

**THE RELATIONSHIP BETWEEN EDUCATIONAL
ACHIEVEMENT AND PHYSICAL ACTIVITY** AMONG RURAL
SECONDARY SCHOOL LEARNERS IN XIHOKO CIRCUIT IN
LIMPOPO PROVINCE, SOUTH AFRICA

BY

NGOMANA NOMSA


DISSERTATION

Submitted in fulfilment of the full requirement for the degree

MASTERS EDUCATIONIS

In

EDUCATIONAL STUDIES

In the

FACULTY OF HUMANITIES

At the

UNIVERSITY OF LIMPOPO

SUPERVISOR: Prof. MJ Themane
CO-SUPERVISOR: Prof. I Kibirige

ABSTRACT

A study was conducted to investigate the relationship between educational achievement (EA) and physical activity (PA) among rural secondary school learners based on the hypothesis that PA boasts educational achievement. The participants (n=275) (164 girls and 111 boys) aged 17-27 were selected from three rural high schools at Xihoko Circuit, Limpopo Province in South Africa. Due to mounting pressures to reach adequate yearly progress, many school officials view non-assessed activities like Physical Education (PE) and recess as unnecessary, consequently creating a case for the elimination of any subject that is not directly measured through standardized testing. This action ends up depriving learners of one of the elements that they need to do well in the classroom. Participation in PE has been found to have many benefits, such as, improved EA and health. This is the only subject that provides learners with an opportunity for PA after long hours of sitting.

Most of the evidence linking PA to student achievement comes from studies looking at the impact of PE classes. Overall, there seems to be consensus among those who have studied the issue that reducing the amount of instructional time devoted to “academic” subjects in order to devote more time to PE does not harm students’ EA. On the contrary, schools that have reduced their PE time have not seen reliable improvements in student achievement. Finding a link between EA and PA may make educational leaders to re-evaluate time spent during the school day.

In this study, data was collected for one month. PA data were collected by means of a self-report Youth Physical Activity Questionnaire (YPAQ), whereas data on EA were obtained through Mathematics and English tests scores. The University of Limpopo granted ethical clearance for the study and the permission to access schools was given by the Department of Education, Limpopo. **Data was analysed using descriptive and inferential statistics using Statistical Package for Social Sciences (SPSS) version 18. The results revealed a low positive correlation ($r = .079$) for English and ($r = .086$) for Mathematics. The null hypothesis was rejected as a results of the chi-square test outcome which revealed that at $p < 0.05$, $df = 2$, the $\chi^2 = 8.06$ for Mathematics and**

$\chi^2 = 147.2$ for English. Since these values are greater than 5.99 chi-square statistical value, it means that the relationship between EA and PA exists, though non-significant. This has important implications for the introduction of PE in the school curriculum in the face of increasing sedentary life styles among young people and declining education performance that is plaguing our education system.

DECLARATION

I hereby declare that “The relationship between educational achievement and physical activity among rural secondary learners in Xihoko Circuit Limpopo”, is my own work that has not been submitted for any degree or examination in any other university and that all the sources used or quoted have been indicated and acknowledged by complete references.

ACKNOWLEDGEMENT

I am very grateful to all the learners, who were the subjects of this work. I greatly appreciate their willingness to participate in this research and the time they dedicated to this project. I also thank the principals, who granted me permission to conduct this study. I especially acknowledge and thank all teachers of the three schools, who assisted me greatly in establishing contacts necessary to complete my data collection. I greatly appreciate all the encouragement, suggestions, insights and comments of my fellow students Lilian Mdaka and Davison Makondo. If you were not there to encourage me, I would have not finished this project. I may not forget to thank Mr Baloyi Steve and his wife for opening their arms and give me a warm welcome and accommodation in their house every time I went to the university.

Furthermore, I want to thank Mr Chifundo Kanjere for mentoring me. Through your guidance, I feel I have learned and grown a lot in the past two years, especially in learning to question my own assumptions about research and to value quantitative methodologies. Analysis of quantitative data was a daunting project, but you came to my rescue. You really played a major role in my study process. Bravo!

Special and heartfelt thanks are dedicated to my supervisors, Prof. M.J Themane and Prof. I. Kibirige. Your mentoring has allowed me to explore and find my own research path, and for this Profs, I feel extremely lucky and appreciative. Through your guidance, I finally climbed that rocky mountain. I always remember the words of encouragement from Prof. Kibirige, which says, “winners are not quitters and quitters are not winners”. They truly helped me a lot. As a believer, I always believed that I am more than a conqueror and indeed, I conquered. I was also helped greatly by the scripture, which says, “All things work together for good to those who love the Lord.” These words of truth made me endure all the hardships with the hope that I will win the battle and something good will crop out of my sufferings.

Finally, I am delighted and feel extremely lucky to acknowledge in this thesis my great family; my children, my parents, my sisters, my brother and in-laws, whose support and love are boundless. They were always there for me and encouraged me a lot.

In conclusion, I dedicate the completion of this Master's Degree to my loving husband for his immeasurable support and care for our children while I was away. When I went to the University to study, I was stress free, because I knew that our three lovely kids were in good, caring and loving hands. I appreciate his hard work and strong commitment to our education; for his strong beliefs that education is about humanity, life, and growing; for his high expectations and belief in me to achieve this goal; and for his strength and love that have always encouraged me to pursue what I like the most and what I am most passionate about. I know I did my best, dear, and I finished it. Your words have been very important to me in the past years, a source of strength for me in finishing my thesis. God bless you.

DEDICATION

This study is dedicated to my family, whose support has never wavered. To my children Lebo, Tebogo and Vutomi, I pray that my model of hard work and determination may be a Godly example for you to follow as you grow older and as you begin your own journey and discovery of God's will for your life. You know very well how much I missed you and that I always thought of you when I was away from you. I kept you in my mind even when I was discouraged. Your constant presence in my thoughts encouraged me to continue down a difficult road, more especially, because I wanted to set a good example. I used to tell myself that I am more than a conqueror, not a tail but a head, not a loser but a winner and I wish you could do likewise.

This work is especially dedicated to my best friend and lovely husband Magwaza. Your commitment to our family has given me the support I needed to push through this difficult process. You strengthened me even when I had little faith in my own abilities. You stood by my side and allowed me the time and space to pursue this degree even though it meant taking a multiple of responsibilities. I love you and feel blessed to be called your wife. **MAY GOD' S BLESSINGS BE YOURS FOREVER.**

LIST OF ABBREVIATIONS AND ACRONYMS

AASA	American Association of School Administrators
AJPHERD	African Journal for Physical Health Education, Recreation and Dance
ANOVA	Analysis of Variance
DoE	Department of Education
EA	Educational Achievement
ELA	English, Language, Arts
ERASS	Exercise Recreation and Sport Survey
ES	Effect Size
H ^a	Alternative hypothesis
H ^o	Null hypothesis
IEA	International Association for the Evaluation of Educational Achievement
IPAQ	International Physical Activity Questionnaire
ITBS	Iowa Test of basic Skills
LO	Life Orientation
MCAS	Massachusetts Comprehensive Assessment System
MET	Metabolic Equivalent Task
NASPE	National Association for Sport and Physical Education
NGOs	Non-Governmental Organizations
NCHA	National College Health Assessment
PA	Physical Activity
PE	Physical Education
PF	Physical Fitness
RDP	Reconstruction and Development Programmes
SE	Self-Esteem
SES	Socio-Economic Status
SPSS	Statistical Package for Social Sciences Software
TIMMS	Trends in International Mathematics and Science Study
USA	United States of America
WHO	World Health Organization

TABLE OF CONTENTS

ABSTRACT.....	II
DECLARATION.....	IV
ACKNOWLEDGEMENTS.....	V
DEDICATION.....	VII
LIST OF ABBREVIATIONS AND ACRONYMS.....	VIII
TABLE OF CONTENTS.....	IX
LIST OF TABLES.....	XIV
LIST OF FIGURES.....	XV
CHAPTER ONE.....	1
1.1 BACKGROUND.....	1
1.2 PROBLEM STATEMENT.....	1
1.3 HYPOTHESIS.....	4
1.4 AIM AND OBJECTIVES.....	5
1.5 SIGNIFICANCE OF THE STUDY	5
1.6 SUMMARY.....	6
CHAPTER 2.....	7
LITERATURE REVIEW.....	7
2.1 INTRODUCTION.....	7
2.2 DEFINITION OF IMPORTANT CONCEPTS.....	7
2.2.1 Educational achievement (EA).....	7
2.2.2 Physical activity (PA).....	8
2.3 TRENDS OF EA IN MATHEMATICS.....	9
2.4 TRENDS OF PA AMONG LEARNERS.....	11
2.5 FACTORS INFLUENCING ADOLESCENTS' PARTICIPATION	

IN PA.....	14
2.5.1 Physiological Factors that Influence Adolescents’ Participation in PA.....	15
2.5.2 Physical Environment as a factor that influence PA.....	16
2.6 FACTORS INFLUENCING EA.....	16
2.7 THE RELATIONSHIPS BETWEEN EA AND PA.....	17
2.7.1 PA, Health and EA.....	21
2.7.2 PA, Mental Benefits and EA.....	22
2.7.3 PA, Obesity and EA.....	23
2.7.4 PA, Self-Esteem and EA.....	24
2.8 STUDIES THAT FOUND INSIGNIFICANT AND NEGATIVE RELATIONSHIP BETWEEN EA AND PA.....	24
2.9 THEORETICAL FRAMEWORK.....	27
2.9.1 Bandura’s Social Learning Theory and Theory of Planned Behaviour.....	26
2.9.2 Achievement motivation Theory.....	27
2.10 SUMMARY.....	28
CHAPTER 3.....	30
RESEARCH METHODOLOGY.....	30
3.1 INTRODUCTION.....	30
3.2 RESEARCH SETTING.....	31
3.3 METHODOLOGY	31
3.3.1 Research design.....	31
3.3.2 Study population	32
3.3.2.1 <i>Sampling of sites</i>	32
3.3.2.2 <i>Sampling of participants</i>	33
3.4 DATA COLLECTION.....	34
3.3.1 PA Instrument.....	34
3.3.2 EA Instruments	35
3.5 DATA ANALYSIS.....	36
3.5.1 Data screening.....	36

3.5.2 Conversion of PA results into Metabolic Equivalents-Minutes per Week.....	36
3.5.3 An Overview of Data Analysis.....	39
3.6 ETHICAL CONSIDERATIONS.....	39
3.7 RELIABILITY AND VALIDITY.....	39
3.8 SUMMARY.....	40
CHAPTER 4.....	41
RESULTS.....	41
4.1 INTRODUCTION.....	41
4.2 BIO-DEMOGRAPHIC DATA.....	41
4.3 PA RESULTS.....	42
4.3.1 The PE class attendance.....	42
4.3.2 PA performed.....	42
4.3.3 Pattern of PA levels in Metabolic Equivalents Hours per Week (METS/hours/week).....	43
4.4 EA RESULTS.....	45
4.4.1 English Achievement.....	46
4.4.2 Mathematics Achievement.....	47
4.5 SPEARMAN RANK CORRELATION.....	47
4.6 CROSS-TABULATIONS OF EA AND THE CATEGORIES OF PA.....	49
4.7 ACHIEVEMENT PER CATERGORY OF PA PER SUBJECT.....	49
4.8 KRUSKAL WALLIS TEST.....	50
4.9 CHI SQUARE TEST.....	50
4.10 SUMMAR.....	52

CHAPTER 5	54
DISCUSSION.....	54
5.1 INTRODUCTION.....	54
5.2 AIM AND OBJECTIVES OF THE STUDY.....	54
5.3 INTERPRETATION AND DISCUSSION OF THE RESULTS.....	55
5.3.1 Physical activity (PA).....	55
5.3.2 Learners’ PA level and the WHO Guidelines on Recommended PA among Young People.....	56
5.3.3 Educational Achievement (EA).....	58
5.4 RELATIONSHIP BETWEEN EA AND PA AMONG LEARNERS.....	59
5.5 CONCLUSION.....	64
5.6 LIMITATIONS.....	64
 CHAPTER 6.....	 66
RECOMMENDATIONS AND CONCLUSION.....	66
6.1 INTRODUCTION.....	66
6.2 RECOMMENDATIONS.....	66
6.3 CONCLUSION.....	68
 REFERENCES.....	 70
APPENDIX 1.....	81
QUESTIONNAIRE.....	81
APPENDIX 2	87
EXAMPLES OF PHYSICAL ACTIVITIES FOR YOUNG PEOPLE.....	87
APPENDIX 3	88
LETTER OF PERMISSION FROM DET.....	88
APPENDIX 4.....	90
LETTER FOR PERMISSION FROM CIRCUIT OFFICE	90
APPENDIX 5.....	91
LETTER FOR PERMISSION REQUEST TO A SCHOOL.....	91

APPENDIX 6	93
LETTERS OF PERMISSION FROM SCHOOLS.....	93
APPENDIX 7.....	94
PARENT’S CONSENT FORM.....	94
APPENDIX 8.....	97
EDITOR’S CONFIRMATION LETTER.....	97
APPENDIX 9.....	98
FREQUENCY TABLES.....	98
APPENDIX 10.....	99
QUESTION PAPERS.....	99

LIST OF TABLES

Table 4.1	Bio-demographic data of the learners	41
Table 4.2	Common PA activities for learners at Xihoko Circuit	43
Table 4.3	PA categories for participants in METs/hours/week	44
Table 4.4	Comparisons for mean and standard deviation between metabolic equivalents and learners' achievements in Mathematics and English across schools	45
Table 4.5a	Spearman Rank Correlation between EA English and PA in METs/hours/week	48
Table 4.5b	Spearman Rank Correlation between EA Mathematics and PA in METs/hours/week	48
Table 4.6	Cross-tabulations of EA (percentages) and PA (METs/)	49
Table 4.7	Number of participants who passed or failed per category of PA	50
Table 4.8	Kruskal Wallis test results in Mathematics and English	50
Table 4.9	Chi-square test for Mathematics and English	51
Table 4.10	Chi-square test for males and females in Mathematics and English	52

LIST OF FIGURES

Figure 3.1	A map of N'wamitwa and Xihoko communities	30
Figure 4.1	Physical education (PE) lessons attendance	42
Figure 4.2	Physical activity (PA) levels in metabolic equivalent-hours per week (METs/hours/week)	44
Figure 4.3	Pattern of participants' achievement in English	46
Figure 4.4	Pattern of participants' achievement in Mathematics	47

CHAPTER 1

BACKGROUND OF THE STUDY

1.1 INTRODUCTION

Educators and other education professionals, such as, principals, curriculum planners, curriculum advisors and subject specialists have long believed that physical activity (PA) is one of the major factors that affect the learning ability of children (Bogden, 2000). Many studies have been conducted to examine the relationship between educational achievement (EA) and PA among learners, and their results were mixed. Investigators observed either no association (Coe, Pivarnik, Womack, Reeves & Malina, 2006; Daley & Ryan, 2000; Fisher, Juszczak & Friedman, 1996) or modest to moderate positive association (Action for Healthy Kids, 2002; Symons, 1997; Dwyer, Sallis, Blizzard, Lazarus & Dean, 1996) between EA and PA among learners. The indicators of EA are direct and indirect. Direct indicators include grade points averages, scores on standardized tests and grades in a specific course; measures of concentration, memory and classroom behaviour provide indirect estimates. The studies conducted were examining the relationship of both indicators of EA to PA.

1.2 PROBLEM STATEMENT

Lack of PA affects EA (in Mathematics and English) among high school learners living in rural areas, particularly in Xihoko circuit of Limpopo Province. EA refers to achievement by individuals of objectives related to various types of knowledge, skills, understanding and ideas. These objectives are based on the age, prior learning and capacity of each individual with regard to education, socialization and qualification. In this study, EA will refer to 50% pass mark in Mathematics/Mathematical Literacy and English tests. Dwyer et al. (1996) state that providing more opportunity to increased PA programmes improves EA as measured by Mathematics, Writing and Reading test scores.

It has been reported that children from all socio-economic backgrounds experience a lack of PA (Action for Kids, 2002). Most people, both young and old around the world are living in an advanced technological society, where PA is less of a central focus in their daily lives (Biddle &

Mutrie, 2001). The World Health Organization (WHO, 2002) has defined PA as all human movement in everyday life, including work, recreation, exercise and sporting activities. According to WHO, this encompasses activities that range in intensity from taking the stairs regularly, dancing, and walking briskly to jogging, biking and practicing in sports.

The National Association for Sports and Physical Education (2001) recommends that children and young people engage in at least 60 minutes of PA every day. Yet almost half of young people aged 12 to 21 and more than a third of high school children do not participate in PA on a regular basis, thus this practice reduces the quality of life and renders people to a high risk of heart diseases, cancer and strokes (National Association of Sports and Physical Education, 2001). **According to Bogden (2000)** people with poor health find it difficult to concentrate and are regularly absent from class; all these may interfere with their learning.

In America less than one in four children get 30 minutes or more of moderate PA per day and more than 20 minutes of vigorous PA per day (International Life Sciences Institute, 1997). The Council of Chief State School Officers' Policy Statement on School Health (2004) acknowledges the enormous impact that health has on EA of a nation's youth. Trembly, Inman and William (2000) indicate that children's physical, cognitive and emotional health is linked to their readiness to learn and ability to achieve educational success.

Symons (1997) indicates that numerous studies have shown that schools, which offer intense PA programmes have seen positive effects on EA, for example, improved Mathematics, Reading and Writing test scores and less disruptive behaviour, even when the added PE time reduces time for other subject areas. An American National Survey of 500 teachers and 800 parents conducted by The Robert Wood Johnson Foundation found that 90% of teachers and 86% of parents are convinced that physically active children are able to learn better as opposed to physically inactive children (The Robert Wood Jonson Foundation, 2003). On the other hand, Shepherd, Volle, Lavalee, Labarre, Jequier and Rajic (2002) observed that students, who participate in PA, are calmer in class and more energetic when studying than physically inactive ones. Furthermore, these authors underwrite Bogden's (2000) statement that physically inactive children are more likely to be sick, show increased absenteeism as well as tardiness and additionally obtain lower scores in Mathematics.

The Regional Advisor for Health Promotion (WHO Regional Office for Africa - 2002) reports that there is a clear and unmistakable tendency towards sedentary lifestyles among all age groups, even though distinct PA patterns are not yet discernable in Africa. According to WHO (2002), South Africa is one of the developing countries that has many young people in schools, who are physically inactive, unfit, have unhealthy eating habits and are increasingly overweight; as a result, this state reduces the quality of their lives. These unhealthy practices are said to have both short and long-term consequences that can result in learning difficulties or health related problems, which can begin during school age years and continue into adulthood. On that note, the former President of South Africa Thabo Mbeki in his speech at the Youth Day Celebration in 2007 said, “As part of promoting healthy lifestyles among our youth, we continue to implement physical activity programmes” (Department of International relations and cooperation RSA, 2007).

As a result, the Departments of Education, Health and other Non-Governmental Organizations (NGOs) in South Africa are trying to promote healthy lifestyles that can reduce physical inactivity and its consequences among young people. For example, in trying to address PA among learners, the Department of Education (DoE) in South Africa introduced Life Orientation (LO) Learning Area or subject. This subject addresses skills, knowledge, values and attitudes about self, environment, responsible citizenship, a healthy and productive life, social engagement, recreation and PA and career choices (DoE, 2002). Participation in PA, community organizations and initiatives are the central focus in LO. Learners are expected to explore, engage responsibly in recreation and PA to promote their wellbeing (DoE, 2002). Despite all the efforts made, most young people are still physically inactive (Dilley, Clitheron, Engelbrecht, Fulken & Lundall, 2005). One of the contributory factors might be that the allocated 60 minutes per week for the PE tasks in grades 10-12 LO falls far below the WHO’s recommended standards of PA for children, which is at least 60 minutes of PA every day.

However, despite the increasing findings and evidence that PA affects the EA of learners in both developing and developed countries, the Ellisras Longitudinal Study conducted in a rural population of South Africa by Themane, Monyeki, Twisk and Kemper (2006) found no significant association between EA and PA in primary school children. The data for this study came from a sample of 212

primary school children (112 boys and 100 girls). The researchers assume that the lack of significant association might be a result of one of the limitations in their study. They cite the use of cross-sectional design as a factor that might have limited the extent to which long-term effects of the relationship could be inferred. These authors conducted a study within the longitudinal study, which was in process and in their study a cross sectional design was employed.

In a cross-sectional study a population or sample is assessed or observed at a single point in time, and this is different from a longitudinal study, which involves repeated observation of the same subjects over long periods of time - often decades. For that reason, Themane et al. (2006) state that a longitudinal study, following the children sampled on their study to higher grades could clarify this relationship. Shephard (1997) mentions that most longitudinal studies, found strong associations between EA and PA after several sets of data were collected over time.

Besides the findings and evidence cited above, there seems to be a scarcity of data on whether a relationship between EA and PA exists among South African rural high schools in Limpopo Province. To the best of this researcher's knowledge, no research seems to have been undertaken among secondary school children, who live in South African rural areas. Therefore, this study aims to answer the following question, "Is there any relationship between EA (in Mathematics and English) and physical activity among secondary school learners living in rural areas like Xihoko?"

1.3 HYPOTHESIS

Null hypothesis (H^0) There is no relationship between EA (in Mathematics and English) and PA among rural high school learners in Xihoko circuit.

Alternative hypothesis (H^a) There is a positive relationship between EA (in Mathematics and English) and PA among rural high school learners in Xihoko circuit.

1.4 AIM AND OBJECTIVES

The aim of the study is to investigate the relationships between EA and PA among rural secondary school learners in Xihoko circuit of Limpopo Province in South Africa.

The objectives of this study are to:

- ❖ Establish if high school learners in Xihoko circuit reach the recommended PA levels for young people as suggested in WHO guidelines,
- ❖ Determine if English test scores for highly physical active learners are significantly different from English test scores for moderate and less physically active learners,
- ❖ Determine if Mathematics test scores for highly physical active learners are significantly different from Mathematics test scores for moderate and less physically active learners, and
- ❖ Compare the mean scores obtained in Mathematics and English across the categories of PA.

1.5 SIGNIFICANCE OF THE STUDY

- ❖ It is envisaged that the results of this study will highlight the effects associated with lack of PA and alert people to the realization that PA associated with EA might have a positive effect.
- ❖ In addition, this study could serve as a guiding source of information to decision makers when formulating policies that concern adolescents.
- ❖ Therefore, the findings should contribute to the knowledge base about PA among learners and serve as a public awareness about it.
- ❖ Lastly, the results of this study could contribute to the development and implementation of PA health promotion programmes among high school learners. The Departments of Health and Education can do this.

1.6 SUMMARY

This chapter presented a worldwide problem concerning PA which is less a central focus in the daily lives of most people both young and old. It points out that more than half of young people aged 12 to 21 and more than a third of high school children do not participate in PA on a regular basis, thus this practice reduces the quality of life and renders people to a high risk of heart diseases, cancer and strokes. This chapter also highlights that numerous studies have discovered that PA can influence EA and shown that schools, which offer intense PA programmes have seen positive effects on EA, for example, improved Mathematics, Reading and Writing test scores and less disruptive behaviour, even when the added PE time reduces time for other subject areas. The chapter also highlights that there are some studies which found no association between EA and PA. Though many studies have been conducted to explore the topic of this study, the researcher feels that there is scarcity of data on whether the relationship between EA and PA exists among South African rural high school learners in Limpopo Province, hence this study.

OUTLINE OF CHAPTERS

- ❖ **Chapter 1** was designed to supply the reader with the background information surrounding this study and the purpose. In addition, the hypothesis was identified as well as the significance of the study.
- ❖ **Chapter 2** describes the literature related to this study and the theoretical framework adopted by this study.
- ❖ **Chapter 3** supplies details concerning the methodology including procedures, validity and reliability information.
- ❖ **Chapter 4** reflects the results of the statistical analysis.
- ❖ **Chapter 5** interprets and discusses the researcher's findings.
- ❖ **Chapter 6** proffers the recommendations and the conclusion of this study.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

During the review of the related literature, the researcher chose topics that would contribute to the theoretical framework and the background of this study, such as, physical fitness, psychology, health benefits and factors affecting adolescents' participation in PA. Additionally, relevant literature on the relationship between EA and PA are also reviewed.

- ❖ Firstly, the chapter commences with defining concepts. This is intended to locate the study into the context of current debates on the subject.
- ❖ Secondly, a global survey of the trends of PA and EA (in Mathematics) among learners is reviewed to gain a global perspective on the trends of the problem. This assisted the researcher to identify gaps that necessitated this study.
- ❖ Thirdly, this chapter scrutinizes the relevant theories that guided the study.

2.2 DEFINITION OF CONCEPTS

2.2.1 Educational Achievement (EA)

After a review of literature on the concept EA, it becomes evident that a number of terms are used to refer to this concept. **EA, academic performance**, educational attainment, educational competence and scholastic achievement are constructs that are used interchangeably to indicate that an evaluation of an individual level of accomplishment within an educational environment has been made (De Jager, 1987). Chetty (1985) used the concept scholastic achievement to refer to EA and defined it in the light of primary school education. He defined scholastic achievement as the ability of the child to complete a given task at a particular age or standard level of the primary school system.

Linda (1987) contends that EA refers to accomplishment at school. According to this source, EA serves as the yardstick to measure the manner in which learners are progressing through various levels of study. **Furthermore, Linda (1987) states that EA assists stakeholders in education to realize how learners are performing at school, and if it is poor**, these patrons should not only possess the

knowledge to identify the cause that hinders learners' progress, but also be equipped to implement possible ways to remedy the problem. Chetty and Linda's views of EA are similar in the sense that **these authors call it scholastic** achievement and define it as a yardstick to measure a learner's completion of a given task at a particular level of study. The difference between the two researchers arises where Chetty defines EA in the light of primary school education, whereas Linda is referring to achievement of learners in various levels of study. Contrary to Chetty and Linda's views, De Jager, who also refers EA as scholastic achievement is of the opinion that EA refers to the level where a student does not have the usual connotation of doing well, but is only concerned with the learning of specific matter up to a specific time.

Gouden (1977) does not use a different concept for EA and simply defines it as an examination mark for each subject obtained by a student. In contrast, Jubber (1988) uses the concept academic performance to refer to EA and views it as a measure of the relationship between a learner's success when compared with learners of the same age and intellectual endowment. In this study, the researcher will use the definition, which is similar to Gouden's, where EA refers to the examination marks or standards that learners achieve or obtain on each subject.

2.2.2 Physical Activity (PA)

According to Barrette (2007), PA refers to any form of exercise or movement. In the Barrette's view, PA includes planned activity, such as, walking, running, basketball, or other sports. **Furthermore, Barrette (2007)** indicates that PA may also include other daily activities, such as, household chores, yard work, walking the dog, *et cetera*. **She suggests** that people should participate in the recommended PA levels, which are at least 30 minutes for adults and at least 60 minutes of moderate PA for adolescents most days of the week or every day. She also states that moderate PA is any activity that requires about as much energy as walking **two miles (3.2 km)** in 30 minutes.

Thompson, Bandera and Burley (2008) define PA as any activity that causes a person's body to work harder than normal. According to these researchers, PA describes activities that are beyond your daily routine of sitting, standing, and walking up stairs and indicate that everyone can benefit from increased PA.

McGraw-Hill Concise Dictionary of Modern Medicine (2002) defines PA differently from the above definitions. PA is defined as athletic, recreational or occupational activities that require physical skills and utilize strength, power, endurance, speed, and flexibility, range of motion or agility. It further states that PA is a behavioural parameter used to evaluate a patient's cardiovascular 'reserve'. In this study, PA will refer to all human movements in everyday life, including work, recreation, exercise and sporting activities (WHO, 2002). This study's definition differs from Thompson, Bandura and Burley's definition in the sense that, these authors only consider PA to be those, which are beyond the people's daily routine, whereas in the definition of this study such activities are also included. In fact, the activities to be considered in this study will include both formal and informal activities. These encompass activities that range in intensity from taking the stairs regularly, dancing, and walking briskly - to jogging, biking and practicing sports. This study has adopted Barrette's definition, who considers any form of exercise and movement to be a PA. The rationale is that, this study considered both formal and informal PA, such as, walking, running, basketball and other sporting activities.

2.3 TRENDS OF EA IN MATHEMATICS

Research on EA, shows that the development of memory, attention, perception and learning provides support for a new interpretation of poor achievement in a variety of task settings (Hannaford, 1995; Jensen, 1998; Schiller, 1999). Poor achievement among learners has often been attributed to the existence of discrete and specific disabilities in a variety of psychological processes necessary for learning. In the context of research from developmental psychology, however, the poor achievement of learning in most children, on many tasks suggests that they may not have developed the cognitive and emotional characteristics, which are necessary to adapt to the requirements of a task and to use active and efficient task strategies (Torgessen, 1977). Literature also shows that these characteristics can be developed by participating in regular PA (Hannaford, 1995; Jensen, 1998; Schiller, 1999). The following paragraphs highlight the trends of EA in mathematics.

Globally, the general picture of achievement in Mathematics is given by the Trends in International Mathematics and Science Study (TIMSS). TIMSS is the largest study of EA ever undertaken. It has

been conducted by the International Association for the Evaluation of Educational Achievement (IEA), with the co-operation of governments from 48 countries throughout the world. South Africa also participated in this study (Howie, 2006). TIMSS provides reliable and timely data on the Mathematics and Science achievement of the United States of America (USA) 4th- and 8th-grade students compared to that of students in other countries. TIMSS data have been collected in 1995, 1999, 2003 and 2007. In 1995, pupils from the Asian countries of Singapore (at the top with 604 scale points), Korea, Chinese Taipei, Hong Kong and Japan demonstrated the best achievement in Mathematics. The 2003 results show that, USA 4th-graders outperformed their peers in 13 of the other 24 participating countries in Mathematics and, in Science, outperformed their peers in 16 countries.

The performance of South African pupils has remained constant in the conducted studies. In 1999, the results showed that South African pupils performed poorly when compared to other participating countries. The average score of 275 points out of 800 points achieved by South African pupils was well below the international average of 487 points. The result was significantly below the average scores of all other participating countries, including the two other African countries of Morocco and Tunisia as well as that of other developing or newly developed countries, such as, Malaysia, the Philippines, Indonesia and Chile. Interprovincial results in South Africa indicated that, the province with the highest average scale score for Mathematics was Western Cape with 381 scale points, but this was still significantly below the international mean score of 487. Northern Cape and Gauteng achieved the second highest score with 318. Northern Province was below all the other provinces with a score of 226 (Howie, 2006).

However, the overall international average achievement in Mathematics did not change, as there was only a small increase by two scale points (from 519 in 1995 to 521 in 1999 across the 26 countries). There was no real difference in achievement between the pupils in 1999 and those in 1995. Less than 0.5% of pupils in South Africa reached the average score of the top 10% of pupils internationally. In the 2007 results the European countries were still leading. Six Percent of USA 8th-graders performed at or above the advanced benchmark compared to the international median of 2% and 10% of USA 4th-graders performed at or above the advanced Mathematics benchmark. Looking at the data provided by TIMMS on Mathematics achievement, it is evident that South African learners are not doing well. As a result, this study aims at investigating if the relationship exists between EA and PA

of rural secondary school learners at Xihoko circuit, Limpopo Province, since PA is considered as one of the contributory factor to EA.

2.4 TRENDS OF PA AMONG LEARNERS

The opportunity for learners to be physically active during school hours seems to be rapidly decreasing in most countries across the globe (Du Toit, Van der Merwe & Rossouw, 2007). This can be attributed to many reasons, some of which include the continuous elimination of physical education, technology and social evolution that have changed children's lives. The following paragraphs highlight the trends of PA across the world.

A survey conducted in Denmark (Wedderkopp, 2001) showed that around 71% of the children are engaged in some kind of organized sport activities including being members of a club, with 17% involved in unorganized sports. On average boys and girls (aged 7-15) were found to be active for 36 minutes per day. This self-reported activity excluded walking and cycling. Participation dropped with age from 90% sport participation at age 12 to only 46% at age 17.

According to the [United States Surgeon's General Report of Physical Activity and Health \(1996\)](#) in the USA, daily participation in PA among high school youths at national level has been found to be 29, 1%. This participation declines as students' progress through grade 9 (42%), 10 (30%), 11 (20%) and 12 (20, 1%). This trend in the USA is also suspected to be the result of physical education classes, which are being replaced by other classes in an effort to increase EA. However, there is no evidence that shows that increasing time for educational classes improves students' EA as measured in standardized tests ([United State Surgeon, 1996](#)) instead; the physical well-being of students has been found to have a direct relationship with learners' ability to [achieve academically](#).

In New Zealand a cross-sectional study was also conducted to check the activity level of adolescents (Hohepa, Scragg, Schofield, Kolt & Scaaf, 2009). A sample of 12–18-year-old students ($n = 3471$) [was](#) recruited from low socioeconomic status high schools within South Auckland, New Zealand. Participants reported their PA during lunchtime, morning recess, and after school, as well as their

level of active transportation to and from school. For each PA opportunity, participants were dichotomised as being either “more active” or “less active”. Other elements that were measured from each participant include height, weight, and waist circumference.

Data for this study were analysed using binary logistic regression to understand demographic associations and with kappa coefficient calculations to examine the level of association in participation levels between different periods. The percentage of students considered ‘more active’ depended on the PA variable of interest (after-school, 56.3%; active transportation, 58.1%; morning recess, 26.4%; lunchtime recess, 32.4%). Only 11.1% of participants were classified as ‘more active’ across all four PA opportunities. Hohepa et al. (2009) pointed out that during a school day, multiple opportunistic periods exist for youth to be active, yet a large proportion of students are not as active as they could be with only a few youth engaging in PA across various segments of the school day.

In some secondary schools in countries like British Columbia, students are allowed in grades 11 and 12 to be exempt from PE if they participate in other school PA opportunities. This arrangement is a forward-thinking strategy to encourage more students to be physically active in a way that suits their interests and abilities. Research continues to emerge that highlights the importance of self-efficacy and feeling competent; therefore, any way that students, who do not identify with PE can be given the opportunity to be active in a way that they enjoy, is a positive thing. Research conducted in (Michigan State University, 2006) discovered that enrolling students to PE alone has no influence on their PA and grade levels. To influence the PA of learners enrolled in PE, they should be engaged in vigorous PA, which could increase their heart rate and breathing.

Elsewhere in Africa, researchers have also expressed concerns about the marked decrease in levels of PA. In a study among Senegalese adolescents Benefice, Garnier and Ndiaye (2001) found that younger adolescents are more sedentary than the older adolescents are and they indicated that this was the case, because older adolescents spend most of the time doing subsistence work like farming, fetching water and carrying firewood. Murenzi (2001) confirmed this in a study done in Rwanda on ‘Habitual activity patterns among adolescent learners’. He reported that learners spend more time on sedentary activities than on non-sedentary activities. In contrast, the Kenyan, Onywera (2009) indicated that their initial research concluded that both male and female rural Kenyan children have

higher running speeds, aerobic fitness and percentile rankings. All Kenyan children, but particularly those in urban settings, are showing signs of PA transition.

In South Africa during the apartheid era, education was unsuccessful in offering majority of the population participation in PE by perpetuating race, class, gender and ethnic divisions, and emphasized separateness rather than common citizenship and nationhood (Chappell, 2005). In most schools of the former Department of Education (DET), PE was viewed as a luxury subject that was seriously practised by the advantaged whites. PE and sport were not considered as priorities due to lack of funds, qualified specialists, sufficient facilities and equipment (Fredericks, Kokot & Krog, 2006). The result was a wide disparity between schools in the access to school sport facilities and consequent widely different degrees of participation.

Since the inception of democracy in South Africa, many initiatives, such as, the Reconstruction and Development Programmes (RDP) have been launched to address the inequalities of the past. One of the goals of these initiatives is to ensure young people's access to opportunities to play and exercise in pursuit of healthier and productive lifestyles (Department of International relations and cooperation RSA, 2007). PE may be used as a vehicle for advocacy as in the secure and protective environment of school.

In the current South African education system, PE has been incorporated into the Life Orientation subject, where PE or physical development and movement are the learning outcomes. These learning outcomes play an imperative role in providing children with PA for at least 30 - 60 minutes per week during school hours. However, this time, falls far short of the WHO's recommendations for PA (Department of Education, 2002). The WHO's recommendation is that children and adolescents should participate in moderate to vigorous PA for at least 60 minutes every day (American Heart Association, 2005; National Association for Sport and Physical Education, 2006; Sallis, 1994). Therefore, additional measures of PA intervention strategies are suggested, to help achieve PA recommendations and create an awareness of healthy lifestyles.

A community-based study, among high school learners in the Western Cape, Phillips (2006) found that more than 60% of the sample was considered irregularly active. A similar study by Frantz (2006) found that 37.5% of the learners participated in insufficient or no PA. Another study by

McVeigh, Morris, Cameron and Pettifor (2004), comprising 381 South African children, discovered a significant racial difference in the patterns of PA. White children were found to be more active, participating more in PE classes at school and watched less television than black children.

McVeigh et al. (2004) conducted another study in South Africa and found that 40% of the children and youth were getting little or moderate to vigorous activity each week. The study indicates that, with only half of high school learners reporting regularly to scheduled PE classes, less than 60% of them engage in vigorous activity during actual classes. These scholars point out that over 30% of learners do not participate in PA at all. In this regard, they also noted that primary school children are far better than high school learners are. Perhaps, this is so, because most primary school learners are at **industry** versus **shame**, which is one of the personality development psychosocial stages as developed by Erick Erickson. This theorist believes that people at this stage tend to be industrious and playful (Behr, 1980). Thus, in the process, they generate a lot of PA.

According to Diez (2005), PA and sports have positive benefits to young people. These include positive influence on concentration and memory retention in the classroom, hence increased EA. According to Piaget (1983), adolescence is a time of experimentation and this leads to recklessness. Piaget believes that **active involvement of young people to PA can reduce reckless behaviour and the main causes of social problems that lead to diseases and deaths. Diez (2005) indicates that these social problems are regarded as health risk factors. These factors include violence, crime, cigarette smoking, alcohol and drug abuse, pre-mature sexual activity, unhealthy eating habits as well as physical inactivity and they consequently affect EA.** The WHO (2002) has also identified lack of PA as a global public health concern. It is evident from the reviewed literature that most young people's PA level is far below the recommended levels globally and this suggests a need for intervention. The studies conducted do not include PA levels of rural secondary school learners at Xihoko Circuit in Limpopo Province; hence, this study intends to close that gap.

2.5 FACTORS INFLUENCING ADOLESCENTS' PARTICIPATION IN PA

An understanding of factors that influence PA behaviour is significant for health promoters and behavioural specialist interested in influencing the physically inactive population groups to become

physically active (Bauman, Marshall, Mohsin & Westley-Wise, 2002). Adolescents' PA is influenced by factors that exist in a variety of domains including psychological, biological, social, cultural and physical environment; these factors may affect an individual's decision to adopt and maintain a physically active lifestyle (Buckworth & Dishman, 2002). Among the four mentioned factors, only two are discussed in the following paragraphs, namely physiological and physical environment. **The rationale for discussing only two factors is that this study is neither from Physical Education nor from Human Movement Science but from educational background, hence review information on factors influencing adolescents' PA is less comprehensive. In addition, the main aim of this study is to examine the relationship between EA and PA; hence, review information is comprehensive in that area.**

2.5.1 Physiological Factors that Influence Adolescents' Participation in PA

Puberty limits access of many adolescents and especially girls to PA and sports. The increase in body fat in the female at puberty may serve to discourage participation in PA and to decrease aerobic power (Rowland, 1999). For example, Rowland indicates that increased fat makes exercise more difficult and causes a tendency to avoid PA, which in turn results in more body fat and a diminished urge to exercise.

In a study done among Canadian youth aged 12-24 years, females were less likely to be active and more likely to be overweight (Higgins, Gaul, Gibbons & Van Gyn, 2003). Consistently, participation in PA was inversely related to age. In an investigation of adolescents' participation in PA programmes in the USA, the findings showed that 12 year olds had a higher frequency of PA as compared to 17 year olds (Gordon-Larsen, McMurray & Popkin, 2000).

Malina (2001) reports that males are generally more active than females and that the sex difference is greater for high intensity activities than for activities of low and medium intensity. This source further asserts that men usually report greater levels of total and vigorous activity, whereas women tend to report participating in low to moderate activities. Numerous descriptive and co-relational studies, show that PA levels decline as children age (Dwyer et al., 2001), and the decline is so great

within adolescents; that is why this age group has been referred to as a risk factor for PA (Rowland, 1999).

2.5.2 Physical Environment as a Factor that Influence PA

Physical environment have an important role in influencing participation in PA in that those environments with facilities that are relevant for PA, such as, pavements, fields and parks may make it easier for people to be physically active (De Bourdeaudhij, Sallis & Saelens, 2003). It was reported by De Bourdeaudhij et al. (2003) that the presence of facilities for PA within 5 minutes drive from home was positively correlated with vigorous PA for both females and males of all ages. Physically active people were also more likely to report a high level of access to facilities, including local exercises halls, recreation centres, cycle paths, swimming pools, tennis court and gyms. Sallis et al. (1997) in their study indicated that, those who engaged in recommended exercise reported a greater number of facilities around their homes.

The components of the neighbourhoods' characteristics include the presence of sidewalks, streetlights, heavy traffic, unattended dogs, hills, high crime rates, aesthetics, safety for exercise and a frequent observation of people exercising. Low perceived safety and crime rate negatively influences participation in PA (Humpel, Owen, Iverson, Leslie & Bauman, 2004). This has been proven in a study examining the determinants of adolescents' PA or physical inactivity conducted by Gordon-Larsen et al. (2000). It was found that high levels of neighbourhood crime were associated with decreased likelihood of being physically active.

2.6 FACTORS INFLUENCING EA

Research has shown that the EA of high school learners is strongly linked to many different factors or elements (Mostert, 1998; Ramashala, 1999). These factors include:

- ❖ resources or facilities,
- ❖ teachers and learners' motivation,
- ❖ learners' attitudes towards subjects, such as,
 - Mathematics,

- study skills,
- intelligence level,
- teachers' qualifications,
- discipline,
- learners and teachers' commitment,
- parental involvement,
- health related factors,
- healthy risk behaviours, such as,
 - lack of PA, and
 - substance abuse et cetera.

In considering the factors that influence learners' achievement, it would be best to consult research and related literature that deal specifically with factors relevant to this study. According to Swift (1983), the listed factors make it evident that education is not about empty minds waiting to be filled, nor about flatulent teachers, discharging hot air, but education is about the opposition of teacher and learner. It is about what is rubbed off between the persistence of one and the other. The above mentioned factors can be categorized into learner factors, teacher factors and school factors. Since most of these factors are irrelevant to this study and are dealt with in other different studies, **this study will focus on one of the learner factors, which is lack of PA because it is relevant to the topic of this study.** This is one of the health risk behaviours and is believed to be one of the major contributory factors on EA. The most relevant work, which is discussed below is the research by National Association for Sport and Physical Education - NASPE (2001); Shepherd (1997); Pate, Heath, Dowda and Trost (1996); Dwyer et al. (1996).

2.7 RELATIONSHIPS BETWEEN EA AND PA

There is a surveillance system known as Youth Risk Behaviour Surveillance System, which monitors behaviours that contribute markedly to the leading causes of social problems, death and disability among youth worldwide. Through the Youth Risk Behaviour Survey, students' risk behaviour, such as, lack of PA and the extent, to which these behaviours are associated with EA, are monitored. Several studies suggest that providing more time for PA (by reducing class time) can lead to increased test scores, particularly in the area of Mathematics (NASPE, 2001). **One can infer** that

students with high scores are less likely to engage in health risk behaviours. Furthermore, students, who do not engage in health risk behaviours, receive higher grades than their classmates receive, for example, in one study, students placed in an experimental group engaged in 24 minutes of additional PA per week. This coincided with a corresponding decrease in class time for academics. Mathematics' test scores in this group were consistently higher than for students in a control group, who saw no change in time allocation (Shepherd, 1997).

The evidence of the connection between EA and PA led the American Academy of Paediatrics to issue a policy statement regarding the need for the

“expansion of school physical education, dissuading children from pursuing sedentary activities, providing suitable role models for physical activity and making activity-promoting changes in the environment” (Council on Sports, Medicine and Fitness and Council on School Health, 2006).

According to NASPE and the American Heart Association (2006) fourteen published studies, analysing data from approximately 58,000 students between 1967 and 2006 have investigated the link between EA and overall participation in PA. In 11 of those studies, regular participation in PA was associated with improved EA. In addition, NASPE reported that eight health surveys involving population-representative samples of children and adolescents from the United States, United Kingdom, Hong Kong and Australia observed statistically significant positive correlations between EA and PA participation.

However, NASPE (2006) found that none of the above-mentioned studies has assessed EA with standardized educational tests; instead, educational records were used. **This study will differ from the above-mentioned fourteen published studies in** the sense that assessment of standardized tests was undertaken to measure the EA of learners. Another national study conducted in 2006 also analysed data collected from 11, 957 adolescents across the USA to examine the relationship between EA and PA using educational scores. Adolescents, who reported either participating in school activities, such as, PE and team sports, or playing sports with their parents, were 20% more likely to earn an “A” in Mathematics or English than their sedentary peers were.

Another study, conducted by Martin and Chalmers (2007) measured EA by using the Iowa Test of basic Skills (ITBS), and physical achievement by using the President's challenge in order to add to the existing literature. The participants, in their study included grade 3, 5, 6 and 8 and participation was voluntary. The results showed a correlation of $p = 0.19$ and the authors indicated that the significance is up to the reader, as $p = 0.19$ is considered to be on the low end of significance. They also mentioned that only 3.7% of the variability in EA could be attributed to physical achievement based on the findings.

Three other smaller studies, reported to have been conducted between 1970 and 2006, involving students from one or two schools, also reported a positive correlation between EA and PA (Coe, Pivarnik, Womack, Reeves and Malina, 2006; Dwyer, Sallis, Blizzard, Lazarus and Dean, 2001; Schuur & Brookover, 1970). Two of these studies found no evidence of a relationship between EA and PA and one study, conducted in Canada in the year 2000 reported a trivial negative association between standardized test scores and PA. Students, whose time in PE or school-based PA was increased, maintained or improved their grades and scores on standardized achievement tests, even though they received less classroom instructional time than students in control groups did. The studies conducted in USA found different results with regard to relationship between EA and PA among learners.

Dwyer et al. (1996) also investigated the association between EA and PA by conducting a cross-sectional survey of 4500 Australian school children between the ages of 7 and 15 years (500 in each age/sex stratum drawn from 109 schools, that is, 10 girls and 10 boys per school). Depending on the group, a linear regression analysis with good control of confounding variables demonstrated a significant association between EA and PA. In all subjects, aged 9-12, school achievement was positively associated with rating of the PA during that preceding week. In girls, 10-15 years old and boys 8-15 years old, EA was also positively associated with the estimates of lunchtime PA. The correlation co-efficient between the two variables although low ($r = 0.10$, $P < 0.01$) for females and ($r = 0.17$, $P < 0.01$) for males, were statistically significant, suggesting that PA was contributing to EA in both boys and girls.

Pate et al. (1996) conducted another study that suggests a positive association between EA and PA in England. This was a cross-sectional study, controlled for socio-economic status. The results also reported a significant association between the EA and PA (Pate et al., 1996). This study differed from the study by Dwyer et al. (1996), because it did not control the socio-economic status of the children. Researchers in Iceland also designed a study that included other health behaviours and found small, but significantly positive univariate associations of PA with self-reported school achievement (Sigfusdottir, Kristjansson and Allegrante, 2007).

Furthermore, another study was conducted in Massachusetts (Tremarche, Robison & Graham, 2007). This study was designed to determine the impact of increased quality PE time on Massachusetts Comprehensive Assessment System' (MCAS) standardized scores. The MCAS test was given to 311 fourth-grade students in two Southeastern communities in Massachusetts, within a two-month period in April and May of 2001. The participants were tested in two areas, English, Language, Arts (ELA) and Mathematics.

The results of this study showed that the mean ELA MCAS' score for School 1 and the mean ELA MCAS' score for School 2 were significantly different. The mean Mathematics MCAS' score for School 1 and the mean Mathematics MCAS' score for School 2 showed no significant difference. Students, who received more hours of quality PE per school year, scored higher in the ELA subject area of the MCAS' standardized test, than in Mathematics. The effect size (ES) was calculated to be 0.1, which is a low value, indicating that the treatment (hours of PE) did not have an effect on the Mathematics' scores. Though the relationship between PE hours and achievement in Mathematics among learners was established, PA levels of learners, which is the main variable in the study, was not established. In addition, the participants, in this study were not adolescents, but children in lower grades, therefore, this study differs from that of Tremarche et al. (2007) in the sense that its focus is on PA of adolescents and the achievement tests are for Mathematics and English as a second language subject.

Evidence supporting the association between EA and enhanced PA is further strengthened by two related national studies conducted in Korea (Kim, Frangillo, Han, Oh, Kim, Yang, Won, Lee & Kim, 2003) and Australia (Dwyer et al., 2001) respectively along with two smaller ones which had sample ranging between 23 and 77 in the USA (Knight and Rizzuto, 1993). All these studies also found

higher levels of PA to be linked with improved EA among children and teens (www.active.livingresearch.org). These studies included students from elementary to high schools and found that PA improves cognitive achievement and promotes task classroom behaviour.

However, the above studies reveal that participation in PA can enhance the EA of students at the high school level. Coleman's (1961) zero-sum model as cited by Dotterer, McHale and Crouter (2007) suggests that students, who put their energies into extracurricular activities like sports, are less likely to pursue educational objectives. The zero-sum model is a model, which indicates that more of one variable results in less of another. In this case, more time involved in PA participation leads to less time spent on educational work. Coleman believes that youth do not have time or energy to achieve excellence and satisfaction in both roles (Coleman, 1961).

In contrast, Marsh (1992) is of the opinion that such activities are likely to increase attachment to school and self-esteem (SE), which are indirect but important factors in EA. Despite the findings stated above, arguments that PA harms EA by tiring children, taking focus off education and/or taking time from learning are still heard (Linder, 1999).

2.7.1 PA, Health and EA

According to WHO (2002) PA is an effective way for individuals to help prevent serious diseases and a cost effective way for societies to improve public health. In addition, WHO also states that lack of PA is the leading cause of major non-communicable diseases, which contribute substantially to the global burden of diseases, deaths and disabilities. WHO further indicates that regular PA provides young people like adolescents with consequential physical, mental, and social health benefits and that PA can improve quality of life in many ways for people of all ages. Good and healthy lives are positively related to good EA.

Cherian (1992) posited that research on the relationship between EA and health in general has been widely reported. In an article entitled "School Health Programmes and Educational achievement" Cherian indicates that today many students have many health problems, which affect their readiness to learn. In addition, the source states that a variety of physical and mental conditions impact students' school attendance, their ability to pay attention, class anger, and self-destructive impulses. Based on Cherian's position, health problems affect the attention span directly, general achievement,

short-term memory, social functioning and concentration, needed by pupils to function productively and efficiently in examinations.

On that note, Themane (2006) suggested that prevention strategies to improve good health should be put in place to enhance EA. The WHO (2003) observes that one of the major challenges in the prevention of diseases and the promotion of PA is communicating the importance of the benefits of PA to health. Novello, Degraw and Kleinman (1992) have proposed an added benefit of focusing on students' health. According to Novello et al. (1992), both health and achievement are important in a child's life, and health issues are indeed intertwined with students' EA. For that reason, “**healthy living** is as important to quality of life as EA” (American Association of School Administrators (AASA), 2006:8).

2.7.2 PA, Mental Benefits and EA

Scientific evidence has shown that participation in regular PA, in its widest sense, does not provide people of all ages with significant physical and social benefits only, but also mental health benefits and well-being throughout their life span (Biddle, Fox & Boutcher, 2000; WHO, 2003). The well-being of the body and the mind has been found to have a positive influence on learning and EA. The National College Health Assessment (NCHA, 2004) in an article entitled “Health Issues Impacting the Educational Achievement of Cal Poly Pomona Students” reveals that mental health issues, such as, stress, sleep difficulties, relationship difficulties, and depression have the most significant impact on EA. It further indicates that cold, flu, sore throat and other reasons for frequent visits to the Student Health Services are the second most common causes of poor EA among all college students.

According to Keays (1993), regular PA improves children's mental health and contributes to their growth and development. This source also states that PA results in increased **self-esteem (SE)** and perceived physical competence, which are necessary variables that enable children to cope with mental stress. Furthermore, Keays explains that improvement in discipline, EA and self-concept are benefits associated with regular PA, while moderate to vigorous PA has been proven to enhance skill achievement in classroom functions favourably, such as, arithmetic, reading, memorization, and categorization.

Moreover Shepherd (1997) and Cocke (2002) indicate that youth, who receive additional PA tend to display improved attributes, such as, increased brain function and nourishment, higher energy/concentration levels, changes in physical structure resulting in improved SE and tolerable behaviour, which may all support cognitive learning. Shepherd further argues that improved brain attributes, associated with regular PA, consist of increased cerebral blood flow, changes in hormone levels, enhanced nutrient intake, and greater arousal. On the other hand, Cocke (2002) states that a trio of studies presented at the 2001 Society for Neuroscience Conference suggest that regular exercise can improve cognitive function and increase levels of substances in the brain responsible for maintaining the health of neurons. In addition the source adds that brain function may also indirectly benefit from PA due to increased energy generation as well as from time outside the classroom/away from studying. Therefore, increased energy levels may give relief from boredom, resulting in higher attention levels during classroom instruction.

On that note, the researcher assumes that children, who are provided with numerous PA experiences at an early age, develop an abundance of neurons and are better learners. Therefore, this can mean that, when these learning opportunities are not provided, the connections are not made and learning is not enhanced. Kathleen (2006) is of the opinion that whole-brain learning through re-patterning, or learning to move in new ways, can help students to access those parts of the brain previously unavailable to them. In addition, the source considers movement to be a vital aspect of the brain's ability to function cognitively. In Kathleen's view, the relationship between motor and intellectual achievement is strongest at very early stages of development and the physical education programme that provides a wide-variety of developmentally appropriate activities and experiences to children, can have profound results on EA.

2.7.3 PA, Obesity and EA

Lack of PA is one of the major factors that cause obesity or overweight in children or adolescents. For example, research findings by WHO (2002) indicate that obesity is associated with many factors, such as, lack of parental support concerning sport activities, lack of PA, diet and urbanization with its high prevalence of sedentary lifestyle. Some observers have noted a worrisome correlation between weight problems and poor EA. One research study found that severely overweight children

and adolescents are four times more likely than their healthy-weight peers to report “impaired school functioning” ([Action for Healthy Kids, 2003](#)). It has also been observed in another study that overweight children are more likely to have abnormal scores on the Child Behaviour Checklist (a commonly used measure of children's behaviour problems) and are twice more likely to be placed in special education and remedial classes, than are children, who are not overweight.

In addition, Haskin and Donahoe (2006) state that obesity affect children's psychosocial outcomes, such as, low SE and depression. These mechanisms may affect other aspects of children's lives, such as, EA, with potentially even more serious adverse social outcomes in the long term. Based on the findings above, one can conclude that obesity is associated with EA, though the correlation is not direct.

2.7.4 PA, Self-Esteem and EA

There is a range of explanations offered for the possible effect of PA on enhanced EA. However, Fox (1997) argues that the most likely mechanism of affect is through increased levels of SE. The source further argues that physically active children have higher levels of global SE and often display increased persistence, effort and general motivated behaviour. As a result, subsequently these behaviours are thought to enhance EA especially if the PA promotes the feeling of mastery, autonomy, competence and relatedness within the child.

2.8 STUDIES THAT FOUND INSIGNIFICANT AND NEGATIVE RELATIONSHIPS

BETWEEN EA AND PA

Several authors, who found an insignificant relationship (Themane et al., 2006) and even those who found a negative relationship (Tremblay et al., 2000) between the two variables have questioned the existence of a relationship between EA and PA. Lack of consensus on this issue can be attributed to the use of varied research designs across these studies. Therefore, this study was carried out using a co-relational design to establish and if necessary, explain the kind of relationship that exists between

EA and PA among rural high school learners in South Africa. The results of this study were quantitatively analysed.

Studies that found no relationship between EA and PA include the one carried out by Law, Hill and Mathews (2008) in the UK. This study used a mixed method approach to establish and if necessary, explain the relationship between EA and PA. The study adopted a two-staged mixed methods approach with both stages aiming to identify whether a relationship between PA, SE and EA exists within a mixed sample of secondary school pupils (n=62; age=13-14). Stage 1 involved a cross-sectional correlation analysis of PA behaviour via a questionnaire specifically designed for study), levels of SE (via SE Scaled) and levels of EA (via key stage achievement indicators for Maths, English and Science). Both groups contained male and female students and each student completed a semi-structured interview, which examined in detail their PA behaviour, aspects of SE and attitudes towards educational work. Within stage 2, two sample groups of participants were chosen based on their scores from stage 1, the first group consisted of students, who produced low scores in all three variables and conversely the second group was selected based on their high scores.

The results of this study, which were qualitatively analysed, found no relationship between PA, SE and EA within a cohort of Year 9 (age 13-14) Secondary School students. According to the researchers of this study, such findings may be explained via the simple cross-sectional research design failing to accommodate the range of moderating variables fully. Therefore, they indicated that Stage 2 aims to address such limitations and extend the findings of Study 1, by providing a qualitative analysis of the PA, SE and EA relationship, and serve to establish and (if necessary) explain any correlation. It was also intended by these researchers that a second study be completed (2008/2009), **to extend the extant literature by examining the impact** of targeted programme of activity on the SE and EA levels of the sample group. This study followed a mixed method approach and it is indicated that the data collected were qualitatively analysed, whereas in my study, although data was also quantitatively analysed only one method has been used. Furthermore, in this study a third variable, which is SE, was considered, whereas in my study only two variables were considered.

Taras (2005) conducted other studies, which focused on EA and PA. Most of her 14 published studies resulted in either a weak or zero correlation between EA and PA. Taras stated that studies, which showed little cognitive improvement with small changes and gains over long periods, were those conducted using adults. Taras also called for more research on the benefits of PA on school-aged children. She mentioned that educational improvement based on PA might be more noticeable in subgroups or with extremely large populations. The source further indicated that PA might indirectly affect EA by reducing stress, inducing a calming effect and changing one's mood.

In South Africa, the study that investigated the relationship between EA and PA is the *Ellisras Longitudinal Study by Themane et al. (2006)*. This study's focus was on the association between PA, physical fitness (PF) and EA in South African rural primary school children. The measure of EA was based on the standardized EA tests in Mathematics and English. Data for this study came from a sample of 212 children (112 boys and 100 girls), aged 7-14, grades 4-8, who *participated in the Ellisras Longitudinal Study*, which was a ten-year follow-up study that started in 1996, to investigate the growth and health patterns of children in 22 schools from the rural Ellisras areas in South Africa.

In general, the results of the study did not support the hypothesis of the study that both PA and PF are associated with EA in both Mathematics and English tests. However, most characteristics of the participants in this study seem to be similar to those in the current study, but the age and education levels are different. Furthermore, investigation on whether the relationship exists between EA and PA in the current study focused on high school learners instead of primary school pupils. *The current study also differs from the above study in the sense that only two variables were considered, PF is excluded. However, the methodology used in both studies is similar.*

2.9 THEORETICAL FRAMEWORK

2.9.1 Bandura's Social Learning Theory and Theory of Planned Behaviour

A number of theories provide a useful conceptual framework for understanding known in the USA as etiology (*aetiology - English UK*) of the adolescents' sedentary behaviours such as physical inactivity and for developing effective prevention approaches. Two notable exceptions are social learning theories (Jessor & Jessor, 1977) and theory of planned behaviour (Bandura, 1977). The theory of planned behaviour originates from SE theory proposed by Bandura. According to Bandura

the expectations, such as, motivation, achievement and a feeling of frustration associated with repeated failures determine effect and behavioural actions. He argues that self-efficacy is the most important precaution for behavioural change, since it determines the initiation of coping behaviour. This theory contributes to various relationships between attitudes, beliefs and intentions. The self-efficacy theory has been widely applied to health related fields, such as, PA and mental health in pre-adolescents and exercise (Ajzen, 1991).

Social learning theory is the theory where people learn new behaviour through overt reinforcement or punishment, or via observational learning of the social actors in their environment. If people observe positive, desired outcomes in the observed behaviour, they are likely to model, imitate, and adopt the behaviour themselves. From the perspective of these theories, physical inactivity and other health risk behaviours are conceptualized as socially learned, purposive, and functional behaviour, which is the result of the complex interplay of environment and individual factors. It is believed by these theorists that adolescents may be influenced by repeatedly seeing high status role models or parents display a particular behaviour.

Social learning theory presumes that psychological factors and environmental factors are important for influencing the way people behave. This theory suggests the combination of both behaviours' learning theory, which assumes that people's environment influence their behaviour and cognitive learning theory, which assumes that psychological factors are important for influencing people's behaviour. Today, most people in South Africa and other western countries sit for many hours in front of computers or TV screens, drive everywhere or use public transport to move between places, even less than 2 kilometres distances. Moreover, they eat too much fast food, so young people copy all these behaviours, thinking that this is the normal way of living (Dilley et al., 2005). One thing that people do not realize is that, their physical inactivity reduces their fitness level and consequently results in poor health, which in turn affects EA.

2.9.2 Achievement Motivation Theory

The achievement motivation theory, also known as the behavioural scientist theory argues that some people have an intense need to achieve, while others, who are perhaps in the majority, are not concerned about it (<http://en.wikipedia.org.online>). Such behavioural scientists include Mc Clelland

(1961), who observed that the need to achieve is a distinct need. According to this source, people who want to achieve would set moderately difficult, but potentially achievable goals. Achievement motivated people are said to behave as they do, because they habitually think about doing things better and whenever people start to think in achievement terms things start to happen. For example, students with a high need for achievement will generally obtain higher grades and outperform equally bright students with weaker achievement needs.

Furthermore, according to this theory achievement motivated people are more likely to be developed in families where parents hold different expectations for their children than do other parents. Therefore, this statement assumes that parenting styles are also crucial in achievement motivation. This statement is closely linked to the social learning theory of Bandura, which has been discussed in detail above. Bandura theorized that children learn certain behaviours from caregivers, who act as role models. It is believed that children imitate the desired exhibited behaviour from their role models. Therefore, in this study the researcher assumes that children and adolescents imitate lifestyles that discourage PA from their parents, teachers or other role models. Based on the aforementioned theory, the researcher can conclude that the quality of student learning as well as the will to continue learning depends closely on an interaction between the kind of social and educational goals students bring to the classroom, the motivating properties of these goals and prevailing classroom reward structures. Therefore, this study has adopted the cognitive learning theory, the rationale being that a person's activity level is not only the determinant of physical health, but psychological health. This idea is accepted on the school level as healthier children are in a better mood, have a higher SE and miss less school than their less healthy counter parts, thus leading to better EA and overall psychological health.

2.10 SUMMARY

It is evident from this review that many attributes, such as, enhanced brain function, energy levels, body builds/perceptions, SE, obesity and behaviour are attributed to PA and to improved EA. However, one cannot make direct correlations from the information offered, since the above studies on the relationship between EA and PA seem to suggest that PA either contributes positively in a small way to EA or does not influence learners' achievements. Since the results of the above

reviewed studies are mixed, further study is needed. Hence, this study aims to contribute to the existing literature by further investigating the relationship between EA (in Mathematics and English) and PA among learners in South African rural high schools, limited to Mopani district Xihoko Circuit, Limpopo Province. Following this chapter, a detailed description of the research setting, design, sampling methods and data collection methods used are presented.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter provides a detailed description of the research setting, design, sampling methods and data collection methods used in this study. The data analysis and ethical considerations are also discussed. Lastly, the chapter explains how the reliability and validity of the research instruments were ensured.

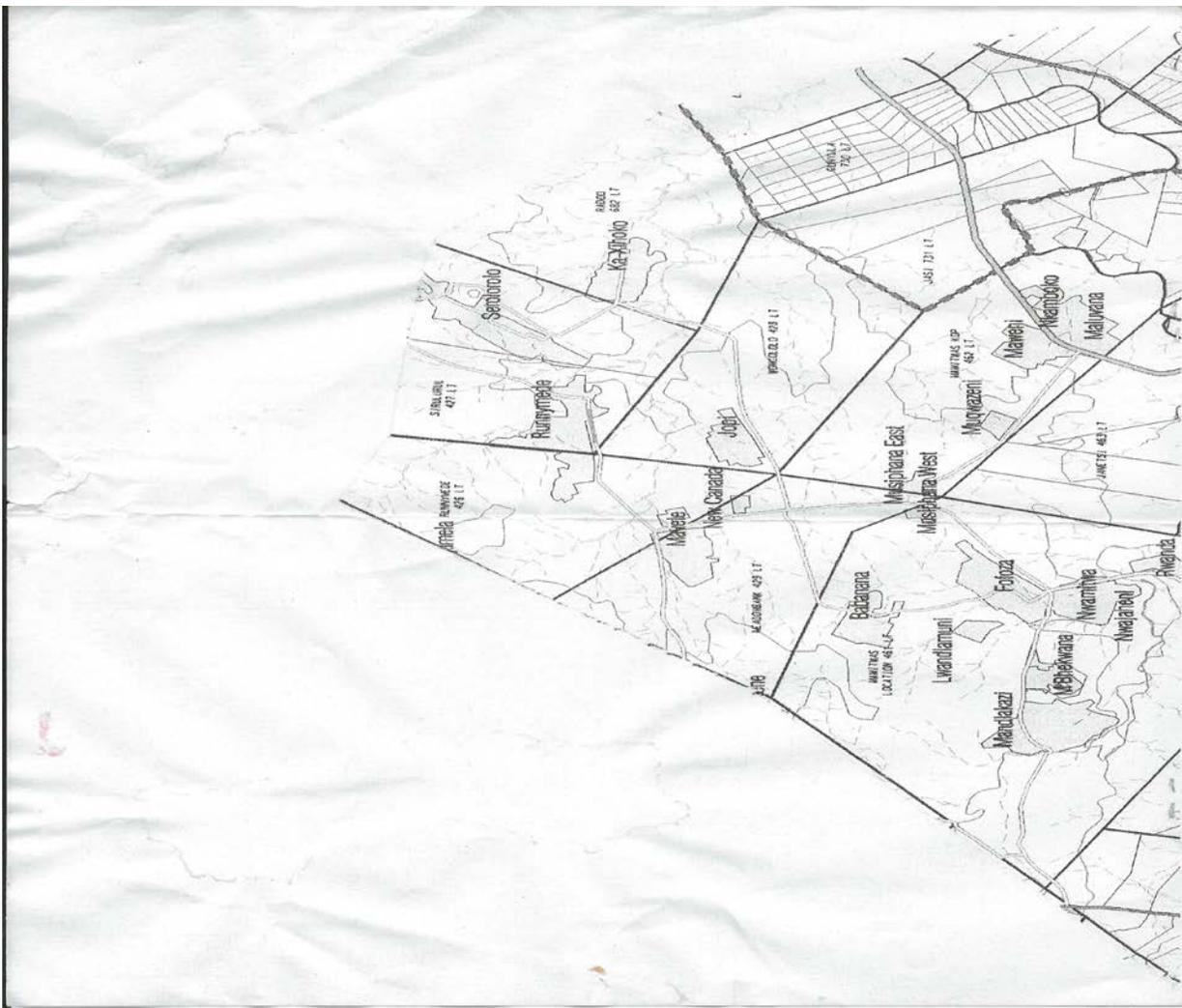


Figure 3.1 N'wamitwa and Xihoko communities map (2009) Scale is 1:50 000

Source: <http://plak.co.za/moreinfo.php?id=45476>

3.2 RESEARCH SETTING

The study was carried out in high schools within N’wamitwa and Xihoko communities (Figure 3.1). These communities are in the Limpopo Province, within the Greater Tzaneen Municipality and they consist of seven villages. The villages have more than 46 000 residents of which more than 15 000 fall into the category of ages 15-21 years (Statistics South Africa, 2001). The residents speak Tsonga and Sotho and they range from low to high socio-economic groups, however, the majority are in the low socio-economic group. Since lack of recreational facilities is one of the characteristics of low socio-economic communities, most adolescents in this study area are engaged in unhealthy behavioural practices, such as, gangs, drug abuse, alcoholism, card playing or games and other activities that encourage physical inactivity.

3.3 METHODOLOGY

The study used a quantitative methodology to verify the formulated hypothesis. It has been suggested by White (2003) that a researcher, who seeks to establish a relationship between variables and causes of changes in measured social facts, needs to use quantitative methodology. According to Mouton (2000), quantitative methodology is the best method for social scientists interested in collecting original data for describing a population too large to observe directly. In addition, White (2003) states that the quantitative method allows the researcher to formulate a hypothesis, which is subjected to empirical testing to be verified. In this study, the quantitative method was used to establish the relationship between EA and PA among rural secondary school learners at Xihoko circuit in Limpopo Province, South Africa.

3.3.1 Research Design

A descriptive **correlation** cross-sectional design was used to investigate the relationship between EA and PA among high school learners at Xihoko circuit in Limpopo Province. Katzenllenbogen and Joubert (2002) indicate that a descriptive quantitative study design is the best research design to quantify the extent of a problem. They also indicate that descriptive research is non-experimental in that it deals with relationships between non-manipulated variables in a natural rather than artificial

setting. Non-manipulation refers to the fact that we cannot create artificial divisions and circumstances in order to test a particular hypothesis as researchers do in experimental studies.

Since the events or conditions have already occurred or exist in descriptive research, relevant variables are merely selected for an analysis of their relationships. Furthermore, a cross-sectional descriptive study design is one, in which the primary goal is to assess a sample at one specific point in time, without trying to make inferences or causal statements. Though many scientific disciplines, especially social science and psychology use this method to obtain a general overview of the subjects, Shuttleworth (2008) argues that many scientists regard this type of study as very unreliable and ‘unscientific’, because there are no variables’ manipulations.

This study is a descriptive cross-sectional design because the variables are measured at a specific point in time for a defined group of people. Creswell (2002) asserts that cross-sectional studies can be thought of as a ‘snapshot’ of the frequency and characteristics of a condition in a population at a particular point in time. Furthermore, this study is also said to be correlational, because the researcher gathers data about two characteristics for a particular group of people, and these two characteristics are EA and PA.

3.3.2 Study Population and Sampling

The study population comprised all secondary school children aged 17-27 years of both sexes from three high schools. The total population (N) was 3450.

3.3.2.1 Sampling of sites

One cluster in Mopani district in the Limpopo Province was chosen as the site of the study. The site chosen was Ritavi. In this cluster, there are four circuits, which are Nkowankowa, N’wanedzi, Xihoko and Mafarana. The focus areas for the study were high schools in the Xihoko circuit. The circuit was chosen because of the researcher’s easy access to it and its proximity to her place of work. The study did not include the other circuits due to limited time.

The chosen circuit comprises four state-funded quintile 1 and quintile 3, high schools. Among these four schools, only three offer grades 12 and fall under quintile 1. The fourth one has grades 8-11 and falls under quintile 3. A quintile is a division of households by income into five quartiles. Schools that are classified as quintile 1 are found in areas where most surrounding households have very low socio-economic status. These schools were purposefully sampled for two main reasons. Firstly, they offer grade 12, wherein learners write provincially standardized June examinations and November-December nationally standardized examinations. These standardized examinations were very important in this study because learners' PA levels were correlated with their EA. Secondly, these schools have learners, who walk to and from school as well as those, who use different modes of transport. Their means of getting to and from school was of interest to the researcher, because it has an influence on the learners' PA.

3.3.2.2 Sampling of participants

From the population of grades (8-12) of the three schools, the researcher purposively selected grade 12 learners from each school as a sample. The selected sample size was (n=395), but only 77% (n=304) completed the questionnaire, 177 girls and 127 boys aged 17-27years doing Mathematics/Mathematics Literacy and English for the year 2010. The total number of participants studying Mathematics was 97 (59 girls and 38 boys), while the number of participants studying Mathematical Literacy was 207 (118 girls and 89 boys). In this study, Mathematics and Mathematical Literacy is referred to as Mathematics. All the students who participated in this study were taking English as a second language; therefore, they enrolled for English as First Additional Language.

The researcher used purposive sampling method to sample grade 12 learners, because this grade is nationally examined and is often used as a measuring standard of education by the country. According to De Vos (2002), purposive sampling is based on the judgment of the researcher, such that the sample is composed of the subjects that contain the most characteristics, which are a representative or typical of the population under study.

3.4 DATA COLLECTION

The survey was conducted for one month. It started two weeks before closing for the winter school holidays of 2010 and ended two weeks after the closing day. Questionnaires were completed during the first week of recess when the participants were attending winter school whereas tests were written before recess. The period of questionnaire completion was chosen to avoid disruptions in the school educational programme. The researcher administered the questionnaire with the assistance of two teachers in each school. One hour was used by the researcher to explain to the assistants what participants were expected to do in each part of the questionnaire. It took each respondent forty minutes, on average to complete the questionnaire. The researcher read the questionnaire first and allowed questions for clarity before participants began to complete the questionnaire.

3.4.1 PA Instrument

Data for PA were collected by means of a self-reported Youth Physical Activity Questionnaire (YPAQ) (www.mrc-epid.cam.ac.uk). This questionnaire was chosen in preference to IPAQ, which has been already validated in South Africa because it includes a detailed activity list. Furthermore, the YPA questionnaire was adapted to obtain an estimate of the prevalence of habitual and sufficient participation in PA and the prevalence of sedentariness. Mov, McFarlane, Scrags and Robinson (2003) indicate that most of the scientifically sound data relating to PA and health status or achievement are derived from prospective observational studies that used self-reported questionnaires, such as, diaries, logs, recall questionnaires, global self-reports and quantitative history.

The questionnaire consisted of thirteen questions, which were grouped into five categories (see Appendix 1).

- ❖ The first category comprised five bio-demographic questions, these assessed the respondent's gender, age, name of school being attended, spoken language and with whom respondent was residing.
- ❖ The second category comprised three questions and these were checking if the participants attended physical education lessons in the past week and the number of lessons they attended. The number of lessons attended was categorized into five options, ranging from

one time per week to five times per week. Participants were also requested to tick the activities they performed in those classes and the time they spent executing those activities in the past week. These activities included soccer, volleyball, athletics, et cetera.

- ❖ The third category comprised one question, which assessed respondents' participation in different informal activities relevant to South Africans, particularly those common among rural children. The activities included fetching water, chopping and carrying firewood, cleaning, washing and gardening. Participants were expected to recall and tick the PA they executed the previous week and the time spent performing each activity in that week.
- ❖ The fourth category also comprised one question, which assessed the respondents' participation in sedentary activities. Here also, they were requested to tick the activities they participated in and indicate the minutes engaged on these activities per week. These activities included, playing games, watching TV, reading books, doing homework, drawing and playing music.
- ❖ The last category of questions comprised three questions, which focused on how participants were commuting to and from school, their sleeping hours and the personal rating of their own PA. On the question of commuting, participants, who were walking or cycling, were also required to indicate their walking or cycling speed choosing from low, moderate or vigorous intensity. The last question of personal ratings for PA was rated as less active, moderate and very active.

3.4.2 EA Instrument

Data on EA of the participants were obtained from the sampled schools through tests scores. **Limpopo Department of Basic Education (LDOBE) set the question papers used in this study for National Senior Certificate Grade 12 (LDOBE, 2010).** Each question paper was carefully designed to cover the learning outcomes and assessment standards of the subject. A variety of skills and knowledge were assessed in each paper. Bloom's taxonomy was also used to classify questions into different levels of cognitive demand. The Mathematics and Mathematical Literacy papers' total marks were 300, and completed in two sessions of three hours each (see Appendix 8a). The English paper was out of 250 marks and completed in three different sessions for a total number of six and

half-hours’’ time (see Appendix 8b). Though the English test had less marks compared to Mathematics/Mathematical Literacy, the allocated time was longer, because it comprised Papers I, II and III, of which the latter comprised essay type questions. Class lists of the sampled classes, which contained Mathematics/Mathematics Literacy and English scores for June examinations, were requested from each school. To enable the researcher to match the scores on the mark sheets with the relevant respondent, participants were requested to write their names and classes on their questionnaires during data collection.

However, most participants in all the tested subjects seldom worked well at the synthesis and evaluation cognitive levels. During the writing process, participants were seriously invigilated to avoid cheating and any unacceptable behaviour.

3.5 DATA ANALYSIS

3.5.1 Data Screening

Before the statistical analysis was done, the screening of the data was undertaken on the univariate and multivariate levels (Tabachnick & Fidell, 2001; Kline, 1998). Data screening helped the researcher to identify potential multicollinearity in the data, because multivariate tests are sensitive to extremely high correlations among predictor variables. Outlying cases were also excluded from the analysis, as a case that actually is in one category of outcome might show a high probability for being in another category. These would result in the poor model fit (Tabachnick and Fidell, 2001). Due to this process, 9.5% (29) of participants who completed the questionnaire were excluded from the analysis, because they reflected unrealistic or over-exaggerated number of minutes spent doing some activities, therefore 275 participants remained for the study.

3.5.2 Conversion of PA Results into Metabolic Equivalent-Minutes per Week

The results of the PA questions are presented as the estimation of energy expenditure in metabolic equivalent-minutes per week (METs/hours/week). Each activity was assigned a Metabolic Equivalent Task (MET) value based on the Compendium of Physical Activities Tracking Guide (Ainsworth, 2002). The Compendium provides a coding scheme that links a five-digit code,

representing the specific activities performed in various settings, with their respective MET intensity levels (low, moderate or vigorous). **The Compendium also facilitates the use of PA records to record the type, intensity, and duration of activities in a systematic manner, though the accurate recall of time by learners is a common problem in all recall questionnaires. It should be emphasised that the Compendium was developed to facilitate the coding of PAs and to compare coding across studies. It does not take into account individual differences that may alter the energy cost of movement. Thus, a correction factor may be needed to adjust for individual differences when estimating the energy cost of PA in individuals; but no such general correction is available at this time.** According to Ainsworth (2002), if MET is defined as the ratio of work metabolic rate to a standard resting metabolic rate of 1.0 (4.184 kJ) \times kg²h²¹, then one MET is considered a resting metabolic rate obtained during quiet sitting. Conversely, if MET is defined as oxygen uptake in ml/kg/min, then one MET is equal to the oxygen cost of sitting quietly and using equivalent of up to 3.5 ml/kg/min.

Ainsworth (2002) argues that, the MET values, assigned for specific activities in the Compendium guide, are experimentally and statistically derived from a sample of persons and are in fact indicative averages. She further states that the level of intensity, at which a specific person performs a specific PA (e.g., the pace of walking, the speed of running) deviates from the representative experimental conditions used for the calculation of the standard MET values.

In the Compendium for Physical Activities, higher intensity activities, such as, cycling, dance and active sports have been assigned 5 to 8 METs and are thus considered as moderate to vigorous PAs, whereas the sedentary activities have been assigned 1MET each. Since the researcher was more interested in determining the PA levels of the participants in this study, total time spent on sitting activities and sleeping was not quantified. Only the time spent on sports, informal activities, cycling and walking activities for each respondent was quantified.

During PA scores' calculation, only the activities, **which were reported to have lasted at least 10 minutes, were taken into account.** The rationale being that according to the scientific evidence, episodes or bouts of at least 10 minutes are required to achieve health benefits, as a result responses of less than 10 minutes [and their associated days] should be re-coded to 'zero' (International Physical Activity Questionnaire – IPAQ Research Guideline, 2005). Furthermore, PAs' total scores,

which were more than 112 hours per week, were not taken into account, the rationale being that every person should have at least eight sleeping hours a day and spend time on other activities not regarded as PAs. This would mean that a person whose PA scores exceeded 112 hours per week never had the minimum sleeping hours, implying that, that person was performing PA even during sleeping time. According to Baranowski (1988), questionnaire-based evaluation of PA has a recall-biased problem, especially when working with adolescents. Adolescents tend to either overestimate (active adolescents) or underestimate (obese adolescents) PA and this can increase the variability of measurements, leading to weaker correlations.

The weighted MET-hours per week (MET/hours/week) were calculated as duration of time taken doing activity x frequency per week x MET intensity, which were then summed across activity domains to produce a weighted estimate of total PA from all reported activities per week (METs/hours/week). This method of calculating the METs/hours/week was adapted from IPAQ scoring protocol (2005). According to IPAQ scoring protocol, METs/hours/week of a specific activity (walking or moderate intensity activity or vigorous intensity activity) is computed by multiplying MET value of particular activity (3.3 for walking, 4.0 for moderate intensity activity, and 8.0 for vigorous intensity activity), with time spent in that particular activity per week.

The METs/hours/week were then broken into 3 categories as referred to the (IPAQ) Guidelines for Data Processing and Analysis (2005), which categorized PA following the WHO's recommended PA level for health. The recommendation indicates that children and adolescents should participate in moderate to vigorous activity at least 60 minutes five days or all weekdays. The categories in this study are less active (<32.5METs/hours/week), moderately active (32.5-45.5METs/hours/week) and highly active (>45.5METs/hours/week). In calculating 'moderately active', the primary requirement was to identify those individuals, who undertook activity on at least five days/week, whereas in calculating very active category, the primary requirement was to identify those individuals, who undertook a combination of walking, moderate-intensity and or vigorous-intensity activity on at least seven days/week.

3.5.3 Overview of Data Analysis

Data were analysed using the Statistical Package for Social Sciences Software (SPSS) version 17.0. Descriptive statistics (mean and standard deviation) were used to describe data. Inferential statistics were run for the Spearman's rank correlation and Chi-square to measure associations between EA and PA of the learners. In comparing EA across the categories of PAs of the participants, the Kruskal Wallis test was applied. The Spearman's rank correlation and Chi-square non-parametric tests were preferred to their parametric equivalents, that is, the student's T-tests and the Analysis of Variance (ANOVA) test.

3.6 ETHICAL CONSIDERATIONS

The researcher obtained clearance for the study from the Senate Higher Degrees Committee of the University of Limpopo. Permission to conduct the study was also obtained from the Department of Education, Limpopo Province (see Appendix 3) and the circuit office (see Appendix 4). On receipt of the permission from the department, school principals were contacted to request permission to conduct the study within their respective schools (see Appendix 6). Each participant was given a letter to notify their parents about the study and to request permission for their children to participate in the study. Participation was voluntary and permission was granted by written consent from parents (see Appendix 7). All participants were assured of anonymity and that the information to be collected was for the use of the study only. It was also emphasized by the researcher that the information obtained would be confidential and that the result of the study would be made available to the participants and the schools involved.

3.7 RELIABILITY AND VALIDITY

The stability or test-retest reliability of this study's instrument was obtained through the pilot testing of the instrument. Test-retest reliability shows if the same results are obtained with repeated administering of the same survey to the similar study participants. **The questionnaire was first used in the pilot study conducted at Mark Shope High School located at N'wanedzi Circuit in Limpopo. The sample for the pilot study comprised (n= 20) participants who were not part of the study. The completed questionnaires were divided into 2 groups (10 in each) and each response was rated as**

(understood/ not understood). Two educators were requested to check if the questions were understood or not, allocating two marks in each question. The agreement percentage between the two raters was 94.6%. The pilot study data were analysed, the responses of the participants indicated that question two and three were not clear to the participants and as a result were misinterpreted. The two questions' wording was then improved. Following, the actual study was conducted and the results of the actual survey compared and correlated with the initial results in the pilot study and expressed by the "Pearson r coefficient".

Validity refers to the degree to which a study accurately reflects or assesses the specific concept or construct that the researcher is attempting to measure (Thorndike, 1997). To ensure validity of the instrument, the researcher's supervisors, the University of Limpopo's statistician, and three other lecturers in the Department of Education have examined wording of the items. Content validity of the survey instrument was used for the study; underwriting the extent to which the survey items and the scores from the questions were representative of all the possible questions about the participants' PA.

3.8 SUMMARY

This chapter outlined the methodology used to perform this quantitative study including demographic data for the participants. Detailed descriptions of participants, instruments and procedures for administering these were also outlined. Finally, ethical considerations, validity and reliability for the instruments were explained. This study examined the relationship between EA and PA among secondary high rural school learners. The researcher used a questionnaire to measure participants' PA. EA were evaluated by using Mathematics and English test scores. The next chapter details the results of the study based on statistical analysis.

CHAPTER 4

RESULTS

4.1 INTRODUCTION

In this chapter, the bio-demographic data and the participants' PE class attendance levels are fully described. In addition, the participants' PA levels as expressed in METs/hours/week are presented. The chapter also reflects the results for the assessment of the association between EA and PA as measured by Spearman's rank correlation test, Chi-square tests and the Kruskal Wallis test. Spearman's rank correlation test was performed to determine association between the EA of learners and the PAs categories whereas Chi-square tests were performed to test the null hypothesis, which states that there, is no significant difference between the expected and the observed results (Fisher & Yates, 2009). Lastly, the Kruskal Wallis test was performed in this study to compare the means of scores obtained in Mathematics and English for each of the categories of PA.

4.2 BIO-DEMOGRAPHIC DATA

The study recruited (n=275) participants (111 boys and 164 girls).

Table 4.1 Bio-demographic data of the learners (n=275)

School	Age range	Frequencies			Percentage	
		Total	Boys	Girls	Boys	Girls
School 1	17 – 24	169	64	105	37.9	62.1
School 2	17 – 27	41	21	20	51.2	48.8
School 3	17 – 24	65	26	39	40.0	60.0
Total		275	111	164	100	100

Table 4.1 above presents demographic information of the participants in terms of age and gender. School 1 had more participants than the two other schools and mainly comprised girls. Interestingly, school two have six learners who are above 24 years and two of them are 27 years old.

4.3 PA RESULTS

4.3.1 PE Class Attendance

The bar graph below reflects the frequencies of the number of learners, who attended PE classes as well as how many times per week these were attended. The maximum attendance frequency is five times a week and the minimum frequency is zero. The chart indicates that 2.2% of the participants did not attend PE classes at all in their schools.

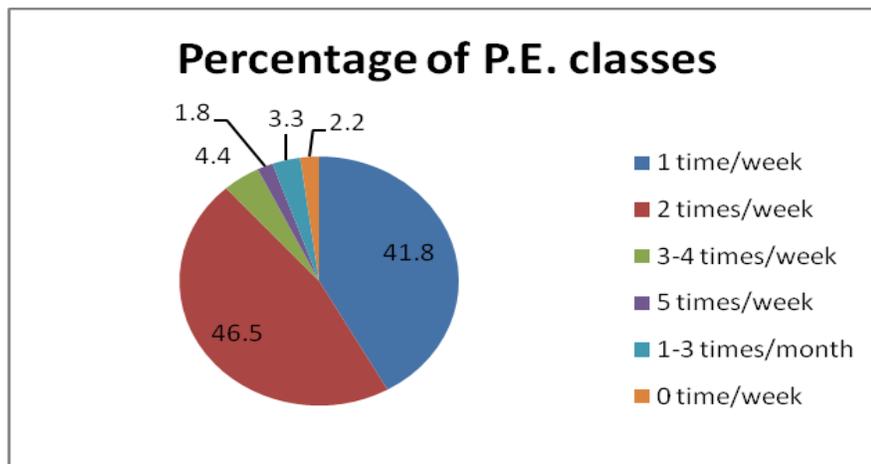


Figure 4.1: Physical education lessons attendance

4.3.2 PA Performed

Table 4.2 on below illustrates the examples of common PAs in which high school learners at Xihoko Circuit participate. These PAs have been classified according to the rate of energy expenditure expressed as metabolic equivalent (METs). METs values were assigned to each activity based on the “best representation” of an intensity level in the 1993 Compendium. In the table, activities were categorized as low, moderate and vigorous intensity. On the basis of previous studies by Ainsworth, Haskell, Whitt, Irwin, Swartz, Strath, O’Brien & Bassett (2000) and Leon, Connett & Jacobs (1987) vigorous intensity activities are those with an intensity code of > 6.0 METs or $> 7\text{kcal}\cdot\text{min}^{-1}$, such as, running, cycling and tennis. Activities of moderate intensity have an intensity code of (3.0-6.0 METs or $4-7\text{kcal}\cdot\text{min}^{-1}$ and examples include gardening, dancing, housework and domestic chores. The last category, which is low intensity activities have an intensity code of < 3.0 METs or $< 4\text{kcal}\cdot\text{min}^{-1}$ and examples include walking for pleasure, home activities and volleyball.

Table 4.2: Common physical activities for learners at Xihoko Circuit

*Low (<3.0METs or <4 kcal.min⁻¹)	*Moderate (3.0-6.0METs or 4-7kcal.min⁻¹)	*Hard/vigorous (>6.0METs or >7kcal.min⁻¹)
Walking slowly (strolling) (1-2 mph)	Walking briskly (3-4 mph)	Walking briskly uphill or with load
Cycling, stationary(<50 mph)	Cycling for pleasure (≤10 mph)	Cycling fast(>10 mph)
Swimming slow treading	Swimming moderate effort	Swimming fast treading
Sports (volleyball , non-competitive)	Sports (track and field shot, discuss & javelin, gymnastics)	Sports (soccer competitive, rope jumping, jogging)
Home activities (cleaning, mopping, wood chopping, cooking, washing)	Home activities (Multiple household activities all at once)	Home activities e.g. moving furniture, pushing wheelbarrows and gardening

*Data from Ainsworth, Haskell, Leon, Jacobs Jr, Montoye, Sallis & Paffenbarger, (1993). The METs (work metabolic rate/resting metabolic rate) are the multiples of the resting rate of oxygen consumption during physical activity. One MET represents the approximate rate of oxygen consumption of a seated individual at rest, or about 3.5-ml. min⁻¹ kg⁻¹. The equivalent energy cost of 1 MET in kilocalories.min⁻¹ is about 1.2 kilocalories.min⁻¹ for a 70kg person, or approximately 1 kcal.kg⁻¹.hr⁻¹.

4.3.3 Pattern of PA Levels in Metabolic Equivalent Hours per Week (METs/hours/week)

Figure 4.2 on the next page depicts the pattern of the PA of participants in METS/hours/week. This histogram clearly shows that the majority of the participants reached the recommended levels of PA, which is 60 minutes of moderate to vigorous activity every day. When these minutes are presented as the estimation of energy expenditure in METS/hours/week, **which is 5-7 days**, they equal to 32.5-45.5 METs/hours/weeks. The histogram also indicates that the average METs/hours/week is 69.19 and the standard deviation is 46.088.

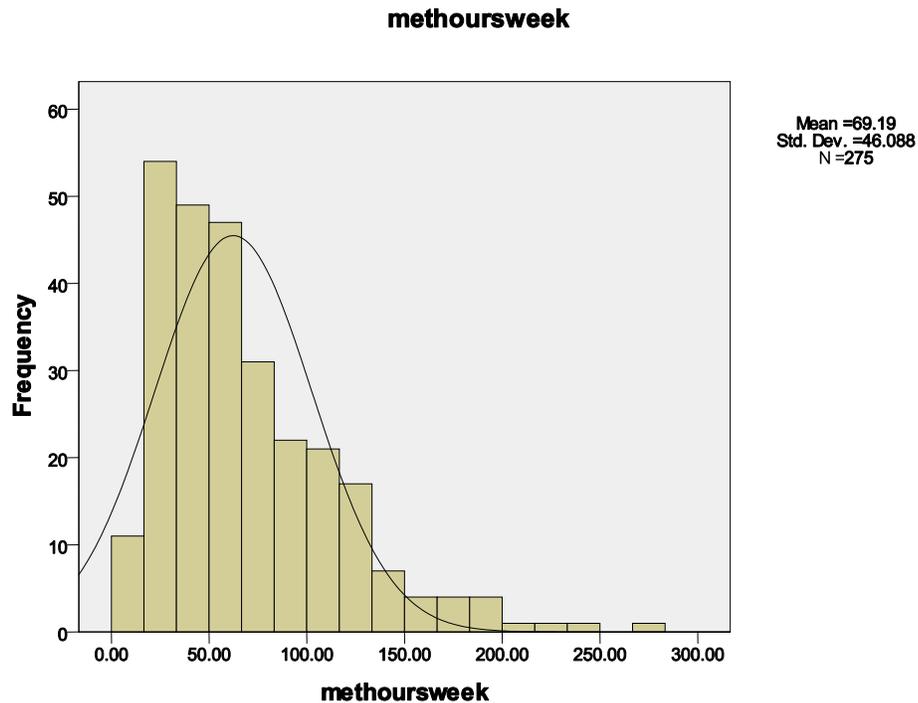


Figure 4.2: Pattern of physical activity levels in metabolic equivalent-hours per week (METs/hours/week)

Table 4.3: Physical activity categories for participants in METs/hours/week

Categories of activity	Frequency	Percent
Less active (<32.5 METs/hours/week)	61	22.2
Sufficiently active (32.5-45.5METs/hours/week)	41	14.9
Very active (>45.5 METs/hours/week)	173	62.9
Total	275	100

Table 4.3 above illustrates the three categories of PA in METs/hours/week calculated from the hours of PA reported by the 275 participants used in this analysis. The first category comprised participants, who were less active, those, who accumulated < 32.5 METs/hours/week. The second category consists of those, who accumulated 32.5-45.5 METs/hours/week and these were considered

sufficiently active. The last category is for those, who accumulated > 45.5 METs/hours/week and they were considered to be highly or very active. According to this table, only 22.2% of the participants were less active (<32.5 METs/hours/week). This means that 77.8 % of the participants were at least, sufficiently active and more (≥ 32.5 METs/hours/week). Among all the participants, 62.9% of them are in the very active category (>45.5 METs/hours/week).

Table 4.4: Comparisons for mean and standard deviation between metabolic equivalent and learners’ achievements in Mathematics and English across schools

School	Variables	Boys (mean \pm SD)	Girls (mean \pm SD)	Whole school (mean \pm SD)
School 1	Metabolic Equivalent	(70 \pm 44.6)	(73 \pm 40)	(71.9 \pm 41.7)
	Mathematics Achievement	(30 \pm 17.6)	(27 \pm 15.2)	(29 \pm 16.1)
	English Achievement	(43 \pm 13.9)	(41 \pm 13.9)	(42 \pm 13)
School 2	Metabolic Equivalent	(45 \pm 19.3)	(61 \pm 35.2)	(52.9 \pm 29)
	Mathematics Achievement	(16 \pm 5.4)	(15 \pm 5.8)	(15 \pm 5.6)
	English Achievement	(37 \pm 7.5)	(33 \pm 11.1)	(35 \pm 9.5)
School 3	Metabolic Equivalent	(63 \pm 37.4)	(80 \pm 64.1)	(69.4 \pm 56.2)
	Mathematics Achievement	(24 \pm 11.2)	(21 \pm 13.4)	(22 \pm 12.6)
	English Achievement	(45 \pm 13.4)	(43 \pm 10.2)	(44 \pm 11.5)

Table 4.4 above displays the comparison of the mean and standard deviation for boys and girls participants’ PA levels as expressed in METs/hours/week with their achievement in Mathematics and English per school. It is evident from the table that girls in all schools were physically more active in comparison to boys, but the achievement was higher for boys in both subjects and in all schools.

4.4 EA RESULTS

Data on participants’ EA were collected from English and Mathematics tests.

4.4.1 English Achievement

Figure 4.3 below illustrates the pattern of participants' achievements in English, where most participants scored between 20% and 60%. Very few obtained below 20% and above 60%. Considering the 30% pass mark set by National Curriculum Statement, only 13.8% of participants failed, suggesting that a vast majority of 86.2% passed. On the other hand, if we were to consider a 50% pass mark, it would mean that only 24% of participants passed.

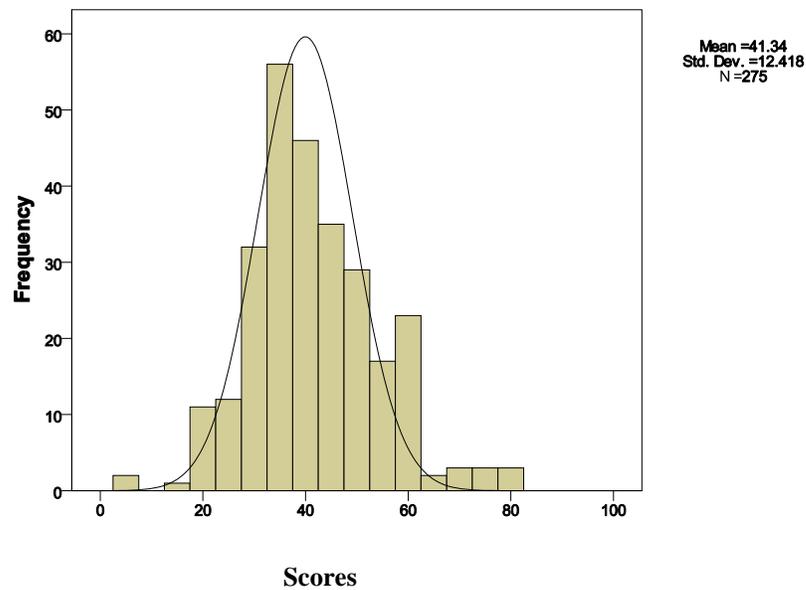


Figure 4.3: Pattern of participants' achievement in English

The frequency Table 4.10 (appendix 9) further illustrates these results by showing the tallies and frequencies under each achievement level.

4.4.2 Mathematics Achievement

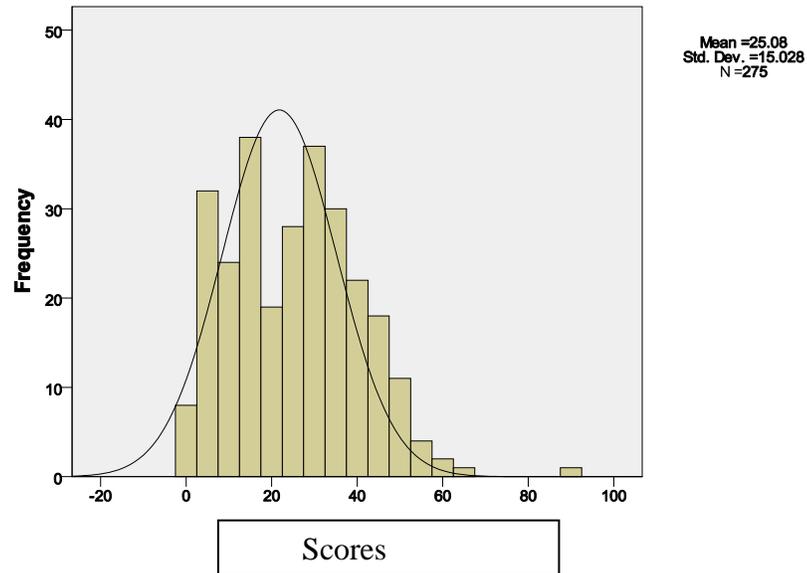


Figure 4.4: Pattern of participants’ achievement in Mathematics

Figure 4.4 on the previous page indicates the pattern of participants’ achievements in Mathematics, where most participants scored between 0% and 50%. Very few obtained above 50%. Considering the 30% pass mark set by National Curriculum Statement 57.5% of participants failed, suggesting that 42,5% passed. On the other hand, if we were to consider a 50% pass mark, it would mean that 95% failed and only 5% of participants passed.

The frequency Table 4.11 (appendix 9) further illustrates the results by depicting the tallies and frequencies under each achievement level.

4.5 SPEARMAN RANK CORRELATION

The Spearman’s Rank Correlation test was performed to investigate the correlation that exists between English scores and PA as well as Mathematics scores and PA. Tables 4.5a and 4.5b below reveal the results of this test. **These results indicate the Spearman’s test ($r = .079$ and $p < 0.05$) with**

regard to English scores and PA as well as Spearman's test ($r = .086$ and $p < 0.05$) with regard to Mathematics scores and PA.

Table 4.5a: Spearman Rank Correlation between EA in English and PA in Mets/hours/week

		English	Met/hours/week
Spearman's rho	English Correlation Coefficient	1.000	.079
	Sig. (2-tailed) N	275	.189 275
Met/hours/week	Correlation Coefficient	.079	1.000
	Sig. (2-tailed) N	.189 275	275

Table 4.5b: Spearman Rank Correlation between EA in Mathematics and PA in Mets/hours/week

		Mathematics	Met/hours/week
Spearman's rho	Mathematics Correlation Coefficient	1.000	.086
	Sig. (2-tailed) N	275	.154 275
Met/hours/week	Correlation Coefficient	.086	1.000
	Sig. (2-tailed) N	.154 275	275

4.6 CROSS-TABULATIONS OF EA AND THE CATEGORIES OF PA

Cross-tabulations of EA and the categories of PA were performed to examine the category of PA where most participants belong. The results in Table 4.6 show that 62.9% of the participants who participated in this study belong to category 3, which implies that they are very physically active.

Table 4.6: Cross-tabulations of EA (percentages) and PA (METs/hours/week)

			MET category			Total
			1	2	3	
English	0-29	Percentage	22.8%	14.8%	62.4%	100.0%
	30-59	Percentage	21.8%	16.0%	62.2%	100.0%
	60-100	Percentage	14.3%	0%	85.7%	100.0%
	% of Total		22.2%	14.9%	62.9%	100.0%
Mathematics	0-29	Percentage	22.2%	15.4%	62.4%	100.0%
	30-59	Percentage	22.5%	10.0%	67.5%	100.0%
	60-100	Percentage	.0%	100.0%	.0%	100.0%
	% of Total		22.2%	14.9%	62.9%	100.0%

4.7 ACHIEVEMENT PER CATEGORY OF PA PER SUBJECT

Table 4.7 below presents the percentage of participants, who passed and those who failed per category and subjects. The means and standard deviations of scores in each category are also indicated. In English, more participants passed and few failed in all categories of PA. A comparison of achievement in English across the categories indicate that category two (moderate or sufficiently active) outnumber the other two categories with participants who passed. In Mathematics, more participants failed and only a few passed in all categories. When comparing the Mathematics achievement across the categories, category 3 (very physically active) has more participants, who passed Mathematics than the other two categories.

Table 4.7: Number of participants who passed or failed per category of PA

Category	Results	English	Mean ± SD	Mathematics	Mean ± SD
1	Fail	8.2	41 ± 10.0	59	26 ± 13.4
	Pass	91.8		41	
2	Fail	9.8	41 ± 10.6	60.9	25 ± 4.01
	Pass	90.2		39	
3	Fail	16.8	42 ± 13.6	56.1	25 ± 15.3
	Pass	83.2		43.9	

4.8 KRUSKAL WALLIS TEST

The Kruskal Wallis test was used to assess whether the median of the participants' EA varied in English and in Mathematics. Table 4.8 below reflects the mean ranks of EA across the PA categories. The results reveal that there was no statistical difference between the different PA categories $H(2) = .072, p = .965$ with mean rank 135.60 for category 1; 138.45 for category 2 and 138.74 for category 3 in English achievement and $H(2) = .518, p = .772$ with mean rank 144.25 for category 1; 138.23 for category 2 and for Mathematics.

Table 4.8: Kruskal Wallis test results in Mathematics and English

Subjects	PA categories	Cases	Rank sum	Mean Rank	H Tests
English	1	61	14837	135.60	.072
	2	41	7723	138.45	
	3	173	14060	138.74	
Mathematics	1	61	14947	144.25	.518
	2	41	7811	138.23	
	3	173	13962	135.74	

Key: PA category 1= less active, 2= sufficiently active and 3= very active

4.9 CHI-SQUARE TEST

When the Chi-square tests were performed, a relationship between EA and PA was evident. Table 4.9 on the following page illustrates that at the probability of $p < 0.05, df = 2$, the χ^2 of 8.06 for Mathematics and 147.2 for English are greater than **5.99 chi-square statistical table value**. This

elicits that an association between EA and PA exists, resulting in the rejection of the null hypothesis, which states that, there is no relationship between EA (in Mathematics and English) and PA among rural high school learners in Xihoko circuit. Therefore, the researcher concluded that there is a relationship between EA and PA among rural secondary school learners at Xihoko circuit.

Table 4.9: Chi-square test for Mathematics and English

Mathematics	Less active	Category	Observed	Expected	O-E	(O-E) ²	(O-E) ² /E
		Fail	36	30.5	5.5	30.25	0.99
	Moderate	Pass	25	30.5	-5.5	30.25	0.99
		Fail	26	20.5	6.5	42.25	2.06
	Very active	Pass	15	20.5	-5.5	30.25	1.48
		Fail	97	86.5	10.5	110.25	1.27
	Pass	76	86.5	-10.5	110.25	1.27	
							$\chi^2 = 8.06$
English	Less active	Category	Observed	Expected	O-E	(O-E) ²	(O-E) ² /E
		Fail	5	30.5	-25.5	650	21.3
	Moderate	Pass	56	30.5	25.5	650	21.3
		Fail	4	20.5	-16.5	272.25	13.3
	Very active	Pass	37	20.5	17.5	306.25	14.9
		Fail	29	86.5	-57.5	3306.25	38.2
	Pass	144	86.5	57.5	3306.25	38.2	
							$\chi^2 = 147.2$

The chi-square tests for males and females were also conducted separately. Different and interesting results emerged from this test. The results indicate an association only between English and PA in both males and females (table 4.10). At the probability of $p < 0.05$, $df = 2$, the χ^2 of 63.94 in females and 85.60 in males for English are revealed and found to be greater than the 5.99 table value, whereas in Mathematics at the probability of $p < 0.05$, $df = 2$ the $\chi^2 = 5.15$ in females and $\chi^2 = 4.58$ in males are shown. The calculated values are less than 5.99 table value of chi square statistical table. This suggests that an association only exists between English and PA but not between Mathematics and PA in both males and females of this study.

Table 4.10: Chi-square test for males and females in Mathematics and English

Females

English	Less active	Category	Observed	Expected	O-E	(O-E) ²	(O-E) ² /E
		Fail	4	15	-11	121	8.07
	Pass	26	15	11	121	8.07	
Moderate	Fail	4	12	-8	64	5.3	
	Pass	20	12	8	64	5.3	
Very active	Fail	23	55	-32	1024	18.6	
	Pass	87	55	32	1024	18.6	
							$\chi^2 = 63.94$
Mathematics	Less active	Category	Observed	Expected	O-E	(O-E) ²	(O-E) ² /E
		Fail	17	15	2	4	0.27
	Pass	13	15	-3	9	0.6	
Moderate	Fail	14	12	2	4	0.33	
	Pass	10	12	-2	4	0.33	
Very active	Fail	65	55.5	10.5	110.25	1.99	
	Pass	46	55.5	-9.5	90.25	1.63	
							$\chi^2 = 5.15$

Males

English	Less active	Category	Observed	Expected	O-E	(O-E) ²	(O-E) ² /E
		Fail	1	15.5	-14.5	210.25	13.7
	Pass	30	15.5	14.5	210.25	13.7	
Moderate	Fail	0	8.5	-8.5	72.5	8.5	
	Pass	17	8.5	8.5	72.5	8.5	
Very active	Fail	6	31.5	-25.5	650.25	20.6	
	Pass	57	31.5	25.5	650.25	20.6	
							$\chi^2 = 85.6$
Mathematics	Less active	Category	Observed	Expected	O-E	(O-E) ²	(O-E) ² /E
		Fail	19	15.5	3.5	12.25	0.79
	Pass	12	15.5	-3.5	12.25	0.79	
Moderate	Fail	12	8.5	3.5	12.25	1.47	
	Pass	5	8.5	-3.5	12.25	1.47	
Very active	Fail	32	31	1	1	0.03	
	Pass	30	31	-1	1	0.03	
							$\chi^2 = 4.58$

4.10 SUMMARY

In summary, the participants included 275 grade 12 students. The assessment of the association between EA and PA as measured by Spearman’s rank correlation test, Chi-square tests and the Kruskal Wallis tests were conducted. In this chapter, the researcher fully described and presented the

results of the descriptive and inferential statistical analysis in tables, graphs and charts. Descriptive statistics revealed that all the participants participate in some form of PA but only 77.8% of the participants were sufficiently active. Most of the participants belonged to the highly active category and reasons for this are explained in the next chapter. Spearman's rank correlation test revealed positive but very low correlation between EA and PA (Spearman's $r = 0.079$ and $p = 0.189$) with regard to English scores and PA as well as (Spearman's $r = 0.086$ and $p = 0.154$) with regard to Mathematics scores and PA. The correlation is closer to zero showing greater uncertainty, and this means that the relationship is not certain enough to be useful. In short, one can say that the results revealed in this study are a positive weak correlation between EA and PA. The next chapter therefore, outlines an interpretation and discussion of the presented results.

CHAPTER 5

INTERPRETATION AND DISCUSSION

5.1 INTRODUCTION

Chapter 4 focused on the analysis of data derived from grade 12 learners of the three sampled schools. In this chapter, the objectives of this study, as outlined in chapter one, are repeated for the convenience of the reader. The interpretation and the discussion of the results presented in chapter four will then follow. It should be noted that in this presentation of the interpretation of the results, not all the items in the questionnaire were considered, but only those items that yielded statistically significant results. Furthermore, EA and PA form the bases of this study. Finally, a concluding paragraph will follow.

5.2 AIM AND OBJECTIVES OF THE STUDY

The main aim of this study was to investigate the relationship between EA and PA among rural secondary school learners in Xihoko Circuit, Limpopo Province in South Africa. This study hypothesized that there is a positive relationship between EA and PA among rural secondary school learners in Xihoko Circuit of Limpopo Province in South Africa. The objectives of this study were to:

- ❖ Establish if high school learners in Xihoko Circuit reach the recommended PA levels for young people as recommended by WHO guidelines,
- ❖ Determine if English test scores for highly physically active learners are significantly different as compared to English test scores for moderate and less physically active learners,
- ❖ Determine if Mathematics test scores for highly physically active learners are significantly different as compared to mathematics test scores for moderate and less physically active learners, and
- ❖ Compare the means of scores obtained in Mathematics and English across the categories of PA.

The most important finding, which emerged from the analysis of the results of this study, reveals a **weak positive correlation coefficient between EA and PA** ($r = .079$ for English and $r = 0.086$ for Mathematics). The correlation found tells us that, as one variable changes the other variable seems to change towards the same direction in a predictable way. This does not mean that one variable cause the other, but it simply means that as PA increases so does EA vice versa. These results validate the hypothesis that there is a relationship between EA and PA, among high school learners in Xihoko circuit. When it comes to the strength of the relationship, the r-value that is closer to zero reveals a weak relationship with no statistical significance. A chi square test was also carried out to further investigate this relationship and the results revealed a relationship because the chi-square value obtained was greater than the table value. Surprisingly, when the chi square test was carried across gender. **From the results, a relationship was only observed between English and PA and no relationship was observed between Mathematics and PA.** Further observation in this target population is that females were more physically active than males, but to the contrary, boys performed better. As such, it is difficult to conclude that there is no relationship between their EA and PA levels. This suggests that, other factors that cause poor achievement among active girls exist, and those factors are discussed later in this chapter.

5.3 INTERPRETATIONS AND DISCUSSION OF THE RESULTS

5.3.1 Physical Activity (PA)

Before testing the main hypothesis the researcher first decided to check participants' level of activity to determine whether they reached the PA levels, recommended by WHO or not, thus impacting on the interpretation of the results on hypothesis testing. Figure 4.1 depicted frequencies of learners, who attended PE classes. It was evident from the chart that 46% of the participants attended PE classes twice a week, 41.8% attended once a week and 2.2% did not attend PE classes at all. Therefore, the researcher is of the opinion that most participants attended once or twice a week, because the Department of Education allocated 60 minutes per week for the PE tasks in grades 10-12 for Life Orientation and that all learners were expected to participate. The researcher is convinced that the Department is trying to address the problem of PA among learners and promote a healthy lifestyle. The question is where do learners, who are not attending these classes, obtain their marks for PE tasks, since it is compulsory to attend?

However, studies of PE have shown that not all PE classes are offered in sufficient dosage (frequency and duration) or instructed with adequate quality to produce the desired health benefits in students (Ahamed, MacDonald, Nylor, Liu-Ambrose & McKay, 2007; Fredericks, Kokot & Krog, 2003). As a result, participants in this study were required to report on the time they spend participating in formal and informal activities that could raise their heart rate and increase their breathing speed to more than normal during and after school. The results obtained enabled the researcher to calculate the PA level of participants. Table 4.3 illustrates the three categories of PA in METs/hours/week calculated from the amount of time spent doing PA reported by the 275 participants used in this analysis. According to this table, only 22.2% of the participants were less active (<32.5 METs/hours/week) meaning that 77.8 % of the participants were at least, sufficiently active or more active (≥ 32.5 METs/hours/week). Among all the participants, 62.9% fell into the very active category (>45.5 METs/hours/week). Despite them not attending PE classes daily, 77.8% remain physically active. Factors that could be contributing to their physical activity may include travelling long distances to and from school; house chores (chopping wood, cleaning, cooking) and playing of traditional games (kgathi, masikitlana). Other physical activities that learners in Xihoko participated in are displayed in Table 4.2.

5.3.2 Learners' PA Level and the WHO Guidelines on Recommended PA among Young People
Analysis for the first objective provided support for the hypothesis that high school learners in Xihoko circuit, reach WHO's recommended PA level. Although there is a growing concern about inadequate PA levels among adolescents globally as a result of internet surfing, TV viewing, discontinuity of PE as a subject in most schools and increased sedentary behaviour, this study highlighted that most learners were physically active in Xihoko Circuit and that they met the WHO's recommended PA level for health (WHO, 2005). The recommendation indicates that children and adolescents should participate in moderate to vigorous activity at least 60 minutes x 5 days a week or 60 minutes every day. In this population, learners were far above this norm.

The guideline also suggests that the minutes of exercise can be accumulated throughout the day in small course of activities and further suggests that, more benefits can be obtained by adding more time to exercise sessions or by working at a higher intensity.

In terms of PA levels, the results of the current study are in contrast with findings of the study in the Western Cape Province of South Africa among school going adolescents. The latter found that 32% of the participants did not meet the recommended level of PA (Frantz, 2006). In addition, the study in Nairobi, Kenya, found that 28.2% were considered physically inactive or sedentary (Kibet, 2007). The reasons for less PA levels among adolescents are not clear. One of the possible reasons might be age change. A study by Nader, Bradley, Houts McRitchie & O'Brien (2008) observed progressive a decline in levels of activity as children moved to adolescents, beginning at 9 years where 3 hours were spend daily in moderate to vigorous physical activity (MVPA) to 15 years where only 49 minutes were spent in MVPA. To add on that, unavailability of safe places to be physically active and the quality of school based PE may explain some of the individual and regional differences of PA levels noted in this study and other studies of PA.

Furthermore, the current study differs with that of Frantz (2006) and Kibet (2007) in the sense that the PA level was grouped into two categories, which are physically active and physically inactive or sedentary. Although participants of the current study were asked to indicate the time they spend on sedentary activities, the researcher did not include the results, because the interest was only in PA that quickened the participants breathing and heart rate more than normal. In the researcher's view, the energy expended during sedentary activity is far below 3 METs and such amounts of METs were rated zero in this study, refer to Chapter 3, which explains the reason for this view.

Looking at the number of physically active participants, the results of the current study differed from the findings of the study conducted by Phillips (2006) among black female adolescents in the Western Cape, South Africa, which discovered that 60% of the participants were physically less active. This difference could be attributed to the fact that, the above-mentioned study's sample constituted only females. In most cases, female learners tend to spend most of their time in smaller groups and engage in verbal games, conversation and socialising (personal observation). In contrast, boys most boys play in larger groups, which lend themselves more to physically active games such

as football. This suggests that schools should be aware of the differences between the way girls and boys behave in playground and the fact that girls tend to favour small groups activities. They could then consider the availability of equipments and provision of playtime that would encourage girls to take part in more vigorously active play.

Literature has also proven that females are less active than males. One of the studies that revealed such findings is the first South African National Youth Risk Surveillance conducted in 2002 (Reddy, Panday, Swart, Jinabhai, Amosun, James, Monyeki, Stevens, Morejele, Kambaran, Omardien & Van den Borne, 2003). In all the provinces, males were physically more active than females. Of 10,100 participants, who participated in insufficient or no PA nationally, 5,414 were females. The national average for learners, who had participated in sufficient vigorous activity in the week, preceding the survey, was 44.6% [42.3 - 46.8]. Significantly, more males (57.1% [54.6 - 59.6]) than females (34.7% [31.7 - 37.6]) participated in sufficient vigorous PA.

The issue of more highly physically active girls than boys, depicted in Table 4.4 differed from the findings by South African National Youth Risk Surveillance (SANYRS) conducted in 2002, which found that boys were more physically active than girls were. The contributing factor to high PA levels of girls in this study might be the fact that this study was conducted in a rural area, where girls still walk long distances to collect wood and fetch water. However, the comparison of PA levels must be made with caution, as studies might differ in data collection methods. In short, one can say the data of the current study suggests that the level of PA in this sample was similar or slightly higher than what has been found in the African continent among same age adolescents. Though a higher percentage of young people seemed to be physically active, a large number still does not meet the WHO's recommended level of activity.

5.3.3 Educational Achievement (EA)

EA in English and Mathematics were analysed and the results were reflected in Figure 4.3 and Figure 4.4. The two figures revealed a pattern of achievement where most participants scored between 20% and 60% in English, and in Mathematics the majority scored between 0% and 50%. The pass percentage in English amounted to 86.2%, whereas in Mathematics it only panned out at 42.5%.

Many factors might have contributed to low pass rate in Mathematics as compared to English pass rate. Such contributory factors might include attitude of learners towards the subject, unqualified or under qualified teachers, teaching strategies and motivation. Most learners just heard that Mathematics is difficult and because of what their minds conceived, negative attitude toward the subject developed and this negatively affect their performance. Societal and parental beliefs have also been proven to adversely affect students' attitude about mathematics and problem solving (Olson, 1998).

In the case of unqualified teachers, shortages of qualified Mathematics teachers in schools leave principals with no other option than to allocate the Mathematics subject to those who are at their disposal. As a result of insufficient expertise, teachers employ wrong teaching strategies that hinder learners to acquire basic mathematical skills, consequently, poor learners' performance results. The Mathematics Audit revealed that more than 50% Mathematics teachers have had no formal subject training and this situation negatively affect learners' performance in Mathematics (DoE, 2001). Lastly, in this issue, learners need motivation from their teachers or parents to love their subjects of choices. Schools experience the direct opposite of this. Teachers do not have guts to motivate learners because they are teaching subjects they did not specialise in, they have neither confidence nor interest. In English, most schools have lot of qualified teachers who are performing their duties confidently, enthusiastically and eagerly. As a result, there is good platform for learner motivation hence good performance.

5.4 RELATIONSHIP BETWEEN EA AND PA AMONG LEARNERS

Analysis for the second and third objectives did not provided a good support for the hypothesis that highly physical active learners in Xihoko circuit perform better than moderate and less physically active learners do in English and Mathematics. To analyse the data presented in Chapter 4 descriptive statistics and inferential tests were performed. Descriptive statistics were used to determine measures of central tendency including mean, minimum and maximum scores (see Tables 4.4 and 4.7). The results in Table 4.4 indicated that girls were physically more active in all the sampled schools than boys, but when the EA were exposed, boys outperformed girls in both English and Mathematics in all sampled schools. These results can be attributed to cultural beliefs that boys

do better than girls can in Mathematics and yet at times this has been found to be untrue (Jones & Myhill, 2004).

When results were analysed across the schools in Table 4.4, it was evident that learners in School 1 were physically more active compared to learners in the other two schools, and their achievement in Mathematics was higher as compared to the achievement in the same subject in the other two schools. A contrast was observed regarding the achievement in English where the highest achievement was in School 3, which scored the second position in PA. However, School 2, which scored the lowest PA, was also last in achievement in both subjects. The results, which are depicted in Table 4.4, were mixed; in some schools there was no relationship between PA and achievement among learners, whereas in some the relationship seemed to exist, suggesting there might be other factors, which contribute to both the EA and PA levels of the learners in these different schools.

The results from Table 4.4 indicated mixed results; inferential tests were performed to examine the relationships between EA and PA in English and Mathematics further. The first test was the Spearman's rank correlation test. This test investigated the correlation that existed between English scores and PA as well as Mathematics scores and PA. In Spearman's test the outcome of ($r = 0.189$) with regard to English and PA was significant, although the correlation was relatively low. Interestingly, according to Spearman's test ($r = 0.154$) a significantly low relationship also materialized between Mathematics and PA. In both English and Mathematics relationship between PA and EA were found to be positive though at low of 20%. The results of this test were consistent with the findings of Nelson and Gordon-Larson (2006), which indicated that adolescents, who reported either participating in school activities, such as, PE and team sports, or playing sports with their parents were more likely to earn an "A" in Mathematics and English than their less physically active peers.

The Kruskal Wallis' test was also conducted to assess whether the medians of the EA varied across the PA categories. The results reveal that there was no statistical difference between the different PA categories, $H(2) = .072$, $p = .965$ with mean rank 135.60 for category 1; 138.45 category 2 and 138.74 for category 3 in English achievement and $H(2) = .518$, $p = .772$ with mean rank 144.25 for category 1; 138.23 for category 2 and for Mathematics. Since the two tests' scores' p-values were

greater than the cut-off point of 0.05, the null hypothesis, which suggests that there is no statistical significant difference in the medians of the scores obtained in English and Mathematics was not rejected and the alternate hypothesis was rejected.

Another test performed was the Chi-square test. This test was performed to assess an association between EA and PA. Table 4.9 revealed that at the probability of $p < 0.05$, $df = 2$, the χ^2 value of 8.06 for Mathematics and 147.2 for English were greater than 5.99 Table value. **This indicated that there is an association between EA and PA, resulting in the rejection of the null hypothesis and accepting the alternate hypothesis, which holds that there is a relationship between EA and PA among rural secondary school learners at Xihoko Circuit. However, even if the chi-square test shows a positive relationship, we should always remember that the correlation is positive but weak.**

In addition, table 4.7, which depicts achievement across the categories, not all cases displayed agree with these results that PA influences EA. A highest pass percentage was observed in the category of less physically active and moderate active participants in English. Nevertheless, the results of the Chi-square correlated with the achievement in Mathematics, where the highest pass percentages of participants were in the category of highly active participants.

The most important finding, which emerged from the analysis of the results of this study, revealed that there was a weak positive correlation between EA (in both Mathematics and English) and PA among rural secondary school learners at Xihoko Circuit. Therefore, the results of this study support the suggested idea that increased levels of PA increases EA (Table 4.9). The analysis also examined differences between females and males. **The observation made in this study was that females in this study were more physically active than males, but when it came to achievement, boys performed better. Exhaustion in girls who are not physically fit caused by too much physical activity might be the cause. One participant in a study conducted by Hylok (2011) indicated that participation in too much PA exhaust them for class. It is like an energy drink, is hyped up, and then one crashes. In addition, most girls more especially in rural areas, do not have time to rest after school, but start doing house chores; as a result, some find it difficult to do their homework. In contrast, boys either rest and do their homework or go to sports field for more exercises that increase their physical**

fitness that has been found to increase EA (Grissom, 2005). However, there could be other factors that cause poor achievement in those active girls that were not controlled for this study.

Xihoko is a circuit in Limpopo Province, where the majority of high school learners reported lengthy walking timeframes to and from schools, thus of necessity increasing their PA level. The results of this study concurred with the results of similar studies' findings, which revealed a positive relationship between EA and PA (Trudeau & Shepherd, 2008; Coe et al., 2006; Grissom, 2005 & Shephard, 1997). Though most learners, participating in this study, reported being physically very active, the schools in this circuit are under increased pressure to have learners perform well in provincial exams. In 2009 and 2010, two of the schools that participated in this study performed below 40% in matric results and one of them was even declared dysfunctional. This indicates that there are other serious factors, which influenced learner achievement in this circuit. Some of these factors might include 'unduly tiredness which is caused by long walking distances or house chores'; shortage of qualified teachers or lack of motivation.

The results of this study might have been concurring with the major axiom of social science, which indicated that correlation was not causality. It could be inferred from these data that PA did not always increase or improve EA. There was no logical ordering that automatically led one event from the other. Although the dynamics of these processes were still being grasped, studies in biology (Weiss, 1969) and developmental psychology (Gollin, 1981) suggest that mental and physical processes are mutually dependent and it is often difficult to determine what is causing what.

Even though it cannot be inferred from correlation data that PA causes EA to improve, correlation and/or naturalistic designs might be the best models for preliminary studies.

- ❖ First, these models offer the best opportunity to build theory about phenomena by better understanding the constructs, what these consist of, and how such constructs relate to other constructs (Smith & Glass, 1987).
- ❖ Second, the difficulty of raising achievement might limit the ability of experimental designs to find a causal relationship even when one exists. This is not an argument against using experimental designs. It is simply an argument that experimental designs might be premature until the relationship between EA and PA is better understood.

Several studies, conducted to examine the relationship between EA and PA among learners revealed mixed results. To evaluate the relationship between physical fitness, a marker of PA, and EA over the course of one school year, Grissom (2005) in his longitudinal studies utilized a large California database of 884,715 students. Grissom also included students' socio-economic status (SES) and gender. Findings supported the presence of a positive relationship between physical fitness, a marker of PA and EA ($r = .19$ for Reading and $r = .22$ for Mathematics) assessed by the Stanford Achievement Test 9th Edition (www.asep.org/files/Grissom.pdf).

Subsequent analyses revealed that this relationship was stronger for girls in comparison to boys. Learners from higher socioeconomic backgrounds also outperformed learners from lower socioeconomic backgrounds. Grissom's study differs from the current study in design and sample size. Other factors to consider in the interpretation of these results are:

- ❖ The current study was not longitudinal but cross-sectional. Though the researcher knew the shortcomings of a cross-sectional study design, that is, it limited the extent to which the long effects could be inferred and that it did not provide information about cause and effects, because it only offered a snap shot of a single moment in time, the choice was influenced by time constraints.
- ❖ Secondly, the current study did not focus on physical fitness (the marker of PA) but on PA only, ranging from formal to informal activities and it had no control for SES, but tested for the difference between males and females.

However, the two studies were similar in the sense that, for EA both assessed achievement in Mathematics, though in language Grissom assessed reading instead of considering the exam scores. Although both studies found a positive relationship, studies like the one of Grissom have been criticized, because physical fitness (which is the marker of PA) scores are believed to be poor indicator of regular PA (Kirkendall, 1985).

Coe et al. (2006) also employed longitudinal data to study the association between both PE and activity and the EA of 214 sixth-grade students. Taking advantage of a scheduling system that randomly assigned half of the students to PE during the first semester and the other half during the

second, the authors compared differences in students' achievement based on the timing of PE enrolment. No significant differences were found. Unfortunately, the students engaged in a minimal amount of PA in that students only averaged 19 minutes of moderate to vigorous PA during a 55-minute PE class. Therefore, the students' activity level might not have been high enough to elicit any effect on their educational behaviour. It is important to note that when students were assigned to a PE course rather than a classroom period, their achievement did not decline.

Furthermore, Coe et al. (2006) found that students, who engaged in some vigorous activity, as defined by the Healthy People 2010 guidelines, had significantly higher grades than those students, who reported no vigorous activity across the two semesters and this differs from the findings of this study, which found no significance relationship between the two variables. The authors found no significant relationship between PE, PA and standardized test scores. Unfortunately, the authors failed to account for differences in socioeconomic backgrounds of the students and cited this omission as an important limitation of the study.

5.5 CONCLUSION

From the present data, it is evident that there is a weak positive correlation between learners achievement and PA . For those, who performed poorly, even though they were physically highly active, it may be assumed that other contributing factors could have led to poor achievement. More data are needed to understand those factors. Based on the evidence of this study, it is therefore tentative to conclude that for the participating rural high school learners at Xihoko there is a relationship between their EA (Mathematics and English) and PA.

5.6 LIMITATIONS

When interpreting the results of this study, it should be noted that the study had the following limitations:

- ❖ Firstly, data collection was based on self-reported through self-administered questionnaires. Self-report measures are open to bias and misreporting through errors in exaggeration, especially when the behaviour is undesirable. In addition, participants' reporting of time

spent doing activities might not have been accurate, because it is not easy to look or record time when doing activities.

- ❖ Secondly, the cross-sectional nature of the study might have limited the researcher's ability to make inferences. Individuals, who currently participate in a PA, might not necessarily continue to do so. Therefore, caution should be exercised in interpreting the results of a cross-sectional nature in the absence of longitudinal data.
- ❖ Lastly, this study might also have been limited by the sample. The sample comprised learners, aged 17-27. Those who were ≥ 21 years were normally regarded as adults. According to WHO recommendation for PA levels, adults and adolescents do not have similar recommended levels. For adults, 30 minutes of moderate to vigorous activity for five days or every day of the week is recommended instead of sixty minutes, which is recommended for youth. However, most participants belonged to the very active group, including those, who were twenty-one years and older even though the scaling was high for them. The researcher believes that the exclusion of young adolescents (from lower grades), who were believed to be more physically active than older ones from this study, did not affect the PA levels of learners in Xihoko Circuit, because the majority of the participants still reported being very active.

Concerning the EA measurements, the researcher did not note any limitation, being of the conviction that the instruments used were valid and reliable, because they were provincially standardised half-yearly exams. Standardised tests are validated and reliability information is readily available on standardized tests (Coe, et al., 2006; Sallis, Johnson, Calfas, Caparosa & Nichols, 1997). These tests are direct measures of educational achievement and are preferred over grade averages and non-standardised tests as teacher bias, validity and reliability are an issue (Sallis et al., 1999). The direct tests are also preferred over indirect tests, such as, behaviour observations and measurement of concentration, because these give a true reflection of learners' ability more especially if cheating is prevented at all cost. The tests used, also assessed the various types of learning outcomes as outlined in the relevant subject's guidelines and also tested the different cognitive levels of Bloom's taxonomy.

CHAPTER 6

RECOMMENDATIONS AND CONCLUSION

6.1 INTRODUCTION

This final chapter presents recommendations for future research and for possible action by policy makers on the development of PA programmes. The chapter concludes by summarising the fundamental points of the study.

6.2 RECOMMENDATIONS

Though the results of this study revealed that there is a low positive correlation between EA and PA, there is a need to create a culture of healthy lifestyles in our children and youth, through education, and by changing the social norms. This action will enable young people to realize the numerous benefits of PA as literature revealed. This recommendation can be achieved through the integration of the legislative mandate, with interventions targeting environments, schools and communities, parents and youth. In addition, the planning of health promoting programmes by government, the private sector and communities are required. Such planning in turn requires data, on which to base decision-making.

Other few short-term recommendations, which are suggested in this study that could help create the culture of the healthy lifestyle that we expect from our children and youth, include the following:

Firstly, there should be an ongoing surveillance and monitoring of behaviours and determinants of healthy/unhealthy lifestyle behaviours, such as, the South African National Youth Risk Surveillance conducted in 2002. Within this recommendation, there is a need to engage with adolescents, parents and teachers to explore knowledge, attitudes and practices, prior to the development of interventions.

To increase their levels of PA and fitness, young people can benefit from families, who model and support participation in enjoyable PA. They can gain from school programmes including quality; daily PE; health education; recess; and extracurricular activities, which help students, develop the knowledge, attitudes, skills, behaviours, and confidence to adopt and maintain physically active

lifestyles, while providing opportunities for enjoyable PA. After-school care programmes that provide regular opportunities for active, physical achievement can also play a major role. Young people can also benefit from youth sports and recreation programmes that offer a range of developmentally appropriate activities, accessible and attractive to all of them. A community structural environment, which makes it easy and safe for young people to walk, ride bicycles, and use close-to-home PA facilities and media campaigns that help motivate young people to be physically active, can also play a major role.

Secondly, development and evaluation of promising interventions focused on barriers and determinants to PA. This recommendation includes approaches within both the school curriculum and external school environment, through media, NGOs and other sectors. Furthermore, these interventions should aim at targeting those vulnerable groups specifically. Examples of integrated strategies for PA might include:

- ❖ The appointment of “Sport Coaches” to a cluster of schools rather than one school,
- ❖ The affiliation of schools with various sporting codes, and
- ❖ The government’s national programme for mass participation, and
- ❖ Specifically, the upgrading of sports facilities, particularly in rural areas, or
- ❖ Structured “sharing” of sports facilities between schools or between schools and disadvantaged community settings. The possibility of a successful practice of promising “open school” initiatives are high in our disadvantaged communities, as it happens in other parts of the world with similar disadvantaged settings.

Full implementation of the strategies recommended in this study requires the commitment of resources, hard work, and creative thinking from many partners in the state, and local governments; NGOs; and the private sector. Only through extensive collaboration and coordination can resources be maximized, strategies integrated, and messages reinforced. Development or expansion of a broad, national coalition to promote better health through PA is an important first step toward collaboration and coordination. A foundation to support the promotion of PA could complement the work of the coalition and play a critical role in obtaining the resources needed to help our young people become physically active.

6.3 SUMMARY

In an attempt to examine the relationship between EA and PA, this study found a weak positive relationship that is not statistically significant. The reviewed literature showed mixed results in terms of whether the relationship exists or not. The indicators of EA that are either direct or indirect were highlighted. It is indicated in this study that learners' EA is significantly impacted by many factors. Some of these factors that are suspected to have a negative impact on learners' EA include healthy risk behaviours such as lack of PA and substance abuse; resources; teachers and learners motivation; learners' attitudes towards the subjects; commitment and parental involvement. PA was further explored because the focus of this study is on relationship between EA and PA. The other factors were not further explored in this study, to give other researchers an opportunity to explore them in other studies.

The reviewed literature revealed that regular PA enhances learning and EA. Some of the barriers to learning are attributed to the students' mental and physical health, which can be achieved through PA. It was revealed that PA fuels the brain with oxygen, enhances connections between neurons and assists in memory. Some studies have indicated that children and youth, who participate in daily PA has shown superior EA and better attitudes towards school.

Furthermore, literature revealed that schools, which offer intense PA programmes, have shown positive effects on EA, including increased concentration; improved Mathematics, Reading, and Writing test scores; and reduced disruptive behaviour, even when time for PA reduces time for academics. In another study conducted by the California Department of Education Healthy Kids Programme Office, preliminary findings showed that the lowest performing schools have lower PA levels among their students, with little difference across schools in the top three quintiles. This suggests that the lowest performing schools may benefit from PA programmes. Research also suggests that decreasing PE may undermine the goal of better achievement, while adding time for PA might support improved EA. However, there is growing concern that most people, both young and old around the world from all economic background are less physically active. The opportunity for learners to be physically active is said to be rapidly decreasing in most countries across the globe. The reasons advanced for this situation include the continuous elimination of PE, technology and

social evolution that have changed children's lives. The worrying factor is that the quality of life is reduced, which in turn affects EA.

Though some reviewed studies revealed high percentage of less physical active young people, the result of this study show that most learners in Xihoko circuit are very physical active and they meet the WHO's recommended physical activity levels for health. The existence of a positive relationship between EA and PA was also observed, though weak and insignificant. Though results of most reviewed studies including the current one supported the main hypothesis of this study, several authors, who have found a negative relationship (Tremblay et al., 2000) between the two variables, have questioned a positive relationship between EA and PA. One of the suspected causes of contrasting findings is different study designs employed.

In conclusion, one can say there is a positive relationship between EA and PA. Though the results of this study and other similar studies have found low positive correlation between EA and PA, the researcher recommends that similar studies be conducted in future to further explore these results, especially in the South African rural secondary schools. The researcher also suggests that future researcher in this topic should take care of the control for socioeconomic status, which has been proven to have greater effects to EA, should be included.

REFERENCES

- Action for Healthy Kids. (2003). *Building the Argument: the Need for Physical Education and Physical Activity in our Schools*. Available from, <http://www.actionforhealthykids.org> Accessed on October 15, 2008.
- Action for Healthy Kids. (2002). *Learning Connection: the Value of Improving Nutrition and Physical Activity in our Schools*, Available from, http://www.actionforhealthykids.org/special_exclusive.php. Accessed on September 23, 2008.
- Ahamed, Y., MacDonald, H., Reed, K., Nylor, P.J., Liu-Ambrose, T. & McKay, H. (2007). School based physical activity does not compromise children's academic performance. *Medicine and Science in Sports and Exercise*, 39, (2), 371-376.
- Ainsworth, B.E. (2002). *Compendium of Physical Activities Tracking Guide*. Prevention Research Center Norman J Arnold School of Public Health, University of South Carolina.
- Ainsworth, B.E., Haskell, W.L., Whitt, M.C., Irwin, M.L., Swartz, A.M., Strath, S.J., O'Brien, W.L. & Bassett, D.R Jr. (2000). 'Compendium of physical activities: an update of activity codes and MET intensities'. *Medical Science and Sports Exercise*, 32, S498-S516.
- Ainsworth, B.E., Haskell, W.L., Leon, A.S., Jacobs, D.R. Jr., Montoye, H.J., Sallis, J.F. & Paffenbarger, R.S. Jr. (1993). 'Compendium of physical activities: energy costs of human movement'. *Medical Science and Sports Exercise*, 25, 71-80.
- Ajzen, I. (1991). 'Theory of planned behaviour'. *Organizational Behaviour and Human Decision Processes*, 50, 179-211.
- American Academy of Pediatrics. (2006). *Council on Sports, Medicine and Fitness and Council on School Health*, 1834-1842.
- American Association of School Administrators (AASA). (2006). *School Policy and Practice: Taking on Childhood Obesity*, Author, Arlington, VA.
- American Heart Association, (2005). *Exercise and children*, Available at American Heart Association Website, <http://americanheart.org/presenter.jhtml=4596> Accessed on May 12, 2010.
- Bandura, A. (1977). *Social Learning Theory*, Prentice Hall, Englewood Cliffs, N.J.

- Baranowski, T. (1988). 'Validity and reliability of self-report measures of physical activity: an information processing perspective'. *Research Quarterly for Exercise and Sport*, 59, (3), 14-27.
- Barrette, S. (2007). *Glossary of Obesity, Physical Activity and Weight Control Terms*, National Institute of Diabetes and Kidney Diseases, Weight Control Information Network.
- Bauman, A.L., Marshall, M., Mohsin, V. & Westley-Wise, B.L.M. (2002). 'Perception on physical environment, stage of change for activity, and walking among Australian adult'. *Research Quarterly for Exercise and Sports*, 73, 146-156.
- Behr, A.L. (1980). *Psychology and the School*, (2nd ed.), Durban: Butterworths, Durban.
- Benefice, E., Garnier, D. & Ndiaye, G. (2001). 'Assessment of physical activity among rural Senegalese adolescent girls: influence of age, sexual maturation, and body composition'. *Journal of Adolescence Health*, 28, 319-327.
- Biddle, S.J. & Mutrie, N. (2001). *Psychology of Physical Activity*, Routledge, London.
- Biddle, S.J.H., Fox, K.R. & Boutcher, S.H. (2000). *Physical Activity and psychological Well-Being*, Routledge, London.
- Bogden, J.F. (2000). *Fit, Healthy and Ready to Learn: A School Health Policy Guide*, National Association of State Boards of Education, Alexandria, VA.
- Buckworth, J. & Dishman, R.K. (2002). 'Determinants of physical activity and exercise'. *Exercise Psychology*, 15, (2), 191-209.
- Chappell, R. (2005). Race, Gender and Sport in Post Apartheid South Africa. *International Review for the Sociology of Sport*, 40, (2), 241-254.
- Cherian, V. (1992). 'Relation of parental education and life status to educational achievement among Xhosa children'. *Psychological Reports*, 71, 947-956.
- Chetty, D. 1985. *Relationship between Socio-educational Factors and Scholastic Achievement in India Primary Schools*, Unpublished M. ED thesis, UNISA.
- Cocke, A. (2002). *Brain may also pump up from Workout*. Available from, Society for Neuroscience <http://www.neurosurgery.medsch.ucla.edu/whastnew/societyforneuroscience.htm>
 Accessed on June 06, 2009.

- Coe, D.P., Pivarnik, J.M., Womack, C.J., Reeves, M.J. & Malina R.M. (2006). 'Effect of physical education and activity levels on educational achievement in children'. *Medical Science Sports Exercise*, 38, 1515-1519.
- Coleman, J.S. (1961). *Adolescent society: Social life of the teenager and its impact on education*, Free Press, New York.
- Council of Chief State School Officers' Policy Statement on School Health. (2004). *Policy statement on school health*. Available from <http://www.ccss.org/content>. Accessed November 12, 2009.
- Creswell, J.W. (2002). *Research design: Qualitative, Quantitative, and Mixed Method Approaches*, Sage Publications, Thousand Oaks.
- Daley, A.J. & Ryan, J. (2000). 'Educational achievement and participation in physical activity by secondary school adolescents'. *Perception on Motor Skills*, 91, 531-534.
- De Bourdeaudhij, I., Sallis, J.F. & Saelens, B.E. (2003). 'Environment correlates of physical activity in a sample of Belgian Adults'. *American Journal of Health Promotion*, 1, 83-92.
- De Jager, W. (1987). *Locus Control and Scholastic Achievement in Coloured High Schools*, Masters Dissertation, University of Port Elizabeth.
- Department of Education. (2001). *National Strategy for Mathematics Science and Technology Education in General and Further Education and Training*, Pretoria: Government printer.
- Department of Education Revised National Curriculum Statement Grade R-9 (schools). (2002). *Life Orientation*, Pretoria: Government printer.
- Department of International Relation and Co-operation RSA. (2007). *Speeches by the former president of South Africa T.M Mbeki*. Available from, www.dfa.gov.za/docs/speeches/mbeki.htm Accessed on October 20, 2009.
- De Vos, A.S. (2002). *Research at Grassroots: For Social Sciences and Human Services Professionals*, Van Schaik, Pretoria, South Africa.
- Diez, A.L. (2005). *Personal, Family and Educational Factors Affecting Low Achievement in Secondary Schools*. (Online). Available from, <http://www.actapress.com/Pdfviewer.aspx?paperId=18917> Accessed on March 14, 2010.
- Dilley, L., Clitheron, F., Engelbrecht, B., Fulken, J. & Lundall, B. (2005). *Life Orientation Grade 10*. Oxford University Press, Cape Town.
- Dotterer, A.M., McHale, S.M. & Crouter, A.N. (2007). *Implications of Out-of- School Activities*

- for *School Engagement in African American Adolescents*, 36, (4), 391-401.
- Du Toit P.J, Kruger, P.E., Van Vuuren, K.B. & Van Heerden, B. (2007). The effects of exhaustion on the metabolism and perceptual motor performance of professional cricket players. *African Journal for Physical, Health Education, Recreation and Dance (AJPHERD)*, 12, 50-59.
- Du Toit, D., Van der Merwe, N. & Rossouw, J.P. (2007). *Return of Physical Education to the curriculum: problems facing schools in South African communities: physical education*, 13, 241-253.
- Dwyer T., Blizzard, L. & Dean, K. (1996). 'Physical activity and achievement in children', *Nutrition Reviews*, vol. 54, no. 4, pp. 27-31.
- Dwyer, T., Sallis, J.F., Blizzard, L., Lazarus, R. & Dean, K. (2001). 'Relation on educational achievement to physical activity and fitness in children'. *Paediatric Exercise*, 13, 225-237.
- Fisher, M., Juszczak, L. & Friedman, S.B. (1996). 'Sports participation in an urban high school: educational and psychological correlates'. *Journal of Adolescents and Health*, 18, 329-334.
- Fisher, R.A. & Yates, F. (2009). *Statistical Tables for Biological, Agricultural and Medical Research*, (6th ed.). Edinburgh.
- Fox, K.R. (1997). 'Physical self and processes in self-esteem development'. *The Physical Self: From Motivation to Well-Being*, 6, 111-139.
- Frantz, J.M. (2006). 'Physical inactivity as one of the chronic diseases' risk factors among high school learners in public schools in a local community in South Africa'. *South African Journal for Research in Sport, Physical Education and Recreation*, 28, (2), 73-80.
- Fredericks, C.R., Kokot, S.J., & Krog, S. (2006). Using a developmental movement programme to enhance academic skills in Grade 1 learners. *South African Journal for Research in Sport, Physical Education and Recreation*, 28, (1), 29-42.
- Gollin, E.S. (1981). 'Development and plasticity', *Developmental Plasticity: Behavioral and Biological Aspects of Variations in Development*, pp. 231-249, Educational Press, New York.
- Grissom, J.B. (2005). 'Physical Fitness and Educational Achievement'. *Journal of Exercise Physiology online*, 8, 11-25.
- Gordon-Larsen, P., McMurray, R.G. & Popkin, B.M. (2000). Determinacy of adolescents' physical activity and inactivity patterns. *Paediatrics*, 105, (3), 231-241.

- Gouden, P.K. (1977). *Investigation into the Extent to which certain Psychological Factors and Sociological Factors Influence Educational Achievement among First Year Students in the Faculty of Education*, M. ED dissertation, University of Durban Westville.
- Hannaford, C. (1995). *Smart Moves: Why Learning is Not All in Your Head*, Great Ocean Publishers, Arlington, VA.
- Haskin, R. & Donahoe, E.H. (2006). Parental Perception Body Mass Index Referrals and Overweight. Available from digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1009. Accessed on October 03, 2010.
- Higgins J.W., Gaul C., Gibbons, S. & Van Gyn, G. (2003). 'Factors influencing physical activity levels among Canadian youth'. *Journal of Public Health*, 94, 45-51.
- Hohepa, M., Scragg, R., Schofield, G., Kolt, G.S. & Scaaf, D. (2009). 'Self-reported physical activity level in high school student'. *Journal of School Science and Medicine in Sport*, 12, 284- 292.
- Howie, S.J. (2006). *Context of Learning Mathematics and Science, Lessons learned from TIMSS*, Routledge, New York.
- Humpel, N., Owen, N., Iverson, D., Leslie, E. & Bauman, A. (2004). 'Perceived environment attributes residential location and walking for particular purpose'. *American Journal of Preventive Medicine*, 26, 119-125.
- Hylok, M.J., (2011). *Exploring student perceptions to explain the relationship between physical activity and academic achievement in adolescents: A mixed method study*, ETD collection for University of Nebraska: Lincoln Paper AAI344997.
- International Life Science. (1997). 'Institute improving children's health through physical activity: a new opportunity', *A Survey of Parents and Children about Physical Activity Patterns*.
- International Physical Activity Questionnaire (IPAQ) Research Committee. (2005). *Guidelines for Data Processing and Analysis of the (IPAQ) – Short and Long Forms*, Available from <http://www.ipaq.ki.se/scoring.html> Accessed on October 25, 2010.
- Jensen, E. (1998). *Teaching With the Brain in Mind*, ASCD Publications. Alexandria, VA.
- Jessor, R. & Jessor, S.L. (1977). *Problem Behavior and Psychosocial Development: A longitudinal study of youth*. Educational Press: New York.

- Jones, S. & Myhill, D. (2004). "Seeing Things Differently: Boys as Underachievers." *Gender and Education*, 16,(4).
- Jubber, K. (1988). *Home and Family Environment and School Achievement and Achievement: A Study of 267 pupils from Cape Town Schools*, Master's dissertation, University of Cape Town.
- Katzenellenbogen, J.M. & Joubert, G. 2002. *Data sheet design and analysis*. Oxford University: Cape Town.
- Keays, J. (1993). *The effect of regular (moderate to vigorous) physical activity n the schools setting on the student' s health, fitness, cognition, psychological development, educational achievement and classroom behaviour*. North York: North York Community Health Promotion Research Unit.
- Kibet, J.J. (2007). *Prevalence of Physical Inactivity Among School Going Adolescents in Nairobi, Kenya*, University of Nairobi.
- Kim, H.Y.P., Frangillo, E.A., Han, S.S., Oh, S.Y., Kim, W.K., Yang, Y.A., Won, H.S., Lee, H.S. & Kim, S.H. (2003). 'Educational achievement of Korean children is associated with dietary behaviours and physical status'. *Asia Pacific Journal of Clinical Nutrition*, 12, 186-192.
- Knight, D. & Rizzuto, T. (1993). Relations for children in grades 2, 3 & 4 between balanced skills and educational Achievement '. *Perceptual and Motor Skills*, 76, 1296-1298.
- Law, K., Hill, D.M. & Matthews, N. (2008). *An Examination of the Relationship between Physical Activity, Self-esteem and Educational Achievement*, Faculty of Sport, Health and Social Care, University of Gloucestershire, UK.
- Leon, A.S., Connett, J. & Jacobs, D.R. Jr. (1987). 'Leisure-time physical activity levels and risk of coronary heart disease and death'. *Multiple Risk Factor Intervention Trial. JAMA*, 258, 2388-95.
- Limpopo Department of Basic Education. (2010). *Learner Assessment Directorate*. Limpopo Department of Basic Education: Republic of South Africa
- Linda, D. (1987). *Introduction to Psychology*. (3rd ed.). McGraw Hill, Inc., Toronto.
- Linder, J.K., (1999). Sport participation and perceived educational achievement of school children and youth'. *Paediatric Exercise Science* 11, 129-143.
- Malina, R. M. (2001). 'Adherence to physical activity from childhood to adulthood'. *A Perspective from Tracking*, 5, 346-355.

- Marsh, H. (1992). 'Extracurricular activities: beneficial extension of the traditional curriculum or subversion of educational goals'. *Journal of Educational Psychology*, 84, 553-562.
- Martin, L.T. & Chalmers, G.R. (2007). 'The relationship between educational achievement and physical activity'. *Physical Educator*, 64(4): 214-221.
- McClelland, D. (1961). *Achievement Motivation Theory*, Copyright: review and contextual material, Alan Chapman 2008-2009.
- McGraw-Hill Concise Dictionary of Modern Medicine. (2002). *Physical Activity*, McGraw-Hill Companies, Inc.
- McVeigh, J.A., Morris, S.A., Cameron, N. & Pettifor, J. (2004). 'Association between physical activity and bone mass in black and white South African children at age'. *Journal of Applied Physiology*, 97, 1006-1012.
- Michigan State University. (2006). 'Research finds Vigorous exercise equals better academics'. *Sciencedaily*, Available from <http://www.sciencedaily.com> Accessed on June 23, 2010.
- Mostert, S. (1998). *Factors affecting the educational achievement of grade 12 black learners in the Free State*, Unpublished M.Ed. thesis, Department Psychology of Education, University of the Orange Free State, Bloemfontein.
- Mouton, J. (2000). *The practice of social research*. Cape Town: Oxford University Press.
- Mov, K., McFarlane, K., Scraggs, R. & Robinson, S. 2003, *Validation of MOH-short and SPARC-Long*.
- Murenzi, J.G. (2001). *Habitual Activity Patterns Among Adolescents Learners in Rwanda*, Unpublished Master of Science Thesis, Physiotherapy Department, University of the Western Cape.
- Nader, P.R., Bradley, R.H., Houts, R.M., McRitchie, S.L., & O'Brien. (2008). Moderate to vigorous physical activity from ages 9-15 years. *Journal of the American Medical Association*, 300, (3), 295-305.
- National Association for Sport and Physical Education (NASPE). (2001). *Appropriate Practices for Middle School Physical Education*, EMC Publication, Reston, VA: Georgia.
- National Association for Sport and Physical Education (NASPE). (2006). *Shape of the nation report: Status of physical education in USA*, EMC Publication, Reston, VA; Georgia.

- National College Health Assessment - NCHA, (2004), '*Health issues impacting the educational achievement of Cal Poly Pomona students*'. Florida International University Executive Summary Fall. Baltimore: American College Health Association.
- Nelson, M.C. & Gordon, L.P. (2006). 'Physical activity and sedentary behaviour patterns are associated with selected adolescents' health risk behaviour. *Paediatrics*, 117, 1281-1290.
- Novello, A.C., Degraw, C. & Kleinman, D. (1992). 'Healthy children ready to learn: an essential collaboration between health and education'. *Public Health Reports*, 107, 3-15.
- N'wamitwa and Xihoko community map. (2009). Available at <http://plak.co.za/moreinfo.php?id=45476> Accessed on April 10, 2010.
- Olson, K.A. (1998). Improving students' attitudes and performance in Mathematics. *Masters Action Research project*. Saint Xavier University: IRI/Skylight.
- Onywera, V. (2008). *Physical activity Transition of Kenyans*. Department of Exercise and Sport Science, University of Kenya.
- Pate, R.R., Heath, G.W., Dowda, M. & Trost, S.G. (1996). 'Associations between physical activity and other health behaviours in a representative sample of US adolescents'. *American Journal of Public Health*, 86(11), 1577-1581.
- Phillips, J.S. (2006). 'Concerns about physical inactivity among adolescents in the Strand'. *Journal of Community and Health Sciences*, 1, 39-46.
- Piaget, J. (1983). *Piaget's theory*. In P. Mussen (ed). *Hand book of child Psychology*. (4th ed.). Vol.1. New York: Willey.
- Ramashala, M.S. (1999). *Perceptions on poor matric results*, Unpublished M. Ed. Thesis, Department of Adult Education and Training, Rand Afrikaans University, Johannesburg.
- Reddy, S.P., Panday, S., Swart, D., Jinabhai, C.C., Amosun, S.L., James, S., Monyeki, K.D., Stevens, G., Morejele, N., Kambaran, N.S., Ouardien, R.G. & Van den Borne, H.W. (2003). *The South African Youth Risk Behaviour Survey 2002*. South African Medical Research Council, Cape Town.
- Robert Wood Jonson Foundation. (2003). *Health Schools for Healthy Kids*. Pyramid communications.
- Rowland, T.W. (1999). 'Adolescents: a 'risk factor' for physical inactivity. *The President's Council on Physical Fitness and Sports Research Digest*, series 3, no. 6, Washington DC.

- Sallis, J. & Patrick, K. (1994). 'Physical activity guidelines for adolescents: consensus statement'. *Paediatric Exercise Science*, 6: 302-314.
- Sallis, J.F., Johnson, M.F., Calfas K.J., Caparosa, S. & Nichols, J.F. (1997). 'Assessing perceived physical environmental variables that may influence physical activity', *Research Quarterly Exercise and Sport*, 68, 345-351.
- Schiller, S. (1999). *Start Smart: Building Brain Power in the Early Years*, Gryphon House Publishers, Beltsville, MA.
- Schuur, T. & Brookover, W. (1970), 'Athletes, educational self-concept and achievement'. *Medical Science in Sports*, 2, 96-99.
- Shephard, R.J. (1997). 'Curricular physical activity and educational achievement'. *Paediatric Exercise Science*, 9, 112-113.
- Shephard, R.J., Volle, M., Lavallee, H., LaBarre, R., Jequier, J.C. & Rajic, M. (2002). 'Required physical activity and educational grades, a controlled longitudinal study'. *Children and Sport*, eds Limarinen and Valimaki, 4, 58-63.
- Shuttleworth, M. (2008). *Descriptive Research Design*, Available from Experiment Resources <http://www.experiment-resources.com/descriptive-research-design.html>. Accessed on June 17, 2010.
- Sigfusdottir, I.D., Kristjansson, A.L. & Allegrante, J.P. (2007). 'Health behaviour and educational achievement in Iceland school children', *Health Educational Research*, 22, 70-80.
- Smith, M.L. & Glass, G.V. (1987). *Research and Evaluation in Education and the Social Sciences*, Allyn and Bacon, Needham Heights, MA.
- Stanford Achievement Test 9th Edition. (2005). Available from *The relationship Between Physical Fitness and Educational Achievement*. (www.asep.org/files/Grissom.pdf). Accessed on November 15, 2010.
- Statistics South Africa. (2001). *RSA Census*. National Treasury for local government, South Africa.
- Symons, C.W. (1997). 'Bridging students' healthy risks and educational achievement through comprehensive school health program', *Journal of School Health*, 67(6), 220-227.
- Swift, G. (1983). *Waterland*, Heinemann Educational, Oxford.
- Tabachnick, B.G. & Fidell, L.S. (2001). *Using multivariate statistics (4th ed.)*. Needham Heights, MA: Allyn and Bacon.

- Taras, H. (2005). 'Physical activity and student achievement', *Journal of School Health*, 75(6), 214-218.
- Themane, M.J. (2006). *Health and Educational Achievements on Rural Primary School Children Living in Ellisras, South Africa*. Vrije Universiteit, PhD Thesis, Holland: Gezondheid in Beweging (GIB) N0.16.
- Themane, M.J., Monyeki, K.D., Twisk, J.W.R. & Kemper, H.C.G. (2006). Ellisras longitudinal study, *African Journal for Physical Health Education, Recreation and Dance*. (AJPHERD), 12(3), 298-309.
- Thompson, R.J., Bandera, E.V. & Burley, V.J. (2008). 'Physical activity guidelines for Americans', *Journal for Public Health Nutrition*, 11(10), 1006-1014.
- Thorndike, R.M. (1997). *Measurement and Evaluation in Psychology and Education* (6th ed.). Upper Saddle River, (NJ): Prentice-Hall. Inc.
- Torgessen, J.K. (1977). Psychological and educational perspectives on learning disabilities. *Journal of Learning Disabilities*, 11, 540-543.
- Tremarche, P.V., Robison, E.M. & Graham, L.B. (2007). Physical education and its effect on elementary testing results. *Physical Educator*, 64, 58-64.
- Trembly, M.S., Inman, J.W. & Williams, J.D. (2000). 'Relationship between physical activity, self-esteem and educational achievement in 12-year-old children', *Paediatric Exercise Science*, 12, 7-34, 312-323.
- Trudeau, F. & Shephard, R.J. (2008). 'Physical education, school physical activity, school sports, and educational achievement', *International Journal of Behavioral Nutrition and Physical Activity*, 5, 10.
- United States Surgeon. (1996). 'Report on physical activity and health', *American Family Physician*, 54, 1806-1807.
- Wedderkopp, N. (2001). 'Early life determinants of physical activity in 11-12 year old', *British Medical Journal*, 31, 617-627.
- Weiss, P. (1969). 'Living system: determinism stratified' in *Beyond Reductionism: New Perspectives in the Life Sciences*, pp. 3-42, eds A. Koestler & J.R. Smythies, Beacon Press, Boston.
- White, C.J. (2003). *Research Methods and Techniques*, University of Pretoria, RSA.
- World Health Organization (WHO). (2002). *Let us move for our health: Afro Feature WHO/AFRO*, Press Release, Accessed October 07, 2009.

World Health Organization (WHO). (2005). *World Health Report, Reducing Risks and Promoting Healthy Life*, World Health Organization, Geneva.

Youth Physical Activity Questionnaire. Available at [www.mrc
epid.cam.ac.uk/Research/Programmes/program5/Indepth/download/YPAQ.pdf](http://www.mrc.epid.cam.ac.uk/Research/Programmes/program5/Indepth/download/YPAQ.pdf). Accessed July 14, 2009.

APPENDIX 1

YOUTH PHYSICAL ACTIVITY QUESTIONNAIRE (Adopted from MRC)

Code.....

PART (A) (biographical questions)

1. How old are you?

--

Answer the following questions by making a cross(x) in the appropriate box.

2. What is your gender?

Boy		Girl	
-----	--	------	--

3. In which grade are you?

Grade 10		Grade 11		Grade 12	
----------	--	----------	--	----------	--

4. Which language do you speak at home?

Xitsonga		Sepedi		Venda		Zulu		Other	
----------	--	--------	--	-------	--	------	--	-------	--

5. With whom do you live?

Single parent		Both parents		Child headed		Other(specify)	
---------------	--	--------------	--	--------------	--	----------------	--

PART (B)

This section of the questionnaire is trying to find out about your physical activity from the last 7 days (in the last week). This includes activities that make you sweat, make your legs feel tired, or make you breathe hard, such as, team sport, running, strenuous household activities etc.

Remember

- (a) There are no right and wrong answers - this is not a test.
- (b) Please answer all the questions as honestly as you can.

1. ACTIVITIES AT SCHOOL

1.1 Do you attend physical education lessons at school?

Yes	No
-----	----

1.2 If your answer for 1.1 is yes, how often are the classes held?

1 time a week	1
2 times a week	2
3-4 times /week	3
5 times a week	4
1-3 times a month	5
0 time a week	6

1.3 Now I will list different kinds of physical activities. Please indicate by making a cross under yes at the activities you are participating in, and write the time you spend on those activities during school time per week.

(a)

	YES	time/week
Boxing,		
Karate		
Judo		
Wrestling		
Gymnastics		

(b)

	YES	time/week
Soccer,		
Rugby		
Cricket		
Basket ball		
Swimming		
Tennis		
Netball		
Volleyball		
Dancing		

© Athletics field and track events

	YES	time/week
Long jump		
High jump		
Discuss		
Javelin		
Running		

2. INFORMAL ACTIVITIES OUTSIDE SCHOOL

2.1 Now, I will list informal and household physical activities, which are done outside school but NOT in a sport's club. Make a cross under yes next to the ones you participate in and indicate the time you spend on each per week. e.g. riding a bike, playing in the street or yard, etc.

	YES	time/week
Riding a bike		
Playing in the street or yard		
Cleaning		
Gardening		
Collecting water		
Cooking		
Washing clothes		

3. SEDENTARY ACTIVITIES

3.1 Do you engage in any of the following activities before or after school (MON-FRI)? If you answered 'yes', how many hours per week did you engage in the activities listed below?

Activities	YES	time/week
Watching TV and videos		
Reading		
Drawing		
Homework		
Music lessons		

3.2 Do you engage in any of the following activities over the weekend (SATURDAY & SUNDAY)?

If so, for how many hours per weekend did you engage in these activities?

Activities	YES	time/weekend
Watching TV and videos		
Reading		
Drawing		
Homework		
Music lessons		

4. TRANSPORT

4.1 How do you get to school and how long does it take to get there and back?

Mode of transport to & from school	YES	time/day
Car		
Bus		
Taxi		
Train		
Walk		
Bicycle		

4.2 When you walk or cycle at what pace (how fast) do you usually walk or cycle?

At a vigorous pace, that makes me breath harder than normal.	1
At a medium pace that makes me breath somewhat harder than normal	2
At a slow pace when there is no change in my breathing	3

5. SLEEPING

5.1 How long do you sleep per day?

Less than 8 hours /day	1
8 hours/day	2
More than an 8 hours /day	3

6. How physically active are you?

Very active	1	Moderately active	2	Less active	3
--------------------	----------	--------------------------	----------	--------------------	----------

THE END THANK YOU, GOD BLESS YOU

To be used by the researcher

Subjects	Achievements
Maths/ Maths Literacy	
English	

APPENDIX 2

EXAMPLES OF PHYSICAL ACTIVITIES FOR YOUNG PEOPLE



APPENDIX 3

PERMISSION LETTER FROM THE DEPARTMENT OF EDUCATION

LIMPOPO

PROVINCIAL GOVERNMENT

REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF

EDUCATION

Enquires: Armer I, Telephone: 015-290 7929 e-mail: Armerl@edu.limpopo.gov.za

Mrs Ngomana N

P.O Box 1447

LETABA

0870

Dear Researcher

Request for Permission to Conduct Research

1. Your letter of request bears reference.
2. The Department wishes to inform you that you are granted permission to conduct research.

The title of your research project is "**THE RELATIONSHIP BETWEEN PHYSICAL ACTIVITY AND EDUCATIONAL ACHIEVEMENT AMONG RURAL SECONDARY SCHOOL**

LEARNERS IN XIHOKO CIRCUIT, LIMPOPO PROVINCE"

3. The following conditions should be observed:
 - 3.1 The research should not have any financial implications for Limpopo Department of Education.
 - 3.2 Arrangements should be made with both the Circuit Offices and the schools concerning the conduct of the study. Care should be taken not to disrupt the educational programme at the schools.
 - 3.3 The study should be conducted during the first three terms of the calendar year as schools would be preparing for the final end of year examinations during the fourth term.

3.4 The research is conducted in line with ethics in research. In particular, the principle of voluntary participation in this research should be respected.

3.5 You share with the Department, the final product of your study upon completion of the research assignment.

4. You are expected to produce this letter at schools/offices where you will be conducting your research, as evidence that permission for this activity has been granted.

5. The Department appreciates the contribution that you wish to make and wishes you success in your investigation.

..:52.0 t 0 Io {:,J d-.S;:- .

Date

~_~~\r.\'-. __ ~.g~ . **Head of Department**

APPENDIX 4

PERMISSION LETTER FROM THE XIHOKO CIRCUIT MANAGER

DEPARTMENT OF
EDUCATION

Private Bag X1413
LETABA
0870
Tel No. 015 303 2154
Fax No. 015 303 2196
Cell No. 071 679 3189

Enq. Magwaza Ngomana

From : Office of the Circuit Manager

To : Mrs Ngomana Nomsa
P.O. Box 1944
Letaba 0870

Dear Mrs Ngomana

Re: request for permission to conduct research at Xihoko Circuit Schools: Yourself

1. The matter alluded to above has reference.
2. Permission is hereby granted on the following conditions, that:
 - 2.1. You adhere to all research ethics and principles.
 - 2.2. Your findings and recommendations are made available to the circuit for Circuit Improvement purposes.
 - 2.3. Your activities in those schools do not interrupt effective quality teaching and learning.
 - 2.4. You make proper arrangements with the principal concerned beforehand to avoid unnecessary disagreements.
3. Wishing you all the best in your studies

Duly Signed
Circuit Manager: Xihoko Circuit

15 March 2010
Date

Xihoko Circuit

The heartland of Southern Africa – development is about people

APPENDIX 5

LETTER FOR PERMISSION REQUEST TO A SCHOOL

Box 1944

Letaba

0870

12 April 2010

The Principal
Sevengwana High School
Private Bag x
Nwamitwa
0871

Dear Sir/Madam

Request for a permission to collect data

I, Nomsa Ngomana hereby request permission to collect data for my study at your school. I am a Master's student at the University of Limpopo under the supervision of Dr Themane M.J. The main aim for conducting this study is to investigate the relationship between physical activity and educational achievement among learners in your schools. A self-reported physical activity questionnaire will be administered to learners and the records of marks for June or Trial exams (Mathematics, Mathematics Literacy and English) will be requested from the class teachers of the sampled classes. The estimated time for the questionnaire is 30-60 minutes.

My research topic is, **“The relationship between physical activity and educational achievement (in Mathematics and English) among rural secondary school learners at Xihoko circuit in Limpopo Province, South Africa.”**

My target date for conducting this study is Monday-Wednesday (28th -30th) of June. My sample will comprise all grade 12 learners.

Your co-operation will be highly appreciated.

Yours truly

Nomsa Ngomana

Student's signature.....

Supervisor's signature.....

APPENDIX 6.

PERMISSION LETTER FROM SEVENGWANA HIGH SCHOOL

SEVENGWANA HIGH SCHOOL

ENQ : DEPUY PRINCIPAL
CONTACT : 082 252 3319



P.O BOX 471
N'WAMITWA
0871
Email Sevengwana.egmail.

TENACITY BRINGS SUCCESS

SEVENGWANA HIGH SCHOOL
P.O. BOX 471
NWAMITWA
0871
20 APRIL 2010

Mrs Ngomana N.
P.O. Box 1944
LETABA
0870

RE: REQUEST FOR A PERMISSION TO USE SCHOOL TO COLLECT DATA FOR EDUCATIONAL RESEARCH.

1. The matter above bears the reference.
2. The permission to use school for collection of the said data is granted and the following should be observed:
 - 2.1. The activity should not disturb the school activities.
 - 2.2. The information gathered should be used only for educational purpose.
3. Hope you shall find the above to be in order.

Yours faithfully
Principal

PRINCIPAL: SAMBO M.E DEPUTY NO. 1: KHOSA O. (MATHEMATICS, ADMINISTRATION & MATHEMATICS LITERACY)
DEPUTY NO. 2 : NTIMBANI M.H (LANGUAGE) HOD'S: MATHEBULA N.W.(MATHS & MATHS LITERACY) NGOBENI
(A&C AND LO), NGOBENI K.N (SS), BALOYI S. (SCIENCE) CHAUKE S. (COMMERCE).

APPENDIX 7

PARENTS' CONSENT TO PARTICIPATE IN RESEARCH

Your child is invited to participate in a research study conducted by Ngomana Nomsa, who is a Master's student from the Department of Education at the University of Limpopo. Mrs Ngomana is conducting this study for her Master's thesis.

Your child's participation in this study is voluntary. You should read the information below and ask questions about anything you do not understand, before deciding whether to allow him/her to participate. You are being asked to participate in this study, because you are a resident of the Transitional Living Centre.

• PURPOSE OF THE STUDY

The purpose of this study is to investigate the relationship between physical activity and educational achievement among rural secondary learners in Xihoko Circuit. The information given will only be used for study purposes.

• PROCEDURES

If you allow your child to participate in this study, we will ask him/her to do the following:

1. Complete a questionnaire, which will take 30- 60 minutes.
2. Write an English and Mathematics/ Mathematical Literacy tests (time will depend on the paper).

• POTENTIAL RISKS AND DISCOMFORTS

We expect that any risks, discomforts, or inconveniences will be minor and we believe that they are not likely to happen. If discomforts become a problem, your child may discontinue his/her participation.

- **POTENTIAL BENEFITS TO SUBJECTS AND/OR TO SOCIETY**

It is not likely that your child will benefit directly from participation in this study, but the findings will contribute to the knowledge base about physical activity among learners and serve as a public awareness about it. The results of this study will also contribute to the development and implementation of physical activity health promotion programmes among high school learners.

- **PAYMENT FOR PARTICIPATION**

Your child will not receive any payment or other compensation for participation in this study. There is also no cost to you for participation.

- **CONFIDENTIALITY**

Any information that is obtained in connection with this study and that can be identified with your child will remain confidential and will be disclosed only with your permission or as required by law. Confidentiality will be maintained by means of a code number to let the researcher know, who your child is. We will not use his/her name in any of the information we get from this study or in any of the research reports. When the study is finished, we will destroy the list that shows, which code number goes with which name.

Information that can identify your child's individually will not be released to anyone outside the study. However, the researcher will use the information collected in her study and other publications. We also may use any information that we get from this study in any way we think is best for publication or education. Any information we use for publication will not identify your child's individually.

- **PARTICIPATION AND WITHDRAWAL**

You can choose whether your child should be in this study. If you allow him/her to participate in this study, you may withdraw him/her at any time without consequences of any kind. There is no penalty if a participant withdraws from the study.

• **IDENTIFICATION OF INVESTIGATORS**

If you have any questions or concerns about the research, please feel free to contact

Mrs Nomsa Ngomana
Principal Investigator
Department of Education
University of Limpopo
Box 1944 LETABA 0870
083 444 5382
vutomimi@webmail.co.za

Prof Themane M.J or Prof Kibirige I
Associate Professors
Department of Education
University of Limpopo
Private Bag 1106 SOVENGA 0727
015 268 3431
mahlaphahlaphat@ul.ac.za or israelk@ul.ac.za

I understand the procedures described above. My questions have been answered to my satisfaction, and I allow my child to participate in this study. I have been given a copy of this form.

Printed Name of Subject

Parent's name

Parent' signature of Subject

Date

Signature of Witness

Date

APPENDIX 8

EDITOR'S CONFIRMATION LETTER

**SOLI DEO GLORIA
EDITOR'S CONFIRMATION LETTER
TO WHOM IT MAY CONCERN**

I hereby state that I have edited the document:

**THE RELATIONSHIP BETWEEN PHYSICAL ACTIVITY AND EDUCATIONAL
ACHIEVEMENT AMONG RURAL SECONDARY SCHOOL LEARNERS IN XIHOKO
CIRCUIT IN THE LIMPOPO PROVINCE, SOUTH AFRICA**

BY

**NGOMANA NOMSA
DISSERTATION**

**Submitted in fulfilment of the full requirement for the degree
MASTERS EDUCATIONIS**

In

EDUCATIONAL STUDIES

In the

FACULTY OF HUMANITIES

At the

UNIVERSITY OF LIMPOPO

**SUPERVISOR: Prof. Themane, MJ
CO-SUPERVISOR: Prof. Kibirige, IK**

Disclaimer

At time of submission to student, language editing and technical care was attended to as requested by student and supervisor. Any corrections and technical care required after submission is the sole responsibility of the student.

Regards

Dr JP Sammons
D.Litt.et Phil (University of Johannesburg)

SOLI DEO GLORIA
Language Editing

Cell: 073 778 1801
Email: sdgproofed@gmail.com
DATE: 2011/09/27

