about what they are doing (*Prince*, 2004). Active learning methods include: (i) in-class activities in place of some lecture time, (ii) collaborative work in student groups, (iii) increased in-class formative assessment and (vi) group discussion (*Prince*, 2004).

A traditional lecture is a one-way channel of communication and information. Students are required to sit and listen and sometimes pen down some notes if necessary (*Farooq*, 2012). There has been much debate as to whether or not lecturing actually improves student learning in the classroom (*Malek*, n.d). Research done by Bligh (in *Malek*, n.d) suggests that the traditional lecturing method is a relatively poor instructional approach for maintaining student attention because student concentration during lectures begins to decline after 10 to 15 minutes. According to Bligh (2000), using traditional lecturing method, active thinking is not stimulated and lectures are therefore not effective in creating students' enthusiasm in subjects (*Malek*, n.d).

Another research that was done comparing the lecturing and discussion techniques, showed that the results tend to show differences favouring active learning methods over traditional lecturing methods (*Eison*, 2010).

Students who engage in active learning identify their work as rewarding because in the process of learning; they gain knowledge and understanding. Active learning strategies are also important in the development of friendships that extend beyond the classroom (*Braxton, Jones, Hirschy & Hartley*, 2008). According to Braxton, *et al*. (*2008*) active learning encourage interactions amongst students and these interactions are what builds friendships that will go further than students' lives at institutions. Students will benefit in their learning when lecturers use instructional strategies that actually promote active learning engagement (*Kennedy,* 2007).

Introducing activity into lectures can significantly improve recall of information, as students will be engaged in the learning processes through meaningful and thought-provoking activities (*Daniel & Tivener,* 2016). The most important thing that matters in students' success and development is

not about what students come with or where they study but rather what they actually do during their time as students and also being engaged in academic activities (*Kuh, Palmer & Kish,* 2003).

Student engagement is seen as participation in educationally effective practices, both inside and outside the classroom, which leads to a range of measurable outcomes (*Kuh, Kinzie, Buckley, Bridges, & Hayek,* 2007). According to Krause & Coates, (*2008:493*) student engagement is "the extent to which students are engaging in activities that higher education research has shown to be linked with high-quality learning outcomes". Similarly, Hu & Kuh (*2001:3*) define student engagement as "the quality of effort students themselves devote to educationally purposeful activities that contribute directly to desired outcomes".

A Nobel Prize-winning physicist, Carl Weiman, found that in nearly identical classes, students learned more from graduate teaching assistants that were trained to use interactive teaching methods than they learned from a professor using a lecture-only approach (*Haak & Freeman*, 2011). It is evident from the above research that has been done that students seem to learn more effectively through analyzing, discussing and applying the contents in a meaningful manner.

### 2.7.3 Science learning value

Currently, South Africa has a national economic growth challenge. To rise to this challenge, the education system must produce enough people with the right skills (*SAIP*, 2004). According to SAIP (2004), physics is an essential step in training for most science and engineering disciplines. Science and engineering are the disciplines that can meet the challenges of the 21st century, from sustainable energy and global security to lifelong health and wellbeing (*SAIP*, 2004).

The aim of the Institute of Physics (IOP) is to increase the number of students who choose to study physics (*IOP*, 2011). According to the Council on Higher Education and the South African Institute of Physics (*CHE & SAIP*, 2015), there is value in studying physics, and a physics degree develops skills that open up diverse career options. There is also a monetary value associated with studying physics as research shows that physics graduates can expect to earn more on average than the graduates of most other disciplines (*IOP*, 2011).

Career readiness is not the only reason to understand and value science. Everyday decisions are informed by scientific literacy and the ability of an individual to think about and analyze situations

using evidence (*Shumow & Schmidt,* 2015). However, a research report of the Teaching and Learning Research Programme (TLRP) (*2006*) based at the Institute of Education, University of London, indicates that students do enjoy physics and that levels of enjoyment and engagement are often closely inter-related. The fundamental elements underpinning the enjoyment of and interest in studying physics were associated with: the practical nature of lessons, connections with the substantive content of physics education, the practical application and relevance of the course, perceptions of the ease of learning and the accessibility of physics, and the lecturer's quality and approaches.

There are a number of factors that could either encourage or discourage young people from learning science. These factors include for example: the learning context, social groups of individuals (e.g. parents, family members, teachers and friends) and personal perspectives or outlooks of young people. According to the report of the National Foundation of Educational Research (NFER) in the United Kingdom (*2011*), there is a decline in engagement with science, technology, engineering and mathematics (STEM) study and subsequent choices to pursue related careers. There is thus a need for further, in-depth exploration of the factors or influences that determine young people's interest in science and for them to want to have the desire to pursue it further onwards as their career paths (*NFER*, 2011).

### 2.7.4 Performance goals

Performance goals are short-term objectives set for specific duties or tasks and they are usually related to the overall goals (*Pintrich*, 2000). Students with performance goals are more interested in demonstrating their ability to perform or in avoiding judgments they might have of their competence (*Eurasia*, 2011).  Students who are performance goal driven are motivated to perform better than other students and this is known as the performance-approach. Students can also be motivated to totally avoid any form of failure and this is known as performance-avoidance (*Eurasia*, 2011).

According to Eurasia (*2011*) performance-approach goals are linked to students' intrinsic motivation, their exam performance, the effort that they put in while studying and how effectively they use their learning strategies. However, in some cases performance-approach goals have been linked to students avoiding to seek help, students processing information superficially and students

having a fear of failure (*Eurasia*, 2011). Performance avoidance goals are related to disorganized studying, procrastination and academic efficacy (*Ryan, K., Ryan, A., Arbuthnot & Samuels,* 2007). According to Eurasia (*2011*), performance-avoidance goals are the ones that have the most disadvantage towards students' learning progress.

## 2.7.5 Achievement goals

Achievement goals are defined as the purposes of individuals' pursuits (*Roebken,* 2007). Achievement goal theory is one of the models that has been used to explain and understand students' achievement motivation (*Meece, Anderman, E, & Anderman, L.,* 2006). It has been viewed as a close tool to analyze different learning structures and environments on student motivation and learning. According to Meece, Anderman, E, and Anderman, L. (*2006*), students' achievement goal orientations have been conceptualized into a framework that includes mastery achievement goal orientation and performance goal orientation.

Mastery goal orientation is when students are motivated to understand the material and develop their skills (*Eurasia*, 2011). Students that are mastery orientated tend to become competent by comprehending new content and tend to choose difficult tasks at a risk of failing in order to gain more knowledge, and they are likely to be more successful and becoming lifelong students after graduation (*Eurasia*, 2011). Students with mastery goal orientation perceive learning tasks as valuable, they are confident enough to seek help when needed, appreciate cooperative working, use deep-learning strategies, and experience fulfillment in learning (*Darnon*, 2007).

However, according to Sideridis (*2005*), the mastery goal framework was fully expanded to include the mastery-approach and mastery-avoidance designations. Students who have adopted mastery-approach goals are positively motivated to excel in a task and advance in their learning and students who have adopted mastery-avoidance goals are negatively motivated and are not concerned in striving to do well in a task (*Sideridis*, 2005).

## 2.7.6 Learning environment stimulation

The institutional environment is a place where students spend most of their lives. This environment can be partly responsible for instilling certain values in students, thus playing a vital role in the development of the personality of the students (*Arul*, 2012). If we are to have students become motivated to learn, they have to be in an environment that creates that (*Couros,* 2010).

Positive engagement amongst lecturers and students and environmental change have an impact on students' behavior and attainment (*Greany*, 2005). According to Shamaki (*2015*) a priority for every educator should be that a leaning environment is ideal and comfortable A learning environment is ideal when learning components like furniture and proper ventilation is provided and for it to be comfortable, temperature, lightning and noise control are other factors that makes the academic environments conducive for students and educators (*Shamaki*, 2015).

Lecturers' work and effectiveness can be influenced by the conditions of the lecturing environments (*Earthman*, 2002). Even though the lecturer's effectiveness cannot be measured, perception studies of educators in good and poor learning environments provide a good indication relative to the effect the physical environment has upon educators (*Earthman*, 2002). Those who set up policies in education should be concerned about the relationship between educational infrastructure facilities and student learning and achievement, because when there is no optimal learning environment, it will undermine other efforts that educators put in order to improve students' success (*Nepal*, 2016).

Research done by Stricherz (*in Higgins, Hall, Wall, Woolner & McCaughey,* 2005:36) indicates that student achievement lags in shabby educational buildings, but the research could not show that student performance rises when facilities go from decent buildings to those equipped with fancy lecture rooms (*Higgins et al*., 2005). However, sufficient research has proven that the learning environment remains an important aspect for educators and it should be continuously studied and well managed in order to improve the academic performance of students (*Kamaruddin, Zainal, Aminuddin,* 2009). Furthermore, Earthman has emphasized that "when students are surrounded by a safe, modern and environmentally controlled environment, the facility will have a positive effect on their learning climate" (*Earthman,* 2002:1).

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## 2.8 CHALLENGES IN ASSESSING MOTIVATION

Motivation is a psychological construct and this makes it challenging to be measured directly (*Touré-Tillery,* 2014). There are several challenges in assessing motivation, particularly in students (*Hattie*, 2007). Students are biased and often generalize their responses when it comes to their interests, values, efforts and goals. Interests, goals and achievement affect are some cognitive aspects of motivation that cannot be directly observable. Self-report instruments used to measure motivation tend to produce generalized responses to a statement rather than responses that are specific to that particular statement. (*Hattie*, 2007).

However, according to research done by Touré-Tillery (*2014*) the best way to measure motivation is by means of observable cognitive, affective, behavioral and physiological responses and using self-reports. For example, the Intrinsic Motivation Inventory measures intrinsic motivation by assessing an individual's degree of interest/enjoyment, perceived competence, effort, value/usefulness, felt pressure and tension, and perceived choice while performing a given activity. However, an important aspect of determining how to measure motivation is understanding what type of motivation one is attempting to capture (*Touré-Tillery,* 2014).

## 2.9 ACADEMIC ACHIEVEMENT

There does not appear to be one specific or universal definition of academic achievement. Kai, Hanushek, & Rivkin (*2005*) refers to academic achievement as a student's ability to successfully achieve short or long term goals. On a bigger scope, academic achievement is completing school or obtaining a degree (*Kai, Hanushek, & Rivkin*, 2005).

Academic achievement or academic performance is based on the extent to which a student, educator or institution has achieved their set educational goals. Academic achievement is commonly measured by examinations or continuous assessments (*Shoukat,* 2013). According to Ganai & Mir (*2013*), academic achievement also refers to the knowledge that students have acquired and the skills that they have developed in a learning institution. Academic achievement is often determined by test or examination marks assigned by an educator (*Ganai, & Mir,* 2013).

There are many factors that influence students' academic achievement (*Kai, Hanushek, & Rivkin*, 2005). These factors range from simple demographic factors to more complex factors. Simple factors are age, gender and family socioeconomic status, and complex factors are quality of teaching, home environment, financial ability to study, support and stability obtained from family and loved ones. Students do not have control on all these factors, even though these factors can have a big impact on how students perform academically (*Kai, Hanushek, & Rivkin*, 2005).

In this current research, academic achievement is represented by the 2nd year physics students' first year final examination marks in a physics course.

## 2.10 RELATIONSHIP BETWEEN LEARNING MOTIVATION AND ACADEMIC ACHIEVEMENT

Students' motivation for academic achievement is of great importance. They are stimulated to successfully complete an assignment, achieving a goal or a degree in their professions (*Amrai*, 2011). There is belief that academic performance is promoted by learning motivation in all students (*Veiga, Goulão, & Galvão*, 2014.). Students who are motivated are enthusiastic to learn and willing to get involved in the various academic activities, but students who are unmotivated are not as enthusiastic in their learning efforts, are inattentive, do not monitor their level of understanding, or ask for help when they do not understand what is being taught (*Sikhwari,* 2004:56).

The strong correlation between motivation and academic achievement has been supported by the existing theory and research of Deci and Ryan (*2002*). This theory has shown that motivation plays an important role in the academic performance of students. This is further supported by Sikhwari (*2004:54*)*,* who states that "motivation affects almost all student activities". In a study done by Bakara (*2010*), motivation appeared to be strongly related to high academic achievement. Educators must make efforts to focus on students' attitudes and motivation towards learning as these are the factors that will challenge the students to perform better in their learning process (*Bakara*, 2010).

In this study the researcher attempted to determine the relationship between motivation and academic achievement in physics. The researcher chose to investigate the motivation of students

in physics based on the study by Ormrod (*2011*) showing that students' motivation level is influenced by the specific subject and that students may express different motivational traits in different subjects. These different traits might influence their level of motivation.

However, not all findings support this positive correlation between motivation and academic achievement. A study done by Areepattamannil and Freeman (*2008*), found weak correlations between academic achievement and academic motivation. These are contrasting findings, but based on the literature review in this study, there is just enough research done showing a positive correlation between motivation and academic achievement.

## 2.11 SUMMARY AND CONCLUSSION OF THE CHAPTER

A literature review in this chapter showed that motivation in education is an important concept that has an impact on academic achievement. Attribution theory, self-determination theory and Maslow's hierarchy of needs theory are the three most appropriate theories in learning. Attribution theory examines students' beliefs about why certain events occur and correlates those beliefs to subsequent motivation; it also provides an important method for examining and understanding motivation in academic settings. Self-determination theory of motivation refers to two types of motivation namely, intrinsic motivation and extrinsic motivation. The most positive and desirable form of motivation seems to be intrinsic motivation; however, extrinsic motivation also proves to be important in some educational settings. Maslow's hierarchy of needs theory shows that in an educational setting, each student has basic needs such as food, shelter, love, etcetera that must be met before learning can occur.

This chapter also provides a general overview of motivation as reported in the literature. The relationship between learning motivation and other concepts, namely, metacognition, self-control and drives and desires is also discussed. In addition the chapter covers how motivation is measured, based on the factors that have an influence on learning motivation, namely self-efficacy, active learning strategies, science learning value, performance goals, achievement goals and learning environment.

The chapter further includes the challenges in assessing motivation, and an elaboration on the concept of academic achievement. Lastly the relationship between learning motivation and academic achievement is also investigated.

In the next chapter, Chapter 3, the research design and methodology is discussed in relative detail. It deals with the research design of the study, the data-gathering methods and the validity and reliability of these methods. The chapter includes a discussion of the sample, hypotheses to be tested, statistical techniques as well as the ethical considerations of this study.

# CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

## 3.1 INTRODUCTION

In Chapter 2 the three most appropriate theories regarding learning motivation are exposed. Attribution theory, Self-determination theory and Maslow's hierarchy of needs theory are the three theories that were used as a theoretical framework in order to understand the relationship between motivation and academic achievement. The basic principle of attribution theory as it applies to motivation is that a person's attributions for success or failure affect individuals' behaviors and motivation which in turn determine the amount of effort individuals will spend on tasks. Self-determination theory explores the motivational traits, namely extrinsic and intrinsic motivation of students. Maslow's hierarchy of needs theory also shows the importance of understanding and meeting the basic needs of students.

This chapter will elaborate on the problem statement, hypotheses and aim of the research study, as well as the research design and data collection methods used to investigate the relationship between students' learning motivation and academic achievement. It also includes a discussion of the statistical analysis process and ethical principles applied for this study.

## 3.2 STATEMENT OF THE RESEARCH FOCUS

Research was conducted at the Department of Physics and the participants were 2nd year physics students. The researcher chose 2nd year students on the assumption that these students have passed 1st year physics and are thus comfortable and may be motivated in learning physics and knowing more about it. Motivation has been identified as a variable that could have an influence on academic achievement and was investigated as such in the study.

Student motivation is a variable that can itself be influenced by many factors. As discussed in chapter 2, section 2.4.5, learning motivation can be intrinsic or extrinsic, have different traits and be influenced by the different needs students have. Even though the focus is on students' motivation, it is obvious that the influence of lecturers will also play a role in the students' level of motivation.

Literature suggests that a relationship exists between students' learning motivation and academic achievement (*Pintrich and Maehr*, 2004; *Larson*, 2000; *Pintrich & Schunk*, 2002; *Pugh & Bergin,* 2006; *Hardré & Reeve,* 2003). However, there is not a lot of research that covers how a particular course can influence students' learning motivation (*Farrington, Roderick, Allensworth, Nagaoka, Keyes, Johnson & Beechum,* 2013). When students are interested in a particular subject, they will more likely exhibit perseverant behaviors that may help them to succeed academically in that subject (*Farrington et al.,* 2013). This is also supported by a study done by Ormrod (*2011*), suggesting that students' motivation level is influenced by a specific subject and that they may express different motivational traits in different subjects (*Ormrod*, 2011). It is thus the aim of this study to investigate the relationship between learning motivation and academic achievement among 2nd year physics students at a South African university.

## 3.3 RESEARCH AIM AND OBJECTIVES

The aim of the research study is to investigate the relationship between learning motivation and academic achievement among $2^{nd}$ year physics students at a South African university.

In realization of the above aim, the following research objectives were formulated:

- To determine the relationship between self-efficacy and academic achievement among $2^{nd}$ year physics students.
- To determine the relationship between $2^{nd}$ year physics students' learning strategies and academic achievement.
- To determine the relationship between $2^{nd}$ year physics students' perception of the value of physics and academic achievement.
- To determine the relationship between $2^{nd}$ year physics students' performance goals and academic achievement.
- To determine the relationship between $2^{nd}$ year physics students' achievement goals and academic achievement.
- To determine the relationship between learning environment and academic achievement among $2^{nd}$ year physics students.

## 3.4 HYPOTHESES

A research hypotheses is a statement researchers use when they speculate about the outcome of the research or experiment they are embarking on (*Shuttleworth,* 2008). There are two types of research hypotheses i.e. the null hypotheses ($H_0$) and the alternative hypotheses ($H_1$). The null hypotheses is a hypotheses that the researcher tries to disprove, reject or nullify. The null hypotheses states that "there is no difference between the population means of two groups" (McMillan & Schumachetr, *2010:297*). The alternative hypotheses is tested by analyzing and comparing the results against the null hypotheses and if the null hypotheses is rejected, then the alternative is correct or valid (*Shuttleworth,* 2008).

Hypotheses changes a research question into a 'problem' or question that can be tested whether it predicts a relationship between at least two variables. Although the hypotheses cannot be proved, it must be realistic and it must be verified or falsified by valid statistical and analytical means (*Trice*, 2011).

In a research study the researcher also looks for a significance level of a hypotheses. The significance level determines whether the null hypotheses or alternative hypotheses is rejected, which is a crucial part of testing the research hypotheses. Scientific research is tested mostly by statistical methods that give a degree of confidence in the results (*Shuttleworth,* 2008). The type of statistical method used depends upon the field, the type of data and sample size. Most researchers in statistical methods use a significance level of 0.05, which signifies that there is only a 5% probability that the observed results and trends occurred by chance. For some scientific disciplines the required level is 0.01, signifying that there is only 1% probability that the observed patterns occurred due to chance or error (*Shuttleworth,* 2008). In this research study a significance level of 0.05 is used.

For this research study, the following hypotheses were tested:

$H_0$ (null hypotheses): Learning motivation has no influence on the academic achievement of 2nd year physics students at a South African university.

$H_1$ (alternative hypotheses): Learning motivation has an influence on the academic achievement of 2nd year physics students at a South African university.

Based on the constructs of learning motivation, namely: self-efficacy, active learning strategies, science learning value, performance goal, achievement goal and learning environment, the following hypotheses are proposed in this study:

$H_{0a}$: There is no significant relationship between self-efficacy and academic achievement.

$H_{1a}$: There is a significant relationship between self-efficacy and academic achievement.

$H_{0b}$: There is no significant relationship between students' learning strategies and academic achievement.

$H_{1b}$: There is a significant relationship between students' learning strategies and academic achievement.

$H_{0c}$: There is no significant relationship between students' perception of the value of physics and academic achievement.

$H_{1c}$: There is a significant relationship between students' perception of the value of physics and academic achievement.

$H_{0d}$: There is no significant relationship between students' performance goals and academic achievement.

$H_{1d}$: There is a significant relationship between students' performance goals and academic achievement.

$H_{0e}$: There is no significant relationship between students' achievement goals and academic achievement.

$H_{1e}$: There is a significant relationship between students' achievement goals and academic achievement.

$H_{0f}$: There is no significant relationship between learning environment and academic achievement.

$H_{1f}$: There is a significant relationship between learning environment and academic achievement.

## 3.5 DEPENDENT AND INDEPENDENT VARIABLES

Du Plooy (*2009:75*) defines the dependent variable (Y) as the "criterion measure, the effect or the response". On the other hand the independent variable (X) is regarded as the "treatment, experimental, casual or stimulus variable". In this study the dependent variable (Y) is academic achievement, while the independent variable (X) is learning motivation.

## 3.6 RESEARCH DESIGN AND METHODOLOGY

The research design can be thought of as the structure of research that holds all of the elements in a research project together. According to McMillan & Schumacher (*2006:22*) "the research design describes how the study is conducted and the purpose of a research design is to indicate a plan that will generate evidence that will be able to answer the research questions". The way in which researchers develop research designs is fundamentally affected by whether the research question is descriptive or explanatory, and this will affect what information is collected during the research process (*Fox*, 2007).

The aim of this research was to investigate the relationship between learning motivation and academic achievement among 2nd year physics students. In order to determine if there is a relationship between learning motivation and academic achievement, the variables of learning motivation and academic achievement have been measured. The variables influencing learning motivation were measured using a questionnaire, while academic achievement was measured using the first year results of PHYS 1624 of 2nd year physics students.

The research design employed in this study is a quantitative non-experimental, correlational survey design (*McMillan & Schumacher*, 2006). A standardized questionnaire was used to collect data.

According to McMillan & Schumacher (*2010:23*) "an important sub classification of quantitative research design is to decide whether a study is experimental or non-experimental". An experimental design enables the researcher to test a hypotheses by reaching valid conclusions about cause-and-effect relationships between independent and dependent variables. A non-experimental research study is when a researcher cannot control, manipulate or alter the predictor variable or subjects; but instead relies on interpretation, observation or interactions in order to

come to a conclusion about a relationship. Typically, this means that the non-experimental researcher must rely on correlations, surveys or case studies, and cannot demonstrate a true cause-and-effect relationship (*McMillan & Schumacher*, 2006).

### 3.6.1 Research sample

Sampling is the process of selecting a portion from a population of interest so that by studying the sample, results can be fairly generalized back to the population from which the sample was chosen (*Gravetter & Forzano,* 2011). There are two forms of sampling, namely probability sampling, also known as random sampling, and non-probability sampling, referred to as convenience sampling (*Dudovskiy*, 2011). Probability sampling refers to sampling in which the chance of any given individual to be selected, is known and these individuals are sampled independently of each other. Non-probability refers to when researchers take whatever individuals happen to be easiest to access as participants in a study. Probability sampling in the form of simple random sampling was used to select respondents.

In this study the respondents were all students who were registered for the degree of Bachelor of Science and studying 2$^{nd}$ year physics at the University of the Free State, Bloemfontein Campus, during the 2015 academic year.

### 3.7 MEASURING INSTRUMENT

### 3.7.1 Learning motivation

In order to collect data on the learning motivation of students, the researcher made use of a standardized self-administered questionnaire, namely the Students' Motivation Towards Physics Learning (SMTPL) questionnaire (see Appendix C). The SMTPL questionnaire is an adaptation of the Students' Motivation Towards Science Learning (SMTSL) questionnaire developed by Tuan, Hsiao, Chin & Shieth (*2005*).

The SMTSL questionnaire was developed to measure students' motivation toward science learning (SMTSL) (*Tuan et al.*, 2005). The six scales developed under this questionnaire are: (A) self-efficacy, (B) active learning strategies, (C) science learning value, (D) performance goal, (E) achievement goal and (F) learning environment stimulation. These scales are the key factors that enable the researcher to measure students' learning motivation in science (*Tuan et al*., 2005).

The SMTPL questionnaire consists of 35 questions and uses a 7-point Likert rating scale ranging from 1 to 7 to elicit the relevant data. SECTION 1 of the questionnaire elicited the biographical information of the respondents, while SECTION 2 elicited data regarding the six scales mentioned above.

### 3.7.2 Academic achievement

Academic achievement is commonly measured by examinations or continuous assessment. In this study academic achievement is the actual mark obtained by the students in the examination, as discussed in chapter 1, section 1.2.3 and chapter 2, section 2.9. The data used to represent the academic achievement of the 2nd year physics students were the final examination marks of November 2015, which the students obtained in the first year of their physics course. The researcher was granted permission to use this data and the data was treated confidentially.

There are different variations of the Bachelor of Science (B.Sc.) degree which students can enroll for, inter alia the B.Sc. in Physics, the B.Sc. in Chemistry, the B.Sc. in Geology and the B.Sc. in Applied Mathematics. In some of these programmes mentioned above, physics is a compulsory subject while in others physics may be an elective module. Choosing all students taking 2nd year physics for the study aided the researcher in determining which of these students were studying physics as a major and which of them have selected physics as an elective module. This was determined as each student had to write his major in the particular B.Sc. programme. This enabled the researcher to determine the level of learning motivation among students who have physics as their major and those who chose physics as an elective module. This also aided in understanding what motivated students to choose physics, and what the effects of their motivation were on their academic achievement in this particular course.

### 3.8 VALIDITY AND RELIABILITY OF THE DATA GATHERING METHODS

### 3.8.1 Validity

Validity in surveys relates to how well a measuring instrument measures what it is supposed to measure (*De Vos, Strydom, Fouche & Delport,* 2011). According to Cohen, Manion and Morrison (*2011:133*), validity in quantitative research may be addressed through "careful sampling, appropriate instrumentation and appropriate statistical treatment of data". Although

numerous forms of validity may be distinguished depending on the purposes of the measuring instrument, in this particular study the instrument was subjected to construct validity as a form of measuring validity. Construct validity determines the degree to which an instrument successfully measures a theoretical construct (*Cohen, Manion & Morrison*, 2011).

## 3.8.2 Reliability

Reliability indicates whether the instrument consistently measures what it is intended to measure. Therefore, if the results that the researcher obtains using the measuring instrument are consistent, the measuring instrument will be viewed as being reliable. Reliability is that property of a measuring device which yields consistent measurements when the phenomena is stable, regardless of who uses it and provided that the basic conditions remain the same. Reliability is a property of the measuring instrument used, particularly in quantitative methods of research studies (*Trochim*, 2006).

Based on the research study done by Dudovskiy (*2011*), there are four general classes of reliability, namely: (i) Inter-rater or inter-observer reliability is the extent to which the different raters or observers give consistent estimates of the same phenomenon. (ii) Test-retest reliability assesses the consistency of a measurement from one time to another. (iii) Parallel-forms reliability assesses the consistency of the results of two tests constructed in the same way from the same content domain, and; (iv) Internal consistency reliability assesses the consistency of results across items on the same test instrument (*Dudovskiy*, 2011).

In this research study the researcher focused on the internal consistency of the measuring instrument of the study. The most widely used coefficient for estimating internal consistency reliability is Cronbach's alpha coefficient. The items in the measuring instrument are not scored right or wrong; thus there is a range of possible answers for each item. Using Cronbach's alpha coefficient assumes that all the items in the measuring instrument are equivalent. A reliability coefficient of .70 or higher is considered acceptable in most social science research situations (*de Bruin*, 2013).

This research study uses the SMTPL questionnaire as the measuring instrument, as discussed in this chapter, section 3.7.1. The SMTPL questionnaire is an adaptation of the SMTSL which was developed by Tuan *et al*. (2005). The Cronbach's alpha reliability coefficient for the sub-scales of the SMTSL questionnaire ranged between 0.70 and 0.89. This indicated that the sub-scales of the SMTPL questionnaire have adequate internal consistency reliability.

## 3.9 PROCEDURE FOR ADMINISTERING THE SMTPL QUESTIONNAIRE

The researcher obtained consent from the Head of the Department of Physics, Professor J.J. Terblans to conduct the research study and administer the questionnaire to the 2nd year physics students (see Appendix D).

The respondents were asked to complete the questionnaire in their first term of study in March of the academic year 2015. The reason that the questionnaire was administered during this time was because it was the most appropriate time in the progress of the research study. All the students received the same instructions on filling in the questionnaire. The questionnaire was handed to the students during their physics lecture because the researcher was advised that it would be the best and easiest way to ensure that there is cooperation and participation from the students.

The students were given an informed consent letter (see Appendix E) together with the questionnaire. The consent letter was to ensure that the students understood what the study was about and also to highlight that their participation was completely voluntary.

The respondents' privacy was protected as they were not requested to provide names. The students only needed to indicate their student numbers, age, gender, race and major in their study course. They were only required to write down their student numbers in order to relate it with their academic achievement scores. They were not required to hand in the questionnaires to the researcher directly, as the researcher collected these questionnaires from the lecturers.

The students were asked to indicate their responses to the questions by marking an 'X' in the spaces next to the corresponding statements in the questionnaire. They were asked to respond to each question and were informed that there were no right or wrong answers; all that was required was their opinion regarding physics issues related to their learning motivation and academic achievement.

## 3.10 STATISTICAL TECHNIQUES FOR QUANTITATIVE DATA ANALYSIS

The way the hypotheses is stated will determine the type of methodology, data collection method and statistical techniques that will be used to address the research problem. Statistics can be used to describe an entire population, and summarizing information in order to make sense of it. Statistics can help a researcher to describe social phenomena, identify relationships among them, explore the reasons for these relationships (especially through elaboration), and test hypotheses about them. It is a useful tool for developing our understanding of the social world, a tool that we can use both to test ideas and generate new ones, and to approach a question for research purposes (*Earl*, 2010).

Raw data cannot be interpreted or understood directly and it is thus necessary to analyze it statistically. Data analysis describes the specific instruments of analysis that are used to study research objectives and the type of software that is used to manipulate data. The aim in compiling statistics for analysis is to see if there is any significance in the results obtained, because the acceptance or rejection of a hypotheses is based upon a particular level of significance (*Patel*, 2009).

Statistical significance represents the results of some statistical tests that are performed. The tests performed vary and are dependent on the levels of measurement of the variables and the research objective or hypotheses (*Patel*, 2009). All statistical tests performed will always have one of two outcomes: (i) Reject $H_0$ and Accept $H_1$; this means that the null hypotheses is not true and thus rejected, and the alternative hypotheses is true and therefore accepted. Rejecting the null hypotheses means that there is a significant relationship between the variables, therefore the confidence level will be specified, and (ii) Accept $H_0$ and Reject $H_1$; this means that the null hypotheses is true and thus accepted and the alternative hypotheses is not true and therefore rejected. Accepting the null hypotheses means that there is no significant relationship between the variables, therefore there is no need to specify the confidence level (*Patel,* 2009).

When a hypotheses test is performed, a p-value helps to determine the significance of the results. The hypotheses tests are used to test the validity of the claims about a population. The claim on trial will be the null hypotheses, $H_0$; and the alternative hypotheses, $H_1$, will be accepted if the null hypotheses is concluded to be untrue. The strength of the evidence is weighed by using the

p-value, which is a number that ranges from 0 to 1. A small p-value ($p \leq 0.05$) indicates strong evidence against the $H_0$, therefore the (null) $H_0$ is rejected. A large p-value ($p \geq 0.05$) indicates weak evidence against the $H_0$, therefore the (alternative) $H_a$ hypotheses is rejected. Most of the researchers in statistical methods use a significance level of 0.05 ($p \leq 0.05$) (*Shuttleworth*, 2008).

Statistical Analysis Software (*SAS*, 2012) were used for this research study. A significance level of 0.05 ($p \leq 0.05$) was used. A reputable statistician at the University of the Free State from the Department of Mathematics and Statistics was used to statistically analyze the data.

There are many tests that can be used to analyze data. The test that is chosen depends upon what the researcher is looking for, what data the researcher collected and how the researcher collected the data (*Wheeldon & Ahlberg*, 2012). Mertens (in Dambudzo, 2009:82) suggests that "selecting an appropriate test for a research study in order to determine the p-value is important and the researcher needs to base the selection on four major factors: (i) the level of data, (ii) the number of samples or groups in the research study, (iii) were the data collected from independent groups/samples or from related groups? and, (iv) the characteristics of the data in terms of how data is distributed".

The statistical tests for the analysis of data in this research study were the (i) Fisher's Exact test, (ii) Mann-Whitney U-test, (iii) T-test, (iv) Pearson's Correlation, (v) ANOVA (Analysis of Variance) test and (vi) Hierarchical regression analysis. According to the statistician used for this research study, these were the most suitable to determine the level of significance of the relationship between the variables in this study.

(i)      Fisher's exact test

This test is a statistical test used when there are two variables to determine if proportions for one variable are different among values of the other nominal variable. This test considers a contingency table which displays how different treatments have produced different outcomes. Its null hypotheses is that treatment does not affect the outcome and that the two are independent (*Andale*, 2007).

(ii)     Mann-Whitney U-test

This test is used to compare two population means that come from the same population, to test whether two population means are equal or not, and to test for differences between two independent groups on a continuous measure. It is the alternative test to the independent sample's t-test. It compares medians and converts the scores on the continuous variable to ranks across the two groups. It then evaluates whether the medians for the two groups differ significantly (*Logos*, 2009).

(iii)     T-test

This test is used to test for differences between means when small samples are involved. The t-test can test if: (i) a sample has been drawn from a normal population with known means and variance; (ii) two unknown population means are identical given two independent random samples and; (iii) two paired random samples come from the same normal population (*Patel*, 2009).

(iv)     Pearson's Correlation

Pearson's correlation is used in order to find a correlation between at least two continuous variables and the strength of the relationship between variables. The value for such a correlation lies between -1.00 (no correlation) and 1.00 (perfect correlation). A correlation of 0 means that the variables are not related. A positive correlation indicates a positive relationship, while a negative correlation indicates a negative relationship. The closer a correlation is to -1 or 1, the stronger the relationship between the variables (*Patel*, 2009).

(v)     Hierarchical regression analysis

Hierarchical regression analysis or multiple regression analysis is used in order to predict the value of a variable based on the value of two or more other variables. The variable aimed at being predicted is called the dependent variable or sometimes, the criterion variable. The variables used to predict the value of the dependent variable are called the independent variables or sometimes, the predictor variable. This regression analysis can also determine the overall fit (variance explained) of the model and the relative contribution of each of the predictors to the total variance explained (*Briggs*, 2011)

(vi)   <u>ANOVA (Analysis of Variance)</u>

ANOVA (Analysis of Variance) is similar to two sample t-tests, however, it compares means across more than two groups. ANOVA is used when the researcher is interested in comparing the difference between the groups. Conducting ANOVA alone will not tell the researcher which groups are different from each other, only if there is a difference (*Patel*, 2009).

## 3.11 ETHICAL CONSIDERATIONS

In this research study, the researcher will focus on (i) voluntary participation, (ii) informed consent, (iii) anonymity and confidentiality, and (iv) analysis and reporting of the results.

(i)    Voluntary participation

The respondents in the research study must be aware that their participation is voluntary. They must know that they can choose to withdraw from the study at any time and that it will not have any unfavorable consequences towards them (*Bhattacherjee*, 2012:138).

(ii)   Informed consent

Approval for conducting a research study must be obtained from an institution before any data may be collected by the researcher. Researchers must retain the informed consent forms used for a period of time (often three years) after the completion of the data collection process in order to comply with the norms of scientific conduct in their discipline or workplace (*Bhattacherjee*, 2012:138).

The researcher sought the permission of the Head of the Department of Physics, Professor J.J. Terblans to conduct the research (see Appendix D). Informed consent was also requested from the research respondents. This was done by providing the respondents with an explanation of why the research is being conducted. The researcher attached an informed consent letter to the questionnaire (see Appendix E), making the respondents aware that they were not forced in any way to participate in the research study, and that their participation was totally voluntary.

The researcher obtained ethical clearance from the education faculty of the UFS Faculty of Education Ethics Board. The researcher's ethical clearance number is UFS-HSD2015/0524.

(iii)    Anonymity and confidentiality

In order to protect the respondents' interests and future well-being, their identity must be protected in a study. This is done by using two of the most important principles in research ethics, namely anonymity and confidentiality. Anonymity implies that the researcher or readers of the final research report or paper cannot identify a given response provided by a specific respondent.

Confidentiality means making sure that the privacy of the respondents is protected. No one, except the researcher, should have access to the data and the data must be handled and reported in a way that will not disclose the individual identities of the participating respondents. All data contained in electronic format must be password protected and the hard copies must be locked away (*Bhattacherjee,* 2012:138).

(iv)    Analysis and reporting of findings

Researchers have ethical obligations to the learning institutions to publish research findings. The researcher has to compile a report on how data was analyzed and reported in their study, and this has to be done as accurately and objectively as possible. Any unexpected or negative findings should be fully disclosed, even if the findings cast some doubt on the research design or the findings (*Bhattacherjee*, 2012:138).

In this study, the researcher acknowledged the shortcomings and limitations of this study (see chapter 5, section 5.5).

The results of this research study would be released to the Department of Physics of the UFS Faculty of Natural and Agricultural Sciences.

## 3.12 SUMMARY AND CONCLUSION OF THE CHAPTER

In this chapter the research problem and aim, along with the research hypotheses and the null hypotheses of the study are discussed and the research design is explained and justified in more detail.

The researcher elaborates on the validity and reliability of the questionnaire that was used in this study. The questionnaire, as the researcher's method for data collection, is explained and validated.

The researcher explains the procedure for administering the questionnaire and the statistical techniques that were used for data analysis. Lastly, the ethical considerations applicable to this research study is discussed.

The next chapter provides a discussion of the findings of the study.

## CHAPTER 4: PRESENTATION, ANALYSIS AND INTERPRETATION OF RESULTS

## 4.1 INTRODUCTION

The aim of this research study was to determine the relationship between learning motivation and academic achievement among 2nd year physics students at a South African university. Statistical analyses were done to determine the relationship between these variables. As such chapter 4 presents an analysis and interpretation of the results of the study.

The following aspects are addressed in this chapter, namely:

- data collection
- measurement instrument
- research hypotheses
- statistical analysis procedures
- analysis and interpretation of results; and
- conclusion

## 4.2 DESCRIPTIVE ANALYSIS

### 4.2.1 Distribution of students' majors in the B.Sc. programme

Simple random sampling was used to select respondents. A portion from a population of interest was sampled so that by studying the sample, results can be generalized to the population from which it has been drawn. The study population consisted of 2nd year students studying physics and the sample consisted of 55 2nd year students. In this study the respondents were all students who were registered for the degree of Bachelor of Science and studying 2nd year physics at the University of the Free State, Bloemfontein Campus, during the 2015 academic year. The students were enrolled for various degrees but had a physics module either as a major or as an elective. Students enrolled for variety of majors in their Bachelor of Physics (B.Sc.) degree programme as can be seen in table 4.1 below.

Table 4.1: Distribution of students' majors in the B.Sc. degree progamme:

| MAJOR | N | % |
|---|---|---|
| Chemistry | 4 | 7.27 |
| Engineering | 1 | 1.82 |
| Geology | 10 | 18.18 |
| Mathematics | 1 | 1.82 |
| Mathematics and Statistics | 1 | 1.82 |
| Physics | 19 | 34.55 |
| Physics and Chemistry | 5 | 9.09 |
| Physics and Computer Physics | 3 | 5.45 |
| Physics and Engineering | 5 | 9.09 |
| Physics and Geology | 2 | 3.63 |
| Physics and Mathematics | 3 | 5.45 |
| Physics, Chemistry and Mathematics | 1 | 1.82 |
| **Total** | **55** | **100** |

In the above sample, the most frequent majors were physics (19) and geology (10) and the least frequent majors were mathematics (1), mathematics and statistics (1) and physics, chemistry and mathematics (1).

The data on student learning motivation was collected using a questionnaire, completed by the research participants, as discussed in chapter 3, section 3.5.3. The researcher used a standardized questionnaire for data collection, namely the Students' Motivation Towards Physics Learning (SMTPL) (*Tuan et al.*, 2005). The questionnaire was adapted for this particular research study.

The students' first year final examination marks for 2014 in physics were used to represent the academic achievement of students.

## 4.3 MEASUREMENT INSTRUMENT

### 4.3.1 Students' learning motivation

The Students' Motivation Towards Physics Learning (SMTPL) questionnaire was discussed in chapter 3, section 3.6.1. It is designed to measure students' learning motivation, particularly in physics (*Tuan et al.*, 2005). The questionnaire has six sub-scales, namely, (i) self-efficacy (SE), (ii) active learning strategies (ALS), (iii) physics learning value (PLV), (iv) performance goal (PG), (v) achievement goal (AG) and, (vi) learning environment stimulation (LES). The questionnaire consisted of a total of 35 items, using a 7-point Likert rating scale ranging from 1 to 7. The students were required to rate the items on each sub-scale from 1 ("not at all true") to 7 ("very true") depending on their opinion about the particular statement.

Some of the sub-scales had items that needed to be reversed when scoring the questionnaire, as they were asked in a negative form. A high score in any of the different sub-scales indicates that the student has a high learning motivation in the construct that is being measured by that particular sub-scale. For example, the self-efficacy sub-scale comprises of 7 statements. The highest a student can score is 49 and the lowest is 7. If a student scores 49 in the self-efficacy sub-scale, it is an indication that the student has a high learning motivation in the construct of self-efficacy.

The highest score that a student can obtain for the SMTPL questionnaire as a whole is 245, and the lowest is 35. If the total score for all the six sub-scales is low, it is an indication that the student has a low learning motivation towards physics. The researcher worked with raw scores instead of standardized scores.

The questionnaire was adapted by replacing the word "science" in the original questionnaire with the word "physics". This was done to make the questionnaire applicable to university students who were familiar with the word "physics" while the word "science" is commonly used in schools.

## 4.3.2 Academic achievement

The final first year marks were the core marks that enabled students to continue with physics in the second year, provided that they met the minimum pass requirements. Thus, all participants were students who were registered for the first year physics course in 2014. Using these students' first year marks was the most appropriate way to determine their academic achievement during their first year of study.

Physics is a year module, which means that the students were registered for the module for the first and second semester. Students wrote an examination in June during the first semester and again in November during the second semester. The researcher used the second semester physics examination results. These results were regarded to be the most suitable because of the fact that students have to pass physics during the second semester in order to enroll for second year physics.

## 4.4 RESEARCH HYPOTHESES

In realization of the research aim in this study, the following research hypotheses was formulated, as stated in chapter 3, section 3.4, namely:

**$H_0$: Learning motivation has no influence on the academic achievement of 2nd year physics students at a South African university.**

This research hypotheses was tested in regards to students who have physics as a major and those who have physics as an additional or elective module in the 2nd year. All the students who were registered for the first year physics course wrote the same examination paper at the end of that year. These are the marks that were used to determine the academic achievement of the 2nd year physics students.

The research hypotheses formulated in this study were based on the learning motivation constructs, namely (i) self-efficacy, (ii) active learning strategies, (iii) physics learning value, (vi) performance goal, (v) achievement goal and, (iv) learning environment stimulation. Each learning motivation construct relating to students who have physics as a major and those who have it as an additional subject or an elective subject was tested in terms of the following hypotheses:

**H$_{0a}$: There is no significant relationship between self-efficacy and academic achievement.**

**H$_{0b}$: There is no significant relationship between students' learning strategies and academic achievement.**

**H$_{0c}$: There is no significant relationship between students' perception of the value of physics and academic achievement.**

**H$_{0d}$: There is no significant relationship between students' performance goals and academic achievement.**

**H$_{0e}$: There is no significant relationship between students' achievement goals and academic achievement.**

**H$_{0f}$: There is no significant relationship between learning environment and academic achievement.**

The strength of the evidence is weighed by using the p-value, which is a number that ranges from 0 to 1. A small p-value ($p \leq 0.05$) indicates strong evidence against the H$_0$, therefore the H$_0$ is rejected. A large p-value ($p \geq 0.05$) indicates weak evidence against the H$_0$, and therefore the H$_a$ hypotheses is rejected. Most of the researchers in statistical methods use a significance level of 0.05 (i.e. $p \leq 0.05$) (*Shuttleworth,* 2008). In this research study the researcher tested the null hypotheses H$_0$, and H$_{0a}$-H$_{0f}$ at a 0.05 ($p \leq 0.05$) significance level.

Statistical data analysis was done by means of Statistical Analysis Software (*SAS*, 2012) for this research study.

The researcher will now discuss the statistical analyses procedures that were used to test these research hypotheses.

## 4.5. STATISTICAL ANALYSIS OF QUESTIONNAIRE DATA

Data for the SMTPL questionnaire from 55 study participants were available, consisting of the students' final examination marks for the first year physics module in 2014, biographical data (gender, race and major subject) and students' responses to the statements in the questionnaire. For a further 13 participants, the data for the exam marks was available, but these participants did not fill in the questionnaire.

### 4.5.1 Biographical data

Biographical data was available for gender, race and major subject. Frequencies and corresponding percentages for the biographical data were calculated and tabulated in frequency tables.

Frequency tables, according to Patel (2009:4), are "a detailed description of the categories/values for one variable". A frequency table most often includes all of the following: (i) absolute frequency (or just frequency), (ii) relative frequency (or percent) and, (iii) cumulative frequency. Absolute frequency indicates the number of times a particular category in a particular variable occurs. Relative frequency or percent indicates the percentage of each category/value relative to the total number of cases. Cumulative frequency is simply a cumulation of the relative frequency for each category/value (*Patel*, 2009).

### 4.5.1.1 Gender

Table 4.2: Frequency table: Gender

| GENDER | Frequency | Percent (%) |
|--------|-----------|-------------|
|        |           |             |
| Male   | 41        | 75 (74.55)  |
| Female | 14        | 25 (25.45)  |

Table 4.2, above, shows that out of the 55 2nd year physics students who participated in the study, 41 (75%) were male students and 14 (25%) were female students.

**4.5.1.2 Race**

Table 4.3: Frequency table: Race

| RACE | Frequency | Percent (%) |
|------|-----------|-------------|
|      |           |             |
| Black | 38 | 69.09 |
| Coloured | 2 | 3.64 |
| White | 15 | 27.27 |

Table 4.3, above, shows that the majority of the students were black (69%), with the minority being white (27.27%) and coloured (3.64%).

**4.5.1.3 Major subject**

Table 4.4: Frequency table: Major subject

| MAJOR SUBJECT | Frequency | Percent (%) |
|---------------|-----------|-------------|
| Chemistry | 4 | 7.27 |
| Engineering | 1 | 1.82 |
| Geology | 10 | 18.18 |
| Mathematics | 1 | 1.82 |
| Mathematics & Statistics | 1 | 1.82 |
| Physics | 19 | 34.55 |
| Physics & Chemistry | 5 | 9.09 |
| Physics & Computer Physics | 3 | 5.45 |
| Physics & Engineering | 5 | 9.09 |
| Physics & Geology | 2 | 3.64 |
| Physics & Mathematics | 3 | 5.45 |
| Physics, Chemistry & Mathematics | 1 | 1.82 |

Table 4.4, above, indicates that there were 12 categories (combinations) of majors. These categories suggest that students were registered for 12 different majors in their B.Sc. degree programme. For example, four 2nd year students were registered for B.Sc. and were majoring in chemistry.

Table 4.4 also shows that the majority of students (i.e. 38); 69.09% had physics as a major while the rest had either chemistry, engineering, geology, mathematics or physics in combination with other subjects as a major.

For further analysis, a binary variable "Major Class" (see table 4.5, below) was created, categorizing participants into those who had a physics major, and those who did not have it as a major.

Table 4.5: Participants with a physics major and other majors

| MAJOR CLASS | Frequency | Percent (%) |
|---|---|---|
| | | |
| Other Major | 17 | 30.91 |
| Physics Major | 38 | 69.09 |

From table 4.5, above, it is clear that 17 (30,91%) students were registered for the B.Sc. degree and majoring in other subjects, while 38 (69,09%) students were registered for the B.Sc. degree and majoring in physics.

In sum it can be stated that of the 55 students, 41 were male, 38 black, and 38 were majoring in physics. This means that majority of students that are doing physics 2nd year are black male students majoring in physics.

**4.5.2 Statistical comparison of biographical data and exam marks between participants with and without questionnaire data**

Since there were participants with questionnaire data and participants without such data, the question was whether biographical data and exam marks differed between participants with questionnaire data and participants without such data. If there were differences, it would suggest a potential bias in the sample of participants with questionnaire data.

In order to investigate this question, the binary variable "questionnaire data available" was created. The association between the biographical variables: gender, race and major subject on the one hand and "questionnaire data available" on the other hand was then assessed using Fisher's exact

test at a significance level of 0.05 (p ≤ 0.05). None of the associations were statistically significant as can be seen in the paragraphs below.

Table 4.6: Association between gender and questionnaire data

| Gender | Questionnaire Data | | |
|---|---|---|---|
| | No | Yes | Total |
| Male | 11.00 21.15% | 41.00 78.85% | 52 |
| Female | 2.00 12.50% | 14.00 87.50% | 16 |
| Total | 13.00 | 55.00 | 68 |

From table 4.6 above, it is apparent that there was a total of 68 questionnaire data available; of which 52 questionnaire data was from the males' students and 16 questionnaire data was from the females' students. The total number of students who participated in completing the questionnaire fully were 55 and those who did not were 13. From the total of 52 male students, 41 completed the questionnaire, while 11 did not complete the questionnaire. From the total of 16 female students, 14 completed the questionnaire, while 2 did not complete the questionnaire.

The p-value for Fisher's exact test for association between the biographical variable GENDER and "questionnaire data available" was 0.717. This p-value is large and shows that there is no statistically significant association between gender and "questionnaire data available".

Table 4.7: Association between race and questionnaire data

| Race | Questionnaire Data | | |
|---|---|---|---|
| | No | Yes | Total |
| Black | 10.00<br><br>20.83% | 38.00<br><br>79.17% | 48 |
| Coloured | 0.00<br>0.00% | 2.00<br>100.00% | 2 |
| White | 3.00<br>16.67% | 15.00<br>83.33% | 18 |
| Total | 13.00 | 55.00 | 68 |

As shown in table 7 above, there was a total of 68 questionnaire data available. The students who participated in completing the questionnaire were 55 in total, and those who did not were 13. There were 38 black students who completed the questionnaire, and 10 who did not. There were only 2 coloured students and both of them completed the questionnaire. There were 18 white students, 15 completed the questionnaire and 3 did not.

The p-value for Fisher's exact test for association between the biographical variable RACE and "questionnaire data available" is 0.100. This p-value is large and shows that there is no statistically significant association between race and "questionnaire data available".

Table 4.8: Association between major subject and questionnaire data

| Major subject | Questionnaire Data | | |
|---|---|---|---|
| | No | Yes | Total |
| Physics | 3.00<br>15.00 | 17.00<br>85.00 | 20 |
| Other | 10.00<br>20.83 | 38.00<br>79.17 | 48 |
| Total | 13.00 | 55.00 | 68 |

As shown in table 4.8, above, there was a total of 68 questionnaire data available. Students who participated in completing the questionnaire were 55 in total, and those who did not complete the questionnaire were 13. There was a total of 20 students registered for the B.Sc. degree who majored in physics. From these students, 17 completed the questionnaire while 3 did not complete the questionnaire. There was a total of 48 students registered for the B.Sc. degree who majored in other subjects. From these students, 38 completed the questionnaire while 10 did not complete the questionnaire.

The p-value for Fisher's exact test for association between the biographical variable MAJOR SUBJECT and "questionnaire data available" is 0.741. This p-value is large and shows that there is no statistically significant association between major subject and "questionnaire data available".

Examination marks (EM) for participants with questionnaire data and for those without questionnaire data were compared using one-way ANOVA. The examination marks (EM) used were the 2nd year students' first year physics examination marks of 2014.

Table 4.9: ANOVA test results for participants with and without questionnaire data

| Analysis of variance for the variable EM Classified by Variable Questionnaire Data | | |
|---|---|---|
| Questionnaire Data | N | Mean |
| Yes | 55 | 64.0 |
| No | 13 | 61.8 |

| 10 Source | DF | Sum of Squares | Mean Square | F-Value | Pr>F |
|---|---|---|---|---|---|
| Among | 1 | 90.962752 | 90.962752 | 1.1644 | 0.2845 |
| Within | 66 | 5155.904895 | 78.119771 | | |

*DF (Degrees of freedom); F-Value (variance of the group means / mean of the within group variances); Pr (Observed statistical value).

As shown in table 4.9 above, the physics examination marks (EM) between participants with and without questionnaire data were compared. Out of a total of 68 students, 55 students completed the questionnaire while 13 did not complete the questionnaire. The p-value obtained through the ANOVA was large: 0.285. Again, the examination results for participants with questionnaire data and for those without questionnaire data were not statistically different.

### 4.5.3 Statistical procedure for testing the null hypotheses

The relationship between the predictor variable, learning motivation, and the criterion variable, academic achievement, was investigated. The predictor variable is represented by the six sub-scales, namely: (i) self-efficacy, (ii) active learning strategies, (iii) physics learning value, (vi) performance goal, (v) achievement goal and, (iv) learning environment stimulation. The criterion variable is represented by the examination marks (EM) of the students. Conventional Pearson's correlation coefficients and the corresponding p-values were calculated in order to investigate this relationship.

### 4.5.3.1 Statistical analysis for correlation coefficients

The correlation coefficient is a statistical measure that indicates the extent to which two or more variables fluctuate with each other (*Patel*, 2009). According to Patel (*2009*), a positive correlation indicates the extent to which the criterion and predictor variables increase or decrease parallel to each other, and a negative correlation indicates the extent to which one variable increases as the other one decreases. The value of the correlation coefficient ranges from -1 to +1. The greater the absolute value of the correlation coefficient, the stronger the linear relationship between the variables (*Patel*, 2009).

In this study, the correlation coefficients were calculated between the predictor and criterion variables, as well as correlations among the predictor variables. These coefficients are presented in table 4.10.

Table 4.10: Correlation between predictor and criterion variables, and the correlation among predictor variables

| VARIABLES | Second Year (n=55) | | | | | |
|---|---|---|---|---|---|---|
| | SE | ALS | PLV | PG | AG | LES |
| EM | 0.09977 | 0.03915 | 0.07193 | -0.22927 | -0.09586 | 0.13456 |
| | (0.4686) | (0.7766) | (0.6018) | (0.0922) | (0.4863) | (0.3274) |
| SE | | 0.55478 | 0.28972 | 0.04329 | 0.28218 | 0.35827 |
| | | (<.0001) | (0.0319) | (0.7537) | (0.0369) | (0.0072) |
| ALS | | | 0.40315 | 0.10205 | 0.27969 | 0.44092 |
| | | | (0.0023) | (0.4585) | (0.0386) | (0.0008) |
| PLV | | | | -0.09675 | 0.44359 | 0.4527 |
| | | | | (0.4823) | (0.0007) | (0.0005) |
| PG | | | | | 0.08356 | -0.05667 |
| | | | | | (0.5442) | (0.6811) |
| AG | | | | | | 0.34451 |
| | | | | | | (0.01) |
| LES | | | | | | - |
| | | | | | | - |

From table 4.10, above, based on correlation coefficients calculated the following becomes apparent:

- There are positive and negative correlations between the criterion variable, academic achievement (EM) and any of the predictor variables.
- There are positive correlations between criterion variable EM and the predictor variables namely: SE (0.09977), ALS (0.03915), PVL (0.07193), and LES (0.13456).
- There are negative correlations between criterion variable EM and the predictor variables namely: PG (-0.22927), and AG (-0.09586).
- There is, however, not a strong linear relationship between the criterion variable EM and any of the predictor variables, since the largest absolute value of any of the correlation coefficients is only 0.23.
- The sub-scales of the predictor variable show positive and negative correlations among each other.

- Positive correlations among sub-scales of the predictor variable are SE with ALS (0.55478), PLV (0.28972), PG (0.04329), AG (0.28218), and LES (0.35827); ALS with PVL (0.40315), PG (0.10205), AG (0.27969), and LES (0.44092); PVL with AG (0.44359), and LES (0.45270); PG with: AG (0.08356) and; AG with LES (0.34451).

- Negative correlations among sub-scales of the predictor variable are: PVL with PG (-0.09675) and; PG with LES (-0.05667).

- There is also not a strong linear relationship among the sub-scales of the predictor variable, since the largest absolute value of any of the correlation coefficients among the sub-scales is only 0.55.

The researcher considered the significance level between the criterion variable, academic achievement (EM) and the predictor variables. A significance level of 0.05 ($p \leq 0.05$) was used in this research study. The p-values were calculated between the criterion variable, academic achievement (EM) and the predictor variables, as well as among the predictor variables themselves. These p-values are presented in table 4.10 above and are the values in brackets. P-values $\leq 0.05$ show that there is a statistical significant correlation among variables. P-values $\geq 0.05$ show there is no statistical significant correlation among variables.

From table 4.10, above, based on p-values the following becomes apparent:

- There is no statistically significant correlation between the criterion variable, academic achievement (EM) and any of the predictor variables. EM and SE (0.4686); EM and ALS (0.7766); EM and PLV (0.6018); EM and PG (0.0922); EM and AG (0.4863) and; EM and LES (0.3274).

- There are statistically significant correlations and statistically not significant correlations among the sub-scales of the predictor variable.

- There is statistically significant correlation among SE and: ALS (<.0001); PLV (0.0319); AG (0.0369) and; LES (0.0072). There is no statistical significant correlation among SE and PG (0.7537).

- There is statistical significant correlation among ALS and: PLV (0.0023); AG (0.0386); and LES (0.0008). There is no statistical significant correlation among ALS and PG (0.4585).

- There is statistical significant correlation among PLV and: AG (0.0007) and LES (0.0005). There is no statistical significant correlation among PLV and PG (0.4823).
- There is no statistical significant correlation among PG and: AG (0.5442) and; LES (0.6811).
- There is statistical significant correlation among AG and LES (0.01).

### 4.5.4 Hierarchical regression analysis

Hierarchical regression analysis was done in order to determine if the contributions of the predictor variable to the variance in the academic achievement of students were significant.

The EM (dependent variable) was regressed against the following independent variables: the six SMTPL domain averages, and the biographical variables gender (male/female), race (black/coloured/white) and major subject (physics/other).

In a first analysis run, the regression model was fitted with all the above independent variables present, without model selection (The full model).

Table 4.11: ANOVA table of the full regression model

| Source | DF | F Value | Pr > F |
|---|---|---|---|
| Race | 2 | 4.96 | 0.0115 |
| Major class | 1 | 3.32 | 0.0751 |
| Gender | 1 | 3.87 | 0.0553 |
| Self-efficacy | 1 | 2.52 | 0.1196 |
| Active learning strategies | 1 | 0.38 | 0.54 |
| Physics learning value | 1 | 1.24 | 0.2708 |
| Performance goal | 1 | 0.03 | 0.8696 |
| Achievement goal | 1 | 1.37 | 0.2488 |
| Learning environment stimulation | 1 | 0.14 | 0.7084 |
|  |  |  |  |

From table 4.11, above, based on p-values the following becomes apparent:

- There is statistically significant contribution of the predictor variable to the variance in the academic achievement of students: EM and Race (0.0115).
- There is no statistically significant contribution of the predictor variable to the variance in the academic achievement of students: EM and Major class (0.0751); EM and Gender (0.0553); EM and Self-efficacy (0.1196); EM and Active learning strategies (0.54); EM and Physics learning value (0.2708); EM and Performance goal (0.8696); EM and Achievement goal (0.2488) and; EM and Learning environment stimulation (0.7084).

In a second analysis run, the regression model was fitted with all the above variables present, followed by stepwise model selection using Mallow's Cp as model selection criterion. Table 4.12, below presents the selected model, based on Mallow's Cp.

Table 4.12: Mallow's C(p) table as model selection criterion

| Root MSE | 8.17857 |
|---|---|
| Dependent Mean | 64.01818 |
| R-Square | 0.2653 |
| Adj R-Sq | 0.1903 |
| AIC | 293.81376 |
| $AIC_C$ | 296.19674 |
| BIC | 240.95229 |
| C(p) | 3.45881 |
| SBC | 248.85776 |

*Root MSE (Root mean squared error); R-squared (Root squared), Adj R-Sq (Adjusted R-squared); AIC (Akaike information criterion); $AIC_C$ (corrected Akaike information criterion); (BIC) Bayesian information criterion; C(p) (Customer's tolerance range) and SBC (Schwarz's Bayesian Criterion).

From table 4.12, above, based on C(p) value the following becomes apparent:

▪ Using Mallow's C(p) value as a selection criterion, C(p) (3.45811) is the value of criterion that is used from the stepwise model selection.

After fitting the regression model followed by stepwise model selection using Mallow's Cp, the model selection stopped at a local minimum of the C(p) criterion.

Table 4.13: ANOVA table of the selection regression model

| Stepwise Selection Summary | | | | |
|---|---|---|---|---|
| Step | Effect | Number | Number | $C_P$ |
| | Entered | Effects In | Parms In | |
| 0 | Intercept | 1 | 1 | 10.2335 |
| 1 | Race | 2 | 3 | 6.3352 |
| 2 | GENDER | 3 | 4 | 4.6526 |
| 3 | Major_class | 4 | 5 | 4.335 |
| 4 | Self_efficacy | 5 | 6 | 3.4588* |
| * Optimal Value Of Criterion | | | | |

From table 4.13, above, based on C(p) value the following becomes apparent:

▪ The model selection stopped at optimal C(p) value of criterion (3.4588).
▪ The sub-set self-efficacy has the C(p) value (3.4588).
▪ Self-efficacy has the correlating local minimum C(p) value (3.45881) of the selection model.
▪ From this model selection process, it is seen that self-efficacy is the best sub-set of the predictor variable, learning motivation.

## 4.6 CONCLUSION

From the results of this study, it was found that:

- From the total of 55 students participants, 41 were male, 38 black, and 37 were majoring in physics. Thus the majority of $2^{nd}$ year students were black male students who were majoring in physics.

- There are positive and negative correlations between learning motivation and academic achievement among the 2nd year physics students. Positive correlations exist amongst academic achievement and the following learning motivation sub-scales: self-efficacy (0.09977), active learning strategies (0.03915), physics learning value (0.07193) and learning environment stimulation (0.13456). Negative correlations exist between academic achievement and the following learning motivation sub-scales: performance goal (-0.22927) and achievement goal (-0.09586).

- There is no strong correlation that exists between learning motivation and academic achievement of the 2nd year physics students.

- There is no statistical significant correlation between the learning motivation and academic achievement of 2nd year physics students. Academic achievement and the following learning motivation sub-scales: self-efficacy (0.4686); active learning strategies (0.7766); physics learning value (0.6018); performance goal (0.0922); achievement goal (0.4863) and learning environment stimulation (0.3274).

- There exists statistically significant correlations and statistically not significant correlations among the sub-scales of learning motivation.

- Self-efficacy has a statistical significant correlation with the following: active learning strategies (<.0001); physics learning value (0.0319); achievement goal (0.0369) and learning environment stimulation (0.0072) and there is no statistical significant correlation among self-efficacy and performance goal (0.7537).

- Active learning strategies has a statistical significant correlation with the following: physics learning value (0.0023); achievement goal (0.0386) and learning environment stimulation (0.0008); and there is no statistical significant correlation among active learning strategies and performance goal (0.4585).

- Physics learning value has a statistical significant correlation with the following: achievement goal (0.0007) and learning environment stimulation (0.0005), and there is no statistical significant correlation among physics learning value and performance goal (0.4823).

- Performance goal has no statistical correlation with the following: achievement goal (0.5442) and learning environment stimulation (0.6811).

- There is statistical significant correlation among achievement goal and learning environment stimulation (0.01).

- Based on the stepwise selection model, the sub-set self-efficacy has the correlating local minimum $C(p)$ value 3.4588 of the selection model.

- From all the sub-scales of learning motivation i.e. self-efficacy (SE), active learning strategies (ALS), physics leaning value (PGV), performance goal (PG), achievement goal (AG) and, learning environment stimulation (LES), it is evident that self-efficacy is the sub-scale of students' learning motivation that can best predict students' academic achievement.

## CHAPTER 5: CONCLUSIONS, IMPLICATIONS AND LIMITATIONS

## 5.1 INTRODUCTION

It is reported that students who are high academic achievers are the most motivated to learn and excel in learning activities, and those who are poor academic achievers are not motivated to learn and are at risk of dropping out before they complete their degree (*Harde & Reeve,* 2003).

The aim of the study was to determine if the learning motivation of the 2nd year physics students at the University of the Free State can determine or predict the students' level of academic achievement.

The main objective of this study was to determine if there is a significant relationship between learning motivation and academic achievement among 2nd year physics students at a South African university. In addition the researcher wanted to determine if the learning motivation of 2nd year physics students at the University of the Free State can determine or predict the students' level of academic achievement. The results of the study are based on the responses of 55 students who participated in the study.

This chapter also provides a discussion and summary of the results emanating from the data collected during the research. Conclusions are drawn and recommendations are made, based on the analysis of the collected data. Limitations to the study are in the final instance presented.

## 5.2. FINDINGS IN RESPECT OF THE RELATIONSHIP BETWEEN LEARNING MOTIVATION AND ACADEMIC ACHIEVEMENT

### 5.2.1 Literature review

There are three different theories that are important in educational psychology of academic learning. The Attribution theory (*Weiner*, 1972), Self-determination theory (*Ryan & Deci*, 2000) and Maslow's hierarchy of needs theory (*Maslow*, 1943) are the three most appropriate theories in terms of understanding students' learning motivation. The attribution theory assumes that students actually try to determine why they do what they do, that is, interpret reasons for a particular behavior. This theory helps to determine and understand students' motivation. The self-

determination theory in turn explores the intrinsic and extrinsic motivational traits of students. Maslow's hierarchy of needs theory shows that the basic needs of individuals have to be met first before an individual can be expected to set goals and to fully engage and succeed in achieving the goals.

Numerous studies have been done to determine how learning motivation might influence the academic achievement of students (*Pintrich and Maehr*, 2004; *Larson*, 2000; *Pintrich & Schunk*, 2002; *Pugh & Bergin,* 2006; *Hardré & Reeve,* 2003). According to these studies (see chapter 2, section 2.1), learning motivation is related to students' academic achievement and it determines the goals students strive towards, thus influencing the amount of time and effort students put in activities related to their goals.

Despite the studies done on learning motivation and academic achievement, little research has been done on how students perform in different subjects. Based on the study done by Ormrod (*2004*) which suggests that students are differently motivated in different subjects it was thus important to specifically determine how learning motivation may influence the academic achievement of students in a particular subject such as physics.

### 5.2.2 Summary of research findings

The study revealed the following about the relationship between learning motivation and academic achievement among 2nd year physics students:

- There is a weak correlation between learning motivation and academic achievement among 2nd year physics students (see chapter 4, section 4.5.3).
- There is no significant relationship between learning motivation and academic achievement among 2nd year physics students (see chapter 4, section 4.5.3).
- Learning motivation has no influence on the academic achievement of 2nd year physics students at a South African university (see chapter 4, section 4.5.3).
- The six constructs of learning motivation, namely: (A) self-efficacy, (B) active learning strategies, (C) physics learning value, (D) performance goal, (E) achievement goal and (F) learning environment stimulation, however, show significant relationships among each other (see chapter 4, section 4.5.3).

- The six constructs of learning motivation can contribute in determining the relationship between learning motivation and academic achievement among 2nd year physics students (see chapter 4, section 4.5.3).

- Self-efficacy is the construct that best predicts students' learning motivation (see chapter 4, section 4.5.4).

- Self-efficacy can predict academic achievement among 2nd year physics students (see chapter 4, section 4.5.4).

**5.2.3 Brief discussion of findings in respect of the relationship between learning motivation and academic achievement**

The literature review in this study shows that the level of students' learning motivation does not play a role in the way students will perform academically (see chapter 2, section 2.10).

The findings of this study show a weak correlation between learning motivation and academic achievement of students (see chapter 4, section 4.5.3). The findings of this study are supported by a study done by Areepattamannil and Freeman (*2008*), for instance, that shows a weak correlation between learning motivation and academic achievement. However, there are studies that show a positive correlation between learning motivation and academic achievement (*Deci & Ryan*, 2002; *Sikhwari,* 2004 & *Bakara*, 2010). However, these findings by Areepattamannil and Freeman (*2008*); Deci and Ryan (*2002)*; Sikhwari (*2004*) and Bakara (*2010*) were not based on the relationship between learning motivation and academic achievement in a particular subject.

Research done by Ormrod (*2011*) indicated that students have different motivational traits in different subjects and that students' learning motivation is based on a particular subject. The findings in this this study indicate that learning motivation has no influence on the academic achievement of 2nd year physics students (see chapter 4, section 4.5.3).

The findings in this study, however, showed that self-efficacy is the best construct of learning motivation to predict students' academic achievement. These findings are in line with much research that was done on students' self-efficacy and academic achievement (*Tuan, Hsiao, Chin & Shieth*, 2005; *Klassen, Krawchuk & Rajani*, 2008; *Chandler, Heffer & Turner*, 2009; *Strelnieks*, 2005) (see chapter 2, section 2.7.1).

In a study done by Tuan, Hsiao, Chin & Shieth (*2005*), self-perception of ability, effort, intrinsic goal orientation, task value, self-efficacy, test anxiety, self-regulated learning, task orientation and learning strategies were all factors that influenced students' learning motivation (see chapter 2, section 2.7.1). Klassen, Krawchuk and Rajani (*2008*) showed that self-efficacy is a strong predictor of students' performance. It was further showed by Chandler, Heffer and Turner (*2009*) that self-efficacy correlates highly with students' academic achievement. In a study done by Strelnieks (*2005*) to determine the influence of parenting styles, achievement motivation and self-efficacy on students' academic achievement, the results indicated that self-efficacy was a significant predictor of students' academic achievement.

The study done by Strelnieks (*2005*) also showed that self-efficacy could accurately predict females' academic achievement but it was inaccurate to predict how males performed academically. The findings also showed that self-efficacy could only predict the academic achievement of students with higher socio-economic status (*Strelnieks,* 2005).

Future research could be done to take the above findings of Strelnieks (*2005*) further by investigating how exactly the influence of self-efficacy on academic, achievement depended on some external factors, such as gender and socio-economic status.

**5.2.4 Brief discussion of findings in respect of the hypotheses and research focus**

This section addresses the hypotheses and research focus of this study. The results of the investigation of the hypotheses are discussed, and the focus is on the way in which the research question has been addressed.

### 5.2.4.1 Hypotheses

The main research hypotheses for this research study was the following:

> Learning motivation has an influence on the academic achievement of 2nd year physics students at a South African university

The null hypotheses for this main hypotheses was:

> Learning motivation has no influence on the academic achievement of 2nd year physics students at a South African university.

The findings from the investigation of the main research hypotheses shows that:

> Learning motivation has no influence on the academic success of 2nd year physics students at a South African university since the null hypotheses of this study could not be discarded on the 5% level of significance.

These findings confirm the findings of Areepattamannil and Freeman (*2008*) that there is no significant relationship between learning motivation and the academic achievement of students.

### 5.2.4.2 The hypotheses based on constructs of learning motivation

Based on the constructs of learning motivation, namely self-efficacy, active learning strategies, physics learning value, performance goal, achievement goal and learning environment stimulation, the following hypotheses were proposed in this study:

1. THE HYPOTHESES BASED ON SELF-EFFICACY:

The research hypothesEs for the construct self-efficacy was the following:

> There is a significant relationship between self-efficacy and academic achievement.

The null hypotheses for the construct self-efficacy was the following:

> There is no significant relationship between self-efficacy and academic achievement.

The findings from the investigation for the construct self-efficacy shows that:

There is no significant relationship between self-efficacy and academic achievement since the null hypotheses of this construct could not be discarded on the 5% level of significance (see chapter 4, section 4.5.3).

2.  THE HYPOTHESES BASED ON ACTIVE LEARNING STRATEGIES:

The research hypotheses for the construct active learning strategies was the following:

There is a significant relationship between active learning strategies and academic achievement.

The null hypotheses for the construct active learning strategies was the following:

There is no significant relationship between active learning strategies and academic achievement.

The findings from the investigation for the construct active learning strategies shows that:

There is no significant relationship between active learning strategies and academic achievement since the null hypotheses of this construct could not be discarded on the 5% level of significance (see chapter 4, section 4.5.3).

3.  THE HYPOTHESES BASED ON PHYSICS LEARNING VALUE:

The research hypotheses for the construct physics learning value was the following:

There is a significant relationship between students' perception of the value of physics and academic achievement.

The null hypotheses for the construct physics learning value was the following:

There is no significant relationship between students' perception of the value of physics and academic achievement.

The findings from the investigation for the construct physics learning value shows that:

There is no significant relationship between physics learning value and academic achievement since the null hypotheses of this construct could not be discarded on the 5% level of significance (see chapter 4, section 4.5.3).

4.  THE HYPOTHESES BASED ON PERFORMANCE GOAL:

The research hypotheses for the construct performance goal was the following:

There is a significant relationship between students' performance goal and academic achievement.

The null hypotheses for the construct performance goal was the following:

There is no significant relationship between students' performance goal and academic achievement.

The findings from the investigation for the construct performance goal shows that:

There is no significant relationship between performance goal and academic achievement since the null hypotheses of this construct could not be discarded on the 5% level of significance (see chapter 4, section 4.5.3).

5.  THE HYPOTHESES BASED ON ACHIEVEMENT GOAL:

The research hypotheses for the construct achievement goal was the following:

There is a significant relationship between students' achievement goal and academic achievement.

The null hypotheses for the construct achievement goal was the following:

There is no significant relationship between students' achievement goal and academic achievement.

The findings from the investigation for the construct achievement goal shows that:

> There is no significant relationship between achievement goal and academic achievement since the null hypotheses of this construct could not be discarded on the 5% level of significance (see chapter 4, section 4.5.3).

6.  THE HYPOTHESES BASED ON LEARNING ENVIRONMENT STIMULATION:

The research hypotheses for the construct learning environment stimulation was the following:

> There is a significant relationship between students' learning environment stimulation and academic achievement.

The null hypotheses for the construct learning environment stimulation was the following:

> There is no significant relationship between students' learning environment stimulation and academic achievement.

The findings from the investigation for the construct learning environment stimulation shows that:

> There is no significant relationship between students' learning environment stimulation and academic achievement since the null hypotheses of this construct could not be discarded on the 5% level of significance (see chapter 4, section 4.5.3).

## 5.3 RECOMMENDATIONS

This study indicated that there is no relationship between learning motivation and academic achievement among 2nd year physics students at a higher education institution. Despite this fact, the study showed that self-efficacy is the best sub-scale of learning motivation that can be used to determine the outcome of students' achievement.

Since other researchers (*Tuan, Hsiao, Chin & Shieth,* 2005; *Klassen, Krawchuk & Rajani,* 2008; *Chandler, Heffer & Turner* 2009; *Strelnieks,* 2005) showed that self-efficacy correlates highly with students' academic achievement, it is thus recommended that the relationship between self-efficacy and academic achievement among university students in South Africa be further investigated. This proposed study is based on the study done by Strelnieks (*2005*) which shows

that self-efficacy has an influence on academic achievement of students but depends on gender and socio-economic status of students.

Further research can be done in other departments at the different universities, exploring interests in different subject

## 5.4 LIMITATIONS TO THE STUDY

This study is an attempt to contribute to the existing knowledge base about learning motivation and academic achievement.

There are, however, certain limitations to this study:

1) The sample of this study was only taken from one department at one university, and thus the findings cannot be generalized to all the other departments at the same university or other universities.

2) The researcher used non-probability sampling and did not do random sampling (see chapter 3, section 3.5.3).

3) The measuring instrument was a structured questionnaire with close ended questions. Students had limited options of responses.

4) Students may not be capable of providing unbiased, generalized responses regarding their goals, values, interests, and effort.

5) Cognitive aspects of motivation are not directly observable and thus learning motivation is most commonly assessed using self-report measures or rating scales.

6) Several published instruments exist, but these typically have to be modified to best fit whatever concept is investigated.

## 5.5 CONCLUSION

The academic achievement of students is a high priority in any learning institution. Educators constantly strive to help students achieve academic success. The literature has indicated that students' learning motivation is an important variable that can contribute in influencing the academic achievement of students.
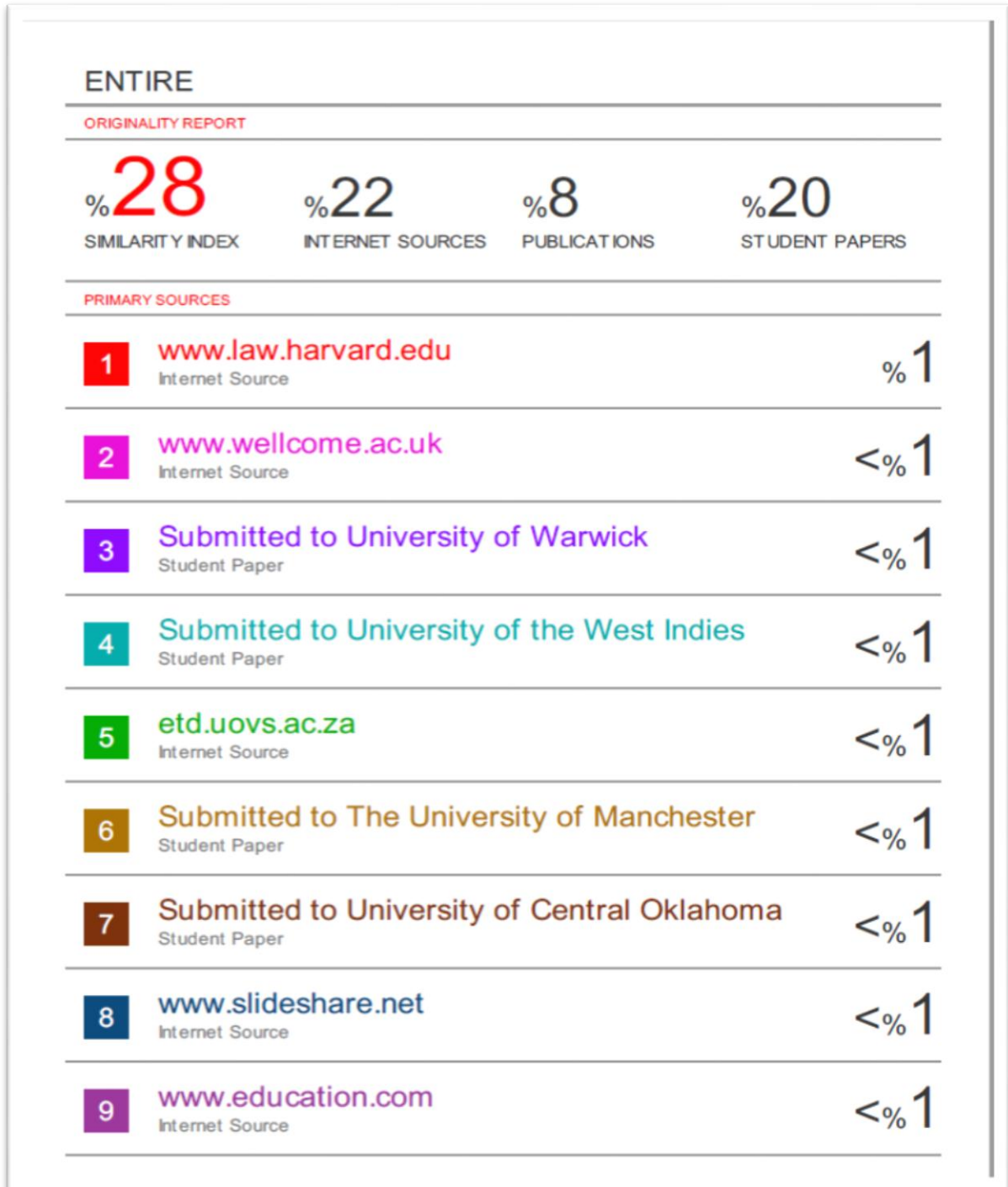
This research study investigated the relationship between learning motivation and academic achievement among 2nd year physics students at the University of the Free State. The results were based on the questionnaire responses of the students.

The statistical tests that were used for the analysis of data in this study were: (i) Mann-Whitney U-test, (ii) T-test, (iii) Pearson's Correlation, and (iv) ANOVA (Analysis of Variance). Based on the findings from this study, there are some positive and negative correlations between learning motivation and academic achievement among 2nd year physics students. There is no significant relationship between learning motivation and the academic success of students. It appears that motivation has no influence on the academic success of 2nd year physics students at a South African university.

From all the sub-scales of the Students' Motivation Towards Physics Learning (SMTPL) questionnaire, self-efficacy (SE) is the best sub-scale to determine students' learning motivation. These findings are consistent with findings from some literature studies (see chapter 2, section 2.6.1). Thus, the best way to determine what influences the academic success of students is by investigating the influence of students' self-efficacy on the academic achievement of university students in a particular subject.

**APPENDIX F**

**PLAGIARISM SUMMARY REPORT COMPILED IN THE TURNITIN PLAGIARISM SEARCH ENGINE**

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ORIGINALITY REPORT

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| **5** | etd.uovs.ac.za<br>Internet Source | <%1 |
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| 30 | study.com <br> Internet Source | <%1 |
| 31 | Amrai, Kourosh, Shahrzad Elahi Motlagh, Hamzeh Azizi Zalani, and Hadi Parhon. "The relationship between academic motivation and academic achievement students", Procedia - | <%1 |

Social and Behavioral Sciences, 2011.
Publication

32    Submitted to Westminster International College - Kuala Lumpur
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33    Submitted to Laureate Education Inc.
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34    documents.mx
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35    www.icaseonline.net
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36    faculty.chicagobooth.edu
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**44** Submitted to University of Sunderland
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**45** www.psy.miami.edu
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**46** Paul R. Pintrich. "A Motivational Science Perspective on the Role of Student Motivation in Learning and Teaching Contexts.", Journal of Educational Psychology, 2003
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**79** Hassanbeigi, Afsaneh, Jafar Askari, Mina Nakhjavani, Shima Shirkhoda, Kazem Barzegar, Mohammad R. Mozayyan, and Hossien Fallahzadeh. "The relationship between study skills and academic performance of university students", Procedia - Social and Behavioral Sciences, 2011.
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111 Yahaya, Noordin, Azizi Yahaya, Jamaludin Ramli, Shahrin Hashim, and Zurihanmi Zakariya. "The Effects of Motivational Factors in Learning among Students in Secondary School in Negeri Sembilan", International Journal of Psychological Studies, 2010.
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112 www.cte.cornell.edu
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Dispositions (CCTDI) among University
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