

**THE EFFECTS OF PARTICIPATION IN COMPETITIVE
SPORTS ON ACADEMIC PERFORMANCE OF SECONDARY
SCHOOL STUDENTS IN NAIROBI PROVINCE**

BY

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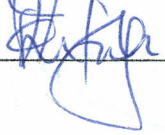
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No portion of the work referred to in this Thesis has been submitted in support of an application for another degree qualification of this or any other university or institute of learning.

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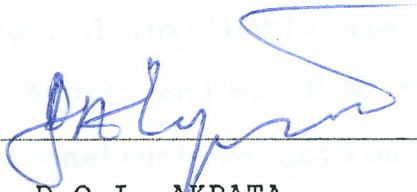
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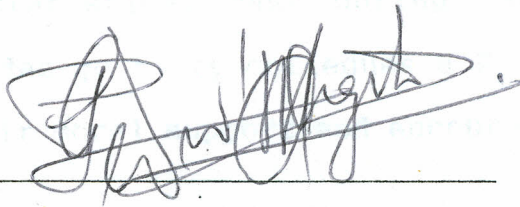


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DEDICATION

It is with deep appreciation and a grateful heart that I dedicate this thesis to my late father (Samwel M'Rintaugu) and my mother who have loved me and given themselves sacrificially to me throughout my school life.

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ABSTRACT

This study investigated the effects of participation in competitive sport on academic performance of secondary school students. The variables of the study included sex, type of school, social economic status, intelligence and participation/non-participation in competitive sport and how these relate to academic performance. It was hypothesized that "there will be no significant effect of participation in competitive sports on academic performance of secondary school students in Nairobi Province."

The study involved 490 subjects (255 athletes and 235 non-athletes) randomly selected from 15 secondary schools within Nairobi Province. Questionnaires, interviews and school records were the tools of data collection. The MANOVA test at 0.05 level of significance was used to determine if there was a significant difference in academic performance between athletes and non-athletes. Further, Tukey H.S.D. post hoc analysis tests was used to determine the strength of the resulting significant differences.

Findings revealed that athletes consistently performed better than non-athletes in measures of academic performance. It was also found out that Social economic status (SES), K.C.P.E. marks and the type of school correlated with academic performance of students. A major finding of the study was that sex is not a significant factor in determining the academic performance of students

in this study. Therefore, it is recommended that competitive sport should be emphasized to all the students regardless of the sex, for it is not detrimental to academic performance. Further studies should be done in secondary schools from the other provinces, and at all other levels of education in Kenya i.e. primary schools, colleges and universities.

Engagement in physical activities and sports can lead to personal, social and cultural development. The benefits are dependent upon the level of involvement and participation (Graham, 1977; Coakley, 1984). Engagement in sports can provide an environment for amusement, recreation, health, social relationships, biological development, freedom of expression, testing of self against self and others, increasing physical skill development, reduction of stress and cognitive benefits (Cheloni, 1977; Van der Pijndexer, 1976; Clarke & Clarke, 1972; Snyder & Spralizer, 1970; French & Janssen, 1997; Sekretsek, 1991).

Different authors have attested that engagement in

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND TO THE PROBLEM

The use of physical activity to improve and maintain physical fitness dates from antiquity (Clarke & Clarke, 1978). The belief that athletic training was conducive to intellectual development existed in the civilisations of ancient China and India. The greek philosophy embodied in the latin phrase "men sano in corpore sano (sound mind in a sound body) has survived through the ages and today provides a philosophical basis for many health fitness programs and sporting activities (Bucher, 1979).

Involvement in physical activities such as in sports and games can lead to personal, social and cultural development but the benefits are dependent upon one's personal involvement and experience (Vannier & Poindexer, 1976; Coakley, 1986). Engagement in sports and games can provide an environment for amusement, recreation, health, social relationships, biological development, freedom of expression, testing of self against self or others, increasing physical skill development, reduction of stress and cognitive benefits (Talamini, 1973; Vannier & Poindexer, 1976; Clarke & Clarke, 1978; Synder & Spreitzer, 1978; French & Jansmce; 1982; Zakrajsek, 1991).

Different authors have attested that engagement in

sports and games contribute immensely toward intellectual development (Arnold, 1972; Hendry, 1978). Specifically, sports and games are more than fun as they are important media for the achievement of educational goals in physical, psychological, social and emotional areas (Brown, 1987). Each time a child participates in a game or sport, thinking is required. As such, Daughtrey & Lewis (1979); French & Jansmce, (1982), contend that the level of physical fitness is related to intellectual accomplishments and particularly mental alertness and concentration.

Research findings support the thesis that sports activities function like grades received in the academic curriculum by providing opportunities for acquiring, developing, rehearsing attitudes and skills. Secondary school athletes have been found to have better grades than non-athletes and they express more interest in continuing with education after school (Hendry, 1978). Ismail & Gruper (1972) concluded that athletes are higher than non-athletes in terms of academic achievement as measured by school marks. Similarly, Jable (1986) noted that athletes tended to have better attendance records, lower drop out rates and less involvement with drugs than do non-athletes, practises that school administrators would like to see adopted by the student population at large.

Launders et al (1978), Snyder & Spreitzer (1978) and Pangrazi (1982) had found a significant relationship

between sports participation and academic achievement. They had argued that sport provides opportunities for success experiences and that these success experience lead to a development of positive self-concept that is necessary for academic achievement. Launder et al (1978) contend that involvement in sport reduces the chances of students dropping out of school.

However, a number of researchers have suggested that participation in competitive sports is detrimental to academic achievement (Coleman, 1961; Spady, 1971). Coleman (1961) propounded the "spend drain" theory which postulates that concentrating on sports expends ones' time and energy, so that resources are not available to achieve success in educational pursuits. Spady (1971) argued that while participation in high school sports fosters the development of attitudes, abilities and motivation which facilitate educational success, sport is not sufficient for total academic achievement. A study was needed to determine the role of sports and its contributions to academic performance and clear the controversy between the two schools of thought.

In Kenyan schools, greater emphasis is placed on competitive sports and high performance (Hall, 1973; Nteere, 1983). Successful sport competitions provide an opportunity to develop optimal level of physical performance, and additionally, offers the satisfaction of

gaining personal recognition among peers which is a credit to academic achievement (Hall, 1973). The spirit of competition leads to the need for further training for improvement of skills. It is not uncommon to find very serious training sessions going on in various sports in the evenings after school hours as well as weekends (Nteere, 1983).

Interschool competitions which involve ball-games, athletics, drama, swimming and music festivals are clearly outlined through the termly distribution of these physical activities throughout the school year. These form the co-curricular activities where competitions transcend intraschool to national levels. In Kenya, the Presidential Decree of 1980 made Physical Education and sports compulsory in all educational institutions. After the year 1980, several studies have been carried out on Physical Education curriculum matters and physical fitness emanating from engagement in Physical Education Programmes. However, little has been done to investigate the contribution of sports towards the academic performance of students in Kenya. Therefore, the thrust of this study was to find out the effects of participation in competitive sport on academic performance of the secondary school students in Nairobi Province.

1.2 STATEMENT OF THE PROBLEM

Competitive sporting activities have been in existence

within the Kenyan educational institutions since pre-independence period. Competitive sporting activities continue to receive publicity from policy-makers, educators and teachers. There is a common belief that they are vital for the physical, social, emotional and intellectual development of the students. However, some researchers have argued that engagement in competitive sport does not enhance academic performance. Despite the lively debate elsewhere, no studies have been carried out in Kenya to show the contribution of competitive sport to academic performance. This study was set to investigate the effects of participation in competitive sports on academic performance of the secondary school students in Nairobi province.

1.3 RESEARCH HYPOTHESIS

The major hypothesis of this study was that there is no significant effects of participation in competitive sports on academic performance of secondary school students in Nairobi Province. From this hypothesis, it was further hypothesized that:

H₀1. There is no significant difference in mean academic performance of male/female athletes and male/female non-athletes in Nairobi Province.

H₀2. There is no significant effect of participation in competitive sport on the mean academic performance of

male and female athletes and male and female non-athletes in Nairobi Province.

H₀3. There is no significant difference in mean academic performance of student athletes and student non-athletes attending national and provincial schools in Nairobi Province.

H₀4. There is no significant effect of participation in competitive sport on the mean academic performance of male and female students in national and provincial schools in Nairobi Province.

H₀5. There is no significant difference in mean academic performance of student-athletes and student-non-athletes having different parental social economic status (SES) in Nairobi Province.

H₀6. There is no significant effect of participation in competitive sport on the mean academic performance of male and female students having parental different social economic status (SES) in Nairobi Province.

H₀7. There is no significant difference in mean academic performance of athletes and non-athletes with different K.C.P.E. marks in Nairobi Province schools.

H₀8. There is no significant effect of participation in

competitive sport on the mean academic performance of male and female students with different K.C.P.E. marks in Nairobi Province schools.

1.4 THE OBJECTIVES OF THE STUDY

The study aimed at investigating whether participation in competitive sport at the secondary school level as any effects on the academic performance of students. The following were the specific objectives of the study.

1. To compare the academic performance of athletes and non-athletes.
2. To establish the effects of gender on academic performance of athletes and non-athletes.
3. To establish the effects of the type of school on the academic performance of athletes and non-athletes.
4. To establish the effects of social economic status on academic performance of athletes and non-athletes.
5. To establish the effects of K.C.P.E. results on academic performance of athletes and non-athletes.

1.5 THEORETICAL FRAMEWORK

Historically, there has been numerous references to the manner in which exercise and vigorous movement activities aid the human condition. The writings of the

first physicians in India, China, Greece and Rome contain prescriptions for exercise that dispel bad vapours associated with disease or perhaps aids in a quick recovery from a debilitating condition or operation (Clarke & Clarke, 1978; Cratty, 1980). While efforts to predict intelligence from measures of kinesthesia and reaction time did not prove fruitful, these works represent some of the first objective attempts to relate movement with intelligence.

The present study is grounded on the Dewey's theory of experiential continuum. The theory maintains that every experience takes up something from those which have gone before and modifies in some way the quality of those which come after (Arnold, 1972). Dewey suggested that a child's education should be on-going and integrative. That is, the physical, intellectual, emotional and social aspects of this development should be synthesized.

Dewey interpreted his theory with the aid of two principles. The principle of continuity is found in the concept of growth. Experiences as they are presented to the child should be educative in the sense that they unite and lead to further development (Arnold, 1972). Interaction expresses the second principle for looking at experiences in its dynamic state - the objective and subjective. This study thrives under the former which is concerned with the environmental conditions and external

stimuli. In fact, Dewey in Daughtrey & Lewis (1979) states that:

"Experiences have shown that when children have a chance to participate in physical activities which bring their natural impulses into play, going to school is a joy and management is less of a burden and learning is easier" p.6.

It is asserted further that lack of physical activity sometimes impedes mental development. The tendency to emphasize the development of the mind without concurrent physical growth and development is one of the major reasons pupils are inattentive in class and receive poor grades and lose interest in school (Clarke & Clarke, 1978; Daughtrey & Lewis, 1979 Coakley, 1986).

According to Dewey, unity and balance in experience could come about by providing occupations that would utilise all the child's faculties. Activity to Dewey meant the engagement of the mind as well as the body. If one of these elements is neglected or over emphasized the result is likely to lead to experiential imbalance. Dewey's theory goes a long way in showing the indivisibility of the individual in terms of the body and mind, and the importance of physical activity in the acquisition of intellect.

In studying the structure of the mind and the body as well as the relationship between them, one discovers that all knowledge is attained through physical senses. The coordinated movements reflect a thinking exercise of the mind thus opening up wider avenues for mental development (Daughtrey & Lewis, 1979). Clarke & Clarke (1978) contend that:

"... a person's general learning potential for a given level of intelligence is increased or decreased in accordance with his degree of physical fitness" p.8.

Similar sentiments have been found in the perceptual motor theories whose basic premise is that movement behaviour both antidotes and positively influences later perceptual and intellectual behaviour (Cratty, 1980). Kephart (1960) believed that ball catching, throwing and handling of missiles in space contribute to children's overall mastery of space and adequacy of spatial judgements which in turn enhance academic abilities.

The above theories contend that movement is a powerful tool in the improvement of perceptual, academic and cognitive functions. Kephart (1960) argues that if the presentation of physical activities is carefully contrived to encourage children to make decisions and think, it is likely that the activities will elicit changes other than

those reflected in improved motor tasks. The investigations of Piaget and other psychologists have underscored the close link between the learning of psychomotor and intellectual skills in the young child (Arnold, 1972; Wamukoya, 1993).

From the foregoing, it appears that engagement in physical activities such as sports and games can enhance the cognitive and sensory perceptual functions.

However, contrasting findings of research work done outside Kenya, necessitated this study so as to confirm or refute the hypothetical correlation between participation in competitive sports and academic achievement of secondary school students in Nairobi Province.

1.6 SIGNIFICANCE OF THE STUDY

The findings of the study will be useful to policy-makers, educators, parents and learners as they have continued to cherish competitive sport without tangible evidence reflecting its role towards intellectual development. Results of the study has established the linkage between participation in competitive sports and academic achievement of students in Kenya. Therefore, it will prove valuable for the administrators and the community at large, for they are charged with the responsibility of providing finances, facilities and equipment which are the basis for competitive sport.

Findings of the study did not find any justification for the belief that engagement in competitive sport is detrimental to academic achievement. This may lead to more engagement in competitive sport by students through parental and teacher encouragement.

Finally, the findings of the study will help future researchers by providing baseline data on the effects of participation in competitive sports participation and academic performance.

1.7 DELIMITATIONS OF THE STUDY

This study was delimited to the following:

- (1) Selection of athletes and non-athletes from 15 public secondary schools from Nairobi Province.
- (2) Inclusion of socio-economic status, intelligence, type of school, sex and participation in competitive sports as independent variables and academic performance as the dependant variable.
- (3) The use of questionnaire, interview schedule and school records as instruments for data collection.
- (4) The use of MANOVA to analyse the data.
- (5) The use of an alpha level of 0.05 for the acceptance or rejection of the hypothesis.

1.8 LIMITATIONS OF THE STUDY

The major limitations faced in this study were the variables selected as factors other than the ones studied may affect academic performance like motivation, discipline and study habits. However the study will still be worthwhile since the variables selected covary with academic performance.

The other limitation of the study is that since there was no stratification of the schools within secondary schools in Nairobi i.e mixed versus single-sexed schools or day versus boarding, the results may not be as comprehensive. However it is hoped that since the schools were randomly selected the effect of this limitation would be minimized.

Another limitation of the study was the responses from the students on SES of their parents. The researcher could not verify the authenticity of their claims. It is however hoped that their responses were correct.

1.9 ASSUMPTIONS OF THE STUDY

The study was carried out under the following assumption - that regular participation in school sports is related to better academic grades whereas non-participation leads to poorer grades.

1.9.1 OPERATIONAL DEFINITIONS OF TERMS

- Academic Performance:** The average total marks obtained in termly examinations by each student.
- Athlete:** A student who represents the school team in external competitions in Athletics, Basketball, Cricket, Handball, Hockey, Netball, Rugby, Racket games, Soccer, Volleyball or Swimming.
- Athletic status:** Refers to whether a student is an athlete or a non-athlete.
- Better Academic Performance:** Refer to mean marks of students which is numerically higher than the mean mark of other students.
- Competitive sport:** The formalized physical activities where students compete outside the school.
- Rx Post Facto Research:** It is a systematic empirical inquiry in which the scientist does not have direct control of

variables because their main manifestations have already occurred or because they are inherently not manipulative (Kerlinger, 1973 pp.379).

K.C.P.E: Kenya Certificate of Primary Education.

Non-athlete: A student who does not represent the school team in competitive sport and games.

Social Economic Status (SES): Refers to the parental educational and/or occupational level along with the highest level of education of the parent.

Sport/Games: The formal competitive physical activities engaged in by students during inter-school competitions. These will include athletics, ball games, racket games and swimming. The terms games and sports are interchangeably used in this study.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter reviews literature pertaining to factors influencing academic performance, and related studies in and outside Kenya.

2.2 FACTORS INFLUENCING ACADEMIC PERFORMANCE

In Kenya, examinations have been accepted as an important aspect of our educational system. They have always been used as the main basis for judging students ability and also as a means of selection for educational advancement and employment (Muola, 1990). According to Eshiwani (1986), school characteristics, teacher characteristics and student characteristics are the main factors that influence academic performance in Kenya.

Teacher characteristics focus on the turn-over rate, training and teacher-student ratio. The school characteristics of class size, school facilities and equipment, time allocated to teaching and learning, school administration, streaming of classes and the professional qualification of teachers have been found to correlate highly with school success (Eshiwani, 1983; Maundu, 1988).

Studies of Sommerset (1974) and Maundu (1988) found that National schools had more qualified teachers, better

equipped science laboratories and libraries than Provincial schools. They concluded that the school life of a student in a national school is focused on doing well in national examinations in comparison with the students from provincial and district schools. Similarly, Sommerset (1974) found students in national high cost schools had higher aspirations than those in local district schools. Thus, students who had high aspirations performed significantly better than students with low academic aspirations. Sommerset concluded that "not merely ability, but also school quality and student background factors that affect the pupils aspirations which are requisites for better academic achievement" pp.5.

The above studies have stressed the disparity between academic achievement of students depending on the type of school. Thus the present study focused on the type of school as a factor affecting the academic performance of students in this sample.

On the other hand, Evans (1965) and Eshiwani (1986) contend that academic achievement is mainly determined by the student qualities when compared to both teacher and school characteristics. These student qualities include intelligence, primary education, social characteristics, motivation, sex and environmental factors. In Kenya there has been controversial findings on who performs better in academics between boys and girls. For instance Keeves

(1972), found that girls performed better than boys in linguistics and verbal tasks involving mathematical reasoning. Similarly, Eshiwani (1983) found that boys did better than girls at "O" levels in all subjects and Maritim (1985) observed that boys had a superior mean score in all the Kenya Certificate of Education (K.C.E) subjects. From the above three studies it can be concluded that no difference exists between boys and girls in their general intelligence and that no particular sex is conclusively superior to another in all academic fields. However, Aduda (1998) while quoting the minister for education, observed that the performance of boys is better than that of girls at the critical grades A to D+ which represent distinction, credit and minimum competence while announcing the Kenya Certificates of Secondary Education (K.C.S.E) examination results.

On the social economic status of the students in Kenya, it has been revealed that the level of education and type of occupation of the parents are important in determining the students academic achievement at primary, secondary and university levels (Nkinyangi, 1980; Eshiwani, 1983; Kathuri, 1984). On the other hand Maundu (1988) had found that the parental backgrounds of students in secondary schools appeared to have little or no direct influence on their academic work. Keeves (1972) had found that the high opportunity costs of education for poor families tended to preclude both boys and girls from

school. Eshiwani (1983) revealed that majority of the students admitted for a Bachelor of Education at Kenyatta University had a peasantly background while still a large proportion of students whose fathers were teachers was notable

A study by Nkinyangi (1980) found that low SES families experienced persistent expulsion of their offspring from school for inability to pay tuition and other charges. Similarly Court and Ghai (1974) pointed out that the socio-economic disadvantage is the equivalent of an educational disadvantage which in turn is productive of poor school performance, repetition, disinterest and even withdrawal. From the above studies it is evident that there is a strong correlation between overall academic performance and social economic background of the students. As such, some of the studies have concluded that the intellectual stimulation that reinforces the schooling experience is less likely to be present in lower-class families than it is likely to be in more privileged families. Therefore, it seems that socio-economic background of the student is a crucial factor in determining his/her academic performance and was included in this study as a factor affecting academic performance.

In Kenya, the primary education forms the basis of both secondary and post-secondary education. The Kenya Certificate of Primary Education (K.C.P.E.) scores are used

as scholastic aptitude measures for placement in secondary schools, village polytechnics and employment. Thus, the performance in K.C.P.E. is very important as it filters pupils to different positions - particularly placement in the secondary schools. A study by Maundu (1988) indicated that there was a general consensus among secondary school headteachers that secondary school entry qualifications are important determinants of student achievement. Information provided indicated that also parents give unequal attention to children who had higher Certificate of Primary Education (C.P.E.) scores. Thus, children with higher C.P.E. scores could be provided with school fees and other requirements i.e uniforms, and pocket money before the others who had lower C.P.E marks as they joined form one. Moreover, the low achievers in C.P.E. could be asked to repeat in order to enable parents provide secondary education to those with higher C.P.E. scores. Equally, it has been observed that a pupil with lower C.P.E. scores stands a very slim chance of doing well in secondary education (Eshiwani, 1983). Thus it was with this framework that K.C.P.E. marks were included in this study as a basis of the students scholastic aptitude.

In summary, according to Banks & Finalyson (1973) successful secondary school students are marked by being introverts, have a dependent relationship with the parents, tend to be oriented towards the future, have set high expectations in relation to examination success, are

strongly motivated toward achievement, intellectually curious, prepared to apply themselves to educational tasks, set for homework and have little interests of the opposite sex.

However, Synder & Spreitzer (1978), Coakley (1986) contend that competitive sport has a role to play in determining academic performance as it competes for time, energy and resources with academic pursuits.

2.3 COMPETITIVE SPORTS AND ACADEMIC PERFORMANCE

It is widely believed that sport participation is an avenue of social mobility in either directly or indirectly through the inculcation of achievement related qualities of deferred gratification, self-discipline and leadership (Synder & Spreitzer, 1978). Linkages exist between sport participation and academic achievement (Synder & Spreitzer, 1978; Coakley, 1986).

Engagement in active sport leads to the acquisition of physical fitness which is instrumental in mental development. Research works by Arnett (1968), Hart & George (1984) found a positive relationship between physical fitness and Grade point average of high school students. Studies by Harris & Jones (1982), Ismail & Gruper (1972), Keller (1981) and Plack (1968) found a relationship between motor skill execution and achievement in reading, comprehension and mathematical ability in

children. They concluded that physical activity enhances intellectual processes of memorization and categorization which serve adjunctive roles in improving grades.

Achievement values and study habits are changed as the motivation, hard work and efficiency derived from engagement in active sport is carried over into the students' academic work (Coakley, 1986). It has been found that participation in sport provides opportunities for success experiences and that these success experiences lead to development of positive self-concept that is necessary for academic achievement. Research findings by Muasya (1989) and Mukonyi (1987) support the thesis that a positive self-concept lead to better academic performance.

Sport participation is a source of prestige and athletes are likely to receive academic support and encouragement from counsellors, teachers, coaches, parents and peers (Coakley, 1986). Though sport by itself is not the source of academic success, under certain circumstances, participation affects the social context of an athlete's life so that favourable educational attitudes and experiences are likely (Synder & Spreitzer, 1978). Research work by Philips (1979) suggest that prestige and encouragement is the most valid explanation as to why interscholastic athletes tend to have slightly higher academic aspirations and achievement levels than other high school students.

Athletes continue to receive special academic assistance from other students, teachers and coaches especially in schools where inter-scholastic sports are highly emphasized. The academic assistance ranges from the provision of extra tuition by coaches and the close relationship between athletes and teachers relative to non-athletes. Coaches and teachers remind the athletes that school work is paramount to sports (Hanks & Eckland, 1976).

From the foregoing, the prestige associated with participation in sports is directly linked to increased academic performance. However, the supplementary roles of academic support, encouragement and the preferential treatment presumes that athletes will do better in school than students not involved in sports (Coakley, 1986).

McIntosh (1966), argued that success in team-games which require tactical skill is more likely to be associated with mental ability than success in individual sports. His findings suggested that in competitive sports as a whole, membership of high ability groups was associated with an enhanced probability for selection for a school team and membership of lower ability groups with decreased probability of selection. He pointed out that it was mainly the academically able who associated with prestigious extra-curricular activities and those were usually sport teams or school choirs.

Schafer & Armer (1968) study involving 585 boys from the high schools found out that athletes tended to have a higher grade average than non-athletes when controlling factors such as intelligence, type of curriculum and the social class background of parents. They found that athletes did have higher educational expectations; Eighty two percent of the athletes planned to complete at least two years of college as compared to seventy five percent of non-athletes. Therefore athletes were more likely to complete four years of college.

Rehberg & Schafer (1968) found the association between athletics participation and higher educational expectations was evidenced among boys from the less privileged backgrounds. It appears that athletics did not have a similar impact on boys from more privileged background, since these youth were already predisposed by their family background toward higher education.

Spady's (1971) study found that the level of participation in high school extracurricular activities accounted for more variability in educational attainment than does family social economic status or academic ability. To assess the relative effects of athletics as compared to other forms of extracurricular activities, the participation of 279 boys was categorised into four groups, namely athlete only, athlete-service, service only and non-participants. The study established that the athlete only

was considerably lower in measures of intelligence than athletes who are also members of academic related societies and clubs.

Hendry, (1978) carried out a longitudinal study of 18 months to ascertain whether sport participation contributes immensely towards academic achievement or not. The study involved over 3000, 15-16 year old secondary school pupils as they progressed from the third year into their fourth year of study in 15 comprehensive schools. The data was collected by questionnaires, inventories, teacher ratings and assessment as well as by direct measurements, observations and recordings. Students were categorised into three groups, namely active competitively, active recreatively and non-participants. He found that more than half of the boys and more than two-thirds of the girls were non-participants in extra school sports. Additionally, the active competitors performed better in academics.

Buhrman, (1972) conducted a longitudinal study of a group of adolescent boys over the period 1959-1965. This research showed that athletic participation was more strongly linked to educational success among boys from poor social economic backgrounds. Such students strived to gain social recognition and acceptance and through it gain greater academic aspirations and higher scholarships.

Hanks & Eckland, (1976) developed high school and

college models to assess the role of extra curricular programme in the educational attainment success which distinguished participation in athletics and other activities. The models were evaluated separately for males and females using longitudinal data from a national sample of youth who were high school sophomores in 1955. Athletics was found to have very weak antecedents and consequences. Social participation had relatively strong direct and total salutary effects on academic performance and achievement in both school and college for both sexes and served to mediate the effects of social economic background and academic aptitude on teacher contacts. Categorically there was no indication that participation in high school athletics is detrimental to academic performance or achievement.

Launder et al, (1978) carried out a study to assess the influence of athletics on educational attainment. The study tested Spady's (1971) contentions that high school athletes were deficient in academic skills necessary for later success in college because athletics were their only form of extracurricular involvement. A 1975 sample of 239 and a 1977 sample of 403 of male and female high school students were categorised into athlete only and athlete-service groups and then compared on scholastic attitude test. Comparisons were also made for the national average for males and females. Results from both samples supported Spady's contentions for males but not for females.

McElroy, (1979) study focused on the role of school value environment in altering the relationship between sport participation and educational aspirations. It was hypothesized that the sport participation and educational aspirations relationship would vary depending on the emphasis placed by the school on either sports or academics or both. Regression models incorporating school value climates and a series of factors believed to be linked to sports participation and educational aspirations were used to test their impact on educational aspirations. An analysis of 1,799 male seniors from 87 high schools resulted in the conclusion that school value climates did not influence the relationship between sport participation and education aspirations. However, the study did not include females in the sample.

Magill & Ash (1979), study classified children in grade 1 through 5 as either participants or non-participants in organized youth sport programs. The study sought to examine the relationship between sports participation and the development of children by identifying certain psycho-social characteristics of elementary school children. They then compared these characteristics for participants and non-participants in youth sport programs. The characteristics examined were academic achievement, self-concept, trait anxiety and motor development. The findings of the study revealed that academic achievement did not suffer when children

participated in sport. The results seemed encouraging when most participants averaged about one hour per day in actual physical involvement in their sport during the season. Equally, it appeared that, the time spent on sport was not time meant for studies but for other activities.

Rehberg & Cohen (1975) carried out a study in which students were categorised as athletes if they had participated in one or more seasons on a varsity sport team or athlete-service if they had participated in one or more varsity sport in addition to one or more service activities. The Behrens Fishers t statistic was used to compute independent t-tests for the total scholastic aptitude test scores. One sample t-test was also used to compare each male and female participation category to national averages for their respective sex and year in school. Statistical comparison between the participation categories indicated that males who were athletes only had lower scholastic aptitude test scores $t(78) = -2.95$. The male athlete-service group however had significantly lower scores than the national average $t(115) = -5.00$. Data presented supported Spady's (1971) contention that male high school students who participated in athletics only lack the academic skills necessary to fulfil their higher educational aspirations.

Feltz & Weiss (1984), designed a study to assess the influence of athletics and other extra curricular

activities on the academic orientation of female high school students. Senior girls were categorised into groups labelled athlete-only (comprising students who participated in athletics only), service only (students who participated in service activities), athlete-service (students participating in both athletics and service activities) and neither (students whose extracurricular activities included neither athletics nor service activities). Categorizations were based on listings from their high school year books. Those taking ACT college entrance exam (N= 487) were compared on composite and English scores to the other groups and to national and state averages. Analysis of covariance controlling for social economic status and extent of activity revealed that the athlete only group recorded the lowest average scores. However, this could not be attributed to the participation category to which they belonged. Rather, social economic status level and extent of activity involvement were predictive of higher ACT scores. The result refuted the notion that involvement in athletics only is detrimental to educational achievements for females and lead to certain recommendations for longitudinal and multimeasure investigations of academic orientations.

Coakley's (1986), study revealed a close connection between academic success as shown by streaming and physical performance as shown by membership of school or house teams. Students in higher stream had a disproportionate

number of places in school teams.

Kiveu (1986), investigated the relationship between academic performance and extra curricular activities in three secondary schools of Webuye division of Bungoma district. Academic performance was indicated by class position after term examinations for second and third terms of 1984 and 1985. The sample was collected from form four classes. The total sample consisted of 309 athletes and non-athletes. Questionnaires and school records were the instruments of data collection. The researcher used descriptive statistics to present the findings. However, the study lacked a statistical tool to test the relationship, uniformity in the collection of data and standardization of class positions.

From the foregoing, the following observations were made:

- (i) Only one study had been carried out in Kenya (Kiveu, 1986) and this focused only on three secondary schools. Different findings will result from a bigger sample.
- (ii) The longitudinal studies did not cater for maturational and attritional effects including those of Buhrman (1972); Hendry (1978); and Hanks and Eckland, (1976).

- (iii) Studies by Hendry (1978); Kiveu (1986); Schafer & Armer (1968); Rehberg & Schafer (1968), lacked statistical tools to establish the relationships.
- (iv) Feltz & Weiss (1984), study involved only females and McElroy (1979) included only males.
- (v) Studies by Hanks & Eckland (1976), did not cater for the retrogression effects of recall data.

Unlike the forementioned studies which focused on all the extracurricular activities, the present study incorporated competitive sports and games only. The students were categorised as athletes and non-athletes. For uniformity and control, the study investigated the parental social economic background, sex, type of school and the K.C.P.E. marks of athletes and non-athletes. The games masters provided information pertaining to students sports participation behaviours unlike other studies which required the students to fill the questionnaire on their sport participation behaviours. In this study, it was deemed that students could not give genuine information pertaining to their participation in competitive sports and therefore games masters were in a better position to give genuine information on the students participatory behaviours.

CHAPTER THREE

METHODOLOGY

3.1 INTRODUCTION

This chapter covers research design, the target population, the sample and sampling procedures, research instruments, piloting and data analysis technique which were used in the study.

3.2 THE RESEARCH DESIGN

This study was designed to investigate the effects of participation in competitive sports on academic performance among secondary school students in Nairobi. The study attempted to compare athletes and non-athletes as they are without any manipulation. Therefore, the design that was considered appropriate in this study is Ex Post Facto research design. Kerlinger (1973), says that:

With a little reflection of the important variables in educational research - intelligence aptitude, home background, parental upbringing, teacher personality and school atmosphere will show that they are not manipulatable pp.343.

Ex Post Facto research design does not allow the manipulation of the independent (sex, type of school, social economic status, K.C.P.E marks and sports participation) dependent (academic performance) variables. Besides, their manifestations have already occurred. As

such, no treatment was administered to the subjects in order to change either their sports participation or academic performance. Moreover, the effects of sports participation on academic performance had already occurred.

3.3 TARGET POPULATION

For the purpose of this study, the target population consisted of public secondary schools students within Nairobi Province.

3.4 THE SAMPLE AND SAMPLING PROCEDURES

Nairobi Province was selected through purposeful sampling. It was considered that schools in Nairobi Province have abundance of both the independent and dependent variables. Thus, schools in Nairobi Province have continued to fare well in the national secondary school sports competitions (Odanga, 1997). Secondly, schools within Nairobi Province have always comparatively performed well in national examinations without much variations unlike other provinces in Kenya (Eshiwani, 1986; Kiugu, 1997)

Stratified random sampling method was used to select 15 public secondary schools from 42 secondary schools. Nairobi province had a total of 47 public secondary schools but the 5 secondary schools which took part in the pilot study were not included in the main study. Therefore, the 15 secondary school selected from 42 secondary schools

represented a sufficient sample of 35.71% as recommended by Borg and Gall (1983) in correlational studies. Simple random sampling method was used to select 2 national and 13 provincial schools using a random number table. The procedure (use of Random number table) involved numbering the schools appropriately, that is 01-04 (for national schools) and 05-42 (for provincial schools). Then the researcher selected a starting point on the random number table and moved systematically horizontally. The researcher counted the number of schools needed (15) using the last two digits and ignoring repetitions and irrelevant numbers (Clarke & Clarke, 1978). The national schools normally admit the best students after Kenya Certificate of Primary Education while the provincial schools recruit students from the pool of applicants after the national schools have made their selection. Thus the students from the national schools have a sound academic base than their counterparts in the provincial schools.

After visiting each school the researcher with the assistance of the games master/mistress randomly selected 30 athletes (incase of national) or 20 athletes (incase of Provincial) and a similar number of non-athletes using a random table of numbers. Therefore, a total of 640, 120 from national schools and 520 students from provincial schools were selected for the study. But during the processing of questionnaires and examination of school records some students' marks were missing and therefore,

they were not included in the study. Therefore, a total of 490 students represented the total sample whose data analysis is presented in chapter four.

3.5 INSTRUMENTS FOR DATA COLLECTION

Three main instruments for data collection were used in this study. They included the Questionnaire, the interview schedule and school records.

(i) Questionnaire

A direct contact Questionnaire was one of the tools used for data collection in this study. It was found suitable as it made it possible to establish rapport with the respondents, clarify points and motivate the students to answer questions (Clarke & Clarke 1984). It also led to minimal wastage of time and loss of questionnaires (Borg & Gall 1983).

A closed ended Questionnaire was used due to its easier statistical tabulation and analysis. The Questionnaire sought athletes' and non-athletes' background information and the social economic background of their parents. The questionnaire was divided into three sections. Section one covered the introductory letter stating the purpose of the study, section two covered the athletes' and non-athletes' background information while section three covered the parental social economic status (see Appendix A).

SOCIAL ECONOMIC STATUS (SES)

After processing the questionnaires, SES was determined using fathers or mothers occupational status (whichever was higher) plus the higher of either parent's educational level. Occupational status and educational level were added together to provide a more discriminating index of SES. This information led to classification of students as coming from three main SES classes i.e. upper, middle and lower as supported by Robertson (1973).

K.C.P.E. MARKS

For ease of statistical analysis, the students K.C.P.E. marks were grouped into three groups A, B, and C with group A having scored (536-646), B (423-535) and C (310-422). The K.C.P.E. examination is normally scored out of 700 and is used as measure of scholastic aptitude. Secondly, it is the K.C.P.E. marks which are used to recruit the students into the national, provincial, district and private schools.

(ii) THE INTERVIEW SCHEDULE

An interview schedule was conducted with the games masters of the sampled schools. The interview was structured to limit the writing by interviewer and to restrict the interviewees to the pertinent matters. The games-masters responded to questions (see Appendix B and C) pertaining to the students' background information and their engagement in competitive sports.

From the interview schedule with the games master/mistress, a student was categorised as an athlete if he/she had represented the school in external competitions on the various games (athletics, Basketball, Cricket, Handball, Hockey, Netball, Rugby, Racket games, Soccer, Volleyball or Swimming) during his life in the school. A student who had never represented the school team in any external sporting competition was categorised as non-athlete.

(iii) SCHOOL RECORDS

School records were examined and they revealed information pertaining to the end of term marks each student attained during the academic years of 1996 and 1997. Schools records had been successfully utilised in related studies of self-concept, academic attitudes and academic achievement motivation (Muasya, 1989; Mukonyi, 1987; Muola, 1990). The researcher carried out a pilot study on five schools to establish the usefulness of this research instrument and it yielded correct results.

3.6 PILOT STUDY

Piloting of the Questionnaire and interview schedule was conducted using students and games masters drawn from five secondary schools within Nairobi Province. The schools involved during the pilot studies were not included in the main study. Piloting was done to assess the suitability of the questionnaire, the wordings of the

questions, the consistency in the responses and the types of responses to be expected from the questionnaire and interview schedule. It also helped the researcher get familiarised to the data collection process in advance of the main research. The findings from the pilot study were used to make adjustments to the Questionnaire and interview schedule.

3.7 DATA ANALYSIS TECHNIQUE

(j) STANDARDIZATION OF THE RAW SCORES

After the collection of data, the resulting end-of-term marks were standardized. The marks obtained were from different examinations taken in individual schools. Comparison of the marks without standardization would have excluded differences in the content of the tests, style of setting and time taken for the test. Standard scores are used to provide a common clearly defined scale for reporting and comparing different tests (Ebel 1979). They have standard deviations and means of standard value. The total end-of-term marks obtained in the academic year of 1996 and the two terms of 1997 (Third term of 1997 was not included in the study) were divided by the number of subjects to get the termly means. The five termly means were added together and divided by five to get the overall mean. It is the overall mean that was used in subsequent data analysis. These means were standardized following the procedure shown in Appendix D.

(ii) The data obtained from the research were summarised and presented using tables, figures, percentages and means. In the present study the effects of participation in competitive sport on academic performance (where academic performance is affected by sex, type of school, social economic status of the parents and K.C.P.E marks) was compared using multifactor analysis of variance (MANOVA).

* MANOVA was deemed appropriate for this study as it provides a more powerful test of the effects of the factors than evaluating them singly. Secondly, MANOVA enables one to determine whether the factors affect or interact with one another. Post hoc test of Tukey HSD (Honestly significant difference) was done to compare the factors to see if their effects are significant. Tukey HSD was chosen as it allows comparison of each pair of factors and is easy to carry out (Hinton 1995). The sub-hypotheses were tested at 0.05 level of significance. For calculations of the MANOVA and Tukey tests refer to Appendix E and F.

Table 1: Distribution of Students by Gender

Gender	Athletes		Non-Athletes		Total	%
	N	%	N	%		
Male	148	37.25	157	39.25	305	76.50
Female	12	3.00	18	4.50	30	7.50
Total	160	40.25	175	43.75	335	100

ANALYSIS OF DATA, INTERPRETATION AND DISCUSSION OF THE FINDINGS

4.1 INTRODUCTION

This chapter presents the analysis of data, interpretation and discussion of the findings generated from this study and observations from other related studies. This focused on the relationship between athletic status and Academic performance based on;

- (a) gender
- (b) type of school
- (c) social economic status (SES)
- (d) K.C.P.E marks

4.2.0 ATHLETIC STATUS, GENDER AND ACADEMIC PERFORMANCE

Table one presents the proportions of the students who took part in the study by gender.

Table 1: Proportion of Students by Gender

		Athletes	%	Non- Athletes	%	Total	%
GENDER	Males	156	47.85	170	52.15	326	66.53
	Females	99	60.37	65	39.63	164	33.47
		255	52.04	235	47.96	490	100

From Table 1, a total of 326 (66.53%) males and 164 (33.47%) females took part in the study. Among these,

there were 255 (52.04%) athletes and 235 (47.96%) non-athletes.

Table 2 presents the summary of the findings on Gender, athletic status and academic performance.

Table 2: Summary of the MANOVA on Gender and Athletic Status on Academic Performance

SOURCE	SS	df	MS	F
Athletic Status	5336.2	1	5336.1	40.62*
Gender	149.7	1	149.7	1.14
Athletic Status Sex	19852.64	1	19852.64	151.15*
Error	63832.93	486	131.34	
Total	89170.93	489		

* $P < 0.05$

From table 2, it is evident that athletic status of the sample did have a main effect on their academic performance but gender did not. The interaction of athletic status and gender had an effect as reflected by the F value of 151.15. Further analysis through Post hoc analysis of tukey HSD is shown in Table 3.

Table 3: The main effects of gender and athletic status on Academic performance

GENDER	ATHLETIC STATUS			MAIN EFFECT OF GENDER
	ATHLETES		NON-ATHLETES	
Males	52.38	4	48.28	50.38
	<u>-13.78</u>		<u>7.32</u>	<u>1.12</u>
Female	66.16	<u>19.2</u>	40.96	51.5
Main effect of athletic status	54.26	<u>6.6</u>	47.67	50.97

In the present statistical result, there are grounds for accepting the first null hypothesis (H_{01}) and rejecting H_{02} since in the first H_{01} the calculated value of probability was less than the required level of significance. Thus there is evidence that academic performance of athletes and non-athletes are different for male and female students. However, it is imperative to examine the different effects of each factor.

4.2.1 MAIN EFFECTS OF ATHLETIC STATUS

The effect of athletic status for males academic performance (4) is less in absolute values than the Tukey HSD of 4.78 and is not statistically significant ($P > 0.05$). However the mean score for the male athletes (52.38) is higher than the mean score of the male non-

athletes (48.38) but the difference of (4) is not statistically significant ($P > 0.05$). For the female students the effects of athletic status (19.2) is greater in absolute values than the Tukey HSD of 4.78. Thus the female athletes mean academic performance of (66.16) is significantly higher than the mean academic performance of female non-athletes (46.96). The F -observed of 40.62 for the mean effects of athletic status is statistically significant ($P > 0.05$) indicating that the main effect means for athletes (54.27) and non-athletes (47.67) differ significantly (6.6).

4.2.2 MAIN EFFECTS OF GENDER

The statistical results indicate that effect of gender on the student academic performance depends on their athletic status. For the athletes, the effect of gender (-13.78) is in absolute values greater than the Tukey H.S.D. of 4.78. Equally, for the non-athletes the effect of gender (7.32) is greater in absolute values than the Tukey H.S.D. of 4.78. However the main effect of gender (1.12) is not statistically significant ($P > 0.05$) and the F -observed of (1.14) is also not statistically significant ($P > 0.05$).

4.2.3 MAIN EFFECTS OF INTERACTION

Figure 1 presents the interaction effects of gender and athletic status on academic performance.

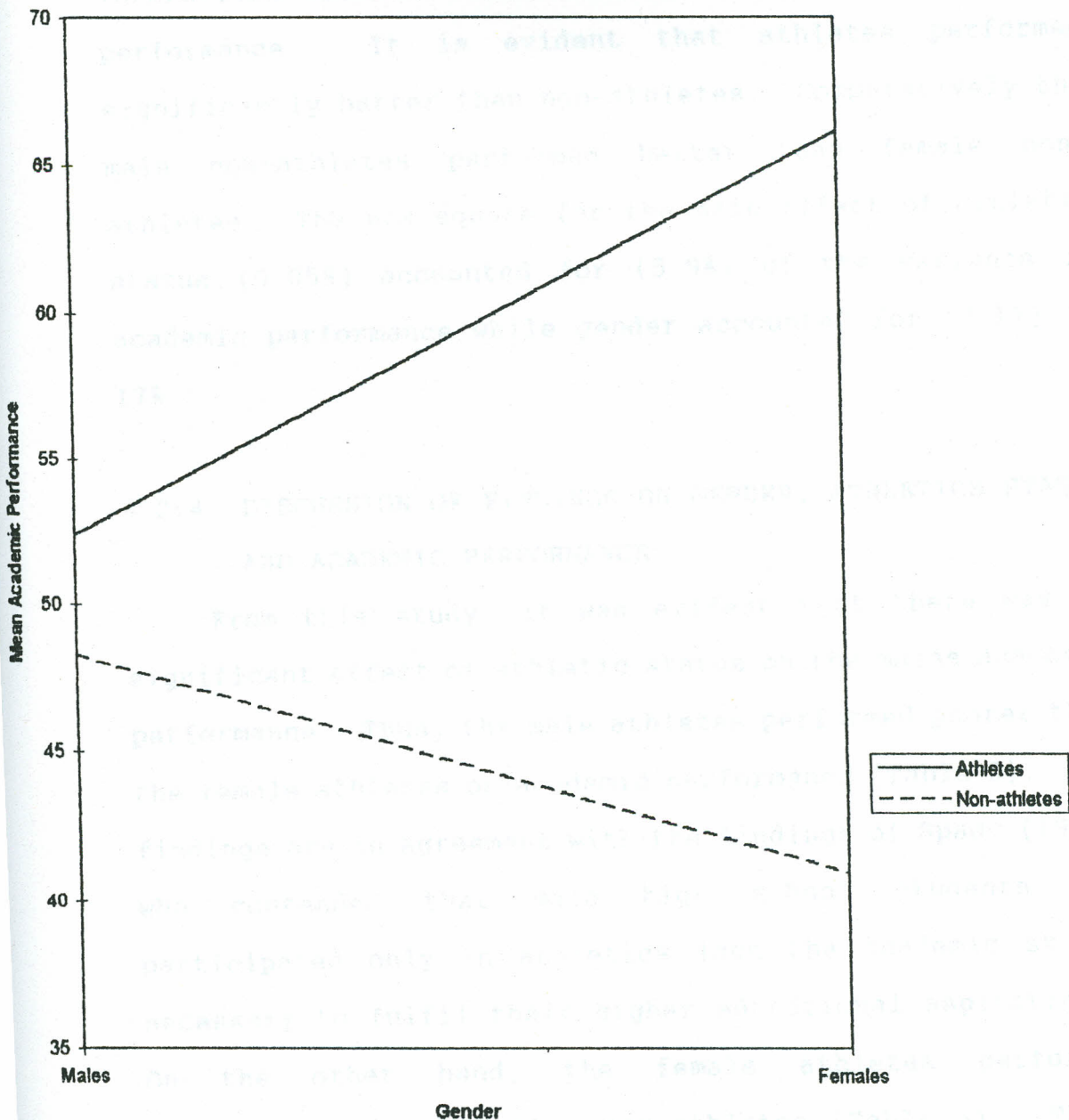


Figure 1: Interaction effects of gender and athletic status on Academic performance

Figure 1 indicates that, there is a significant interaction between athletic status, gender and academic performance. It is evident that athletes performed significantly better than non-athletes. Comparatively the male non-athletes performed better than female non-athletes. The eta square for the main effect of athletic status (0.059) accounted for (5.9%) of the variance in academic performance while gender accounted for (0.17) or 17%.

4.2.4 DISCUSSION OF FINDINGS ON GENDER, ATHLETICS STATUS AND ACADEMIC PERFORMANCE

From this study, it was evident that there was no significant effect of athletic status on the males academic performance. Thus, the male athletes performed poorer than the female athletes on academic performance (Table 3). The findings are in agreement with the findings of Spady (1970) who contended that male high school students who participated only in athletics lack the academic skills necessary to fulfil their higher educational aspirations. On the other hand, the female athletes performed significantly better than non-athletes (Table 3). Thus, the findings of the study are not in agreement with Feltz & Weiss (1984) observation that participation in competitive sport has a greater influence on the academic achievement for males than females.

The present study revealed that the effect of gender

on academic performance is not significant ($P > 0.05$) (Table 3). Therefore, the findings of the study are in agreement with previous studies of Spady (1971). The interaction effects of both athletic status and gender revealed that athletes performed better than the non-athletes regardless of the sex (fig.1). This is in agreement with previous studies (Schafer & Armer, 1968; Hendry, 1978; Philips, 1979; Coakley, 1986; Kiveu, 1986). Furthermore, interaction effects revealed that female athletes achieved higher performance on academics than male athletes (fig.1). These findings have been confirmed by previous studies (Spady, 1971; Rehberg & Cohen, 1975; Hanks & Eckland, 1976; Synder & Spreitzer, 1978; Purdy, Eitzen & Hutuagel, 1982; Feltz & Weiss, 1984). With the above findings there are various possibilities as to why female athletes perform better than male athletes on academics. Launder et al (1978) suggested that coaches may not stress continuous athletic involvement for females as much as they do for males. As a matter of fact, Feltz & Weiss (1984) argued that males may also spend more time outside of the organized practice on improving their sport skills than females and thus have less time to spend on learning the academic skills necessary for higher educational attainment. The same observation was made by Hanks & Eckland (1976) when they said that athletic participation for females seems to carry comparatively positive rather than detrimental effects on their academic attainment. From this study, athletic status accounted for 5.9% of the

variance in academic performance while gender accounted for only 1.67%. Therefore the other proportion of academic performance can be accounted for by other factors such as motivation, study habits and environmental factors.

4.3.0 TYPE OF SCHOOL, ATHLETIC STATUS AND ACADEMIC PERFORMANCE

Table 4 presents the proportion of students who took part in the study by school type.

Table 4: Proportion of students by school type

ATHLETIC STATUS			
TYPE OF SCHOOL	ATHLETES	NON-ATHLETES	TOTAL
National	56	57	113
Provincial	199	178	377
Total	255	235	490

From the table, the national schools had 113 (23.7%) students while provincial schools had 377 (76.93%) of the total sample. Table 5 presents the summary of the MANOVA on athletic status and type of school on academic performance.

Table 5: Summary of the MANOVA on athletic status and Type of school on Academic performance

SOURCE	SS	df	MS	F
Athletic Status	2752.27	1	2752.27	26.26 [†]
School Type	35670.98	1	35670.98	311.68 [†]
Athletic Status X School	1231.63	1	1231.63	11.75 [†]
Error	50946.2	486	50946.2	
Total	86911.08	489		

* $P < 0.05$

With the above statistical results, there are grounds for rejecting the two null hypotheses (H_{03} and H_{04}) and accepting the alternatives, since in each case the calculated value of probability reached the level required for significance. It is therefore asserted that academic performance of athletes and non-athletes are different for the national and provincial schools in Nairobi Province. Further analysis of the data through post hoc tests of Tukey HSD is shown in Table 6.

Table 6: Main Effects of athletic status and Type of school on academic performance

TYPE OF SCHOOL	ATHLETIC STATUS			MAIN EFFECTS OF SCHOOL
	ATHLETE		NON-ATHLETE	
National	64	<u>1.22</u>	62.78	63.39
	<u>13.34</u>		<u>20.38</u>	<u>16.86</u>
Provincial	50.66	<u>8.26</u>	42.4	46.53
Main effects of athletic status	57.33	<u>4.74</u>	52.9	54.96

4.3.1 MAIN EFFECTS OF ATHLETIC STATUS

The main effects of athletic status for the national school, athletes' (1.22) and non-athletes is less in absolute values than the Tukey HSD of 4.40 and is not statistically significant ($P > 0.05$). For the provincial schools, the effects of athletic status (8.26) is greater in absolute values than the Tukey HSD of 4.40 and is statistically significant ($P < 0.05$). Thus for the provincial school athletes' mean score (50.66) and mean score of the non-athletes (42.4) differ significantly (8.26). The F -observed of 26.26 for the main effects of athletic status is statistically significant ($P < 0.05$) indicating that the mean score for athletes (57.33) and non-athletes (52.59) differ significantly (4.74).

4.3.2 THE MAIN EFFECT OF SCHOOL

The results indicates that the effect of school on students' academic performance depends on their athletic status. The effect of school (13.34 and 20.38) are greater in absolute values than the Tukey HSD of 4.40. The statistically significant effects indicates that for both athletes and non-athletes, provincial school students academic performance is significantly less than that of the national school students. Thus, the main effect of school (16.86) revealed that academic performance of national school students is greater than that of the provincial school students. The F-observed of 311.68 indicates that the main effects for school (63.39) and (46.53) differ significantly (16.86).

4.3.3 MAIN EFFECTS OF INTERACTION

From the figure 2, it is evident that there is a significant interaction between school type, athletic status and academic performance. That is, athletes in this study performed significantly better than non-athletes regardless of the school type. The eta square for the main effect of the type of school (0.41) indicates that the type of school accounts for (41%) of the variance in Academic performance whereas athletic status accounted for 3.1%.

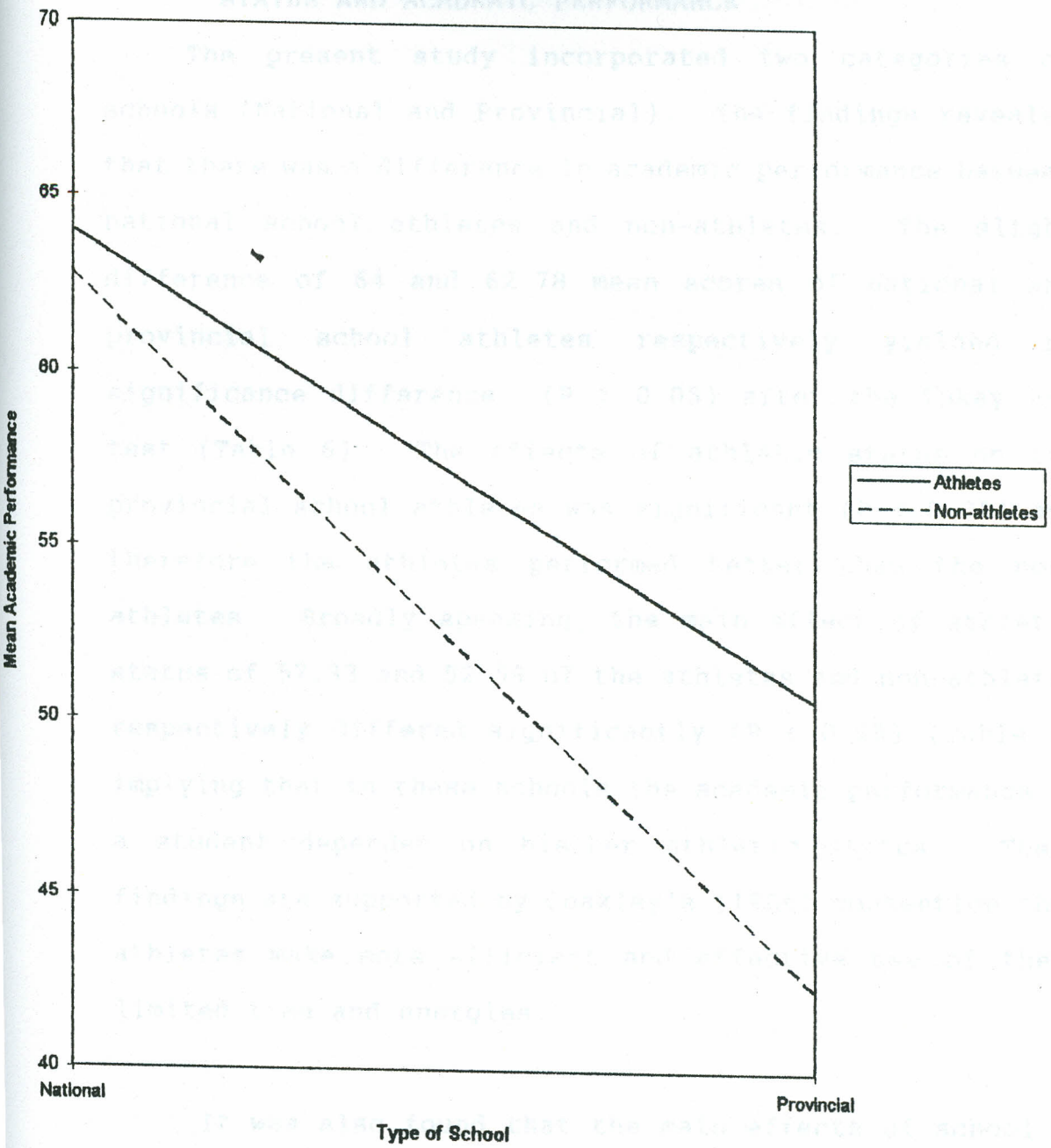


Figure 2: Interaction effects of athletes status and type of school on Academic performance.

4.3.4 DISCUSSION OF FINDINGS ON TYPE OF SCHOOL, ATHLETIC STATUS AND ACADEMIC PERFORMANCE

The present study incorporated two categories of schools (National and Provincial). The findings revealed that there was a difference in academic performance between national school athletes and non-athletes. The slight difference of 64 and 62.78 mean scores of national and provincial school athletes respectively yielded no significance difference ($P > 0.05$) after the Tukey HSD test (Table 6). The effects of athletic status on the provincial school athletes was significant ($P < 0.05$) and therefore the athletes performed better than the non-athletes. Broadly speaking, the main effect of athletic status of 57.33 and 52.59 of the athletes and non-athletes respectively differed significantly ($P < 0.05$) (Table 6) implying that in these schools the academic performance of a student depended on his/her athletic status. These findings are supported by Coakley's (1986) contention that athletes make more efficient and effective use of their limited time and energies.

It was also found that the main effects of school on academic performance depended on a students athletic status (athlete or non-athlete). Athletes in national schools scored higher than non-athletes and the same trend was reflected in the provincial schools (Table 6). There was a remarkable difference in academic performance of both athletes and non-athletes in the two school types. As such

the main effects of school in the students academic performance is greater among the non-athletes (20.38) than for the non-athletes (13.34) (Table 6). Therefore, it implies that non-athletes are more affected by the type of school they are enrolled in.

On the interaction effects of the type of school and athletic status it was evident that athletes performed significantly ($P > 0.05$) better than non-athletes and also the national school students performed better than the provincial school student (fig.2). Sommerset (1974), Eshiwani (1983) and Maundu (1988) attributed the higher performance of national school students to the disparity in the provision of teaching-learning resources. Maundu (1988) argued that the school life of a student in the national school is focused on doing well in the national examinations. Equally, it is noticeable that national schools admit students with higher K.C.P.E. marks than provincial schools. On athletes performing better than non-athletes, Synder & Spreitzer (1978) lamented that "exposure to athletic subculture to effort, hard work, persistent discipline and achievement value gained from competitive sport spills over to the non-athletic activities such as school work. Equally, Heyneman (1976), cited boarding facilities as possible correlates of school achievement in national schools. From the present study, it was evident that the difference in the academic performance between the national and provincial school

students is accounted for by the type of school as reflected by the eta square of 0.41 or 41%.

4.4.0: ATHLETIC STATUS, SOCIAL ECONOMIC STATUS (SES) AND ACADEMIC PERFORMANCE

Table 7, present the proportion of students who took part in the study by their Social Economic Status.

Table 7: Proportion of students by their Social Economic Status

SES CLASS	ATHLETIC STATUS		TOTAL
	ATHLETE	NON-ATHLETE	
UPPER	61	59	120
MIDDLE	96	80	176
LOWER	98	96	194
TOTAL	255	235	490

From the table, 120 (24.49%) students came from the upper class, 176 (35.92%) came from the middle class and 194 (39.59%) came from the lower class. Table 8 presents the summary of the MANOVA on athletic status, SES and academic performance.

Table 8: Summary of the MANOVA on athletic status and SES on Academic performance

SOURCE	SS	df	MS	F
Athletic Status	3612.45	1	3612.45	360.88 [*]
SES	1132.93	2	1132.93	113.17 [*]
Athletic Status X SES	103.89	2	103.89	10.37 [*]
Error	4839.25	484	10.01	
Total	9698.52	489		

* P < 0.05

With the statistical results, there are grounds for rejecting the 2 more null hypothesis (H_{05} and H_{06}) and accepting the alternatives. In each case, the calculated value for probability reached the level required for significance. Thus, it is hereby asserted that academic performance of athletes and non-athletes are different for the upper, middle and lower SES classes. Further analysis of the data through post hoc analysis of Tukey HSD is presented in Table 9.

Table 9: Main effects of athletic status and SRS on Academic performance.

SRS CLASS	ATHLETIC STATUS			MAIN SES EFFECTS
	ATHLETE		NON-ATHLETE	
UPPER	57.45	<u>8.92</u>	48.53	52.99
	<u>4.1</u>		<u>-.16</u>	<u>1.97</u>
MIDDLE	53.35	<u>4.66</u>	48.69	51.02
	<u>2.81</u>		<u>0.86</u>	<u>1.84</u>
LOWER	50.54	<u>2.71</u>	47.83	49.18
Main effects of Athletic status	53.78	<u>5.43</u>	48.35	51.06

4.4.1 THE EFFECTS OF ATHLETIC STATUS

The effects of athletic status for the upper class students academic performance (8.92) is greater in absolute values than the Tukey HSD of 1.42 and is statistically significant ($P < 0.05$). Thus the mean score of the upper class athletes 57.45 is statistically higher than the mean score for the non-athletes (48.53). For the middle class students, the effect of athletic status on academic performance (4.66) is greater in absolute values than the Tukey HSD of 1.42. Therefore the mean score for the middle class athletes (53.35) is statistically higher than the mean score for the non-athletes (48.69).

For the lower class students, the effects of athletic

status on academic performance (2.71) is greater in absolute values than the Tukey HSD of 1.42 and is statistically significant ($P < 0.05$). Therefore, the mean score of academic performance of lower class athletes (50.54) is statistically significant indicating that the mean score for the athletes (53.78) and non-athletes (48.35) differ significantly (5.43)

4.4.2 MAIN EFFECTS OF SOCIAL ECONOMIC STATUS (SES)

The results indicate that the main effects of SES on students academic performance depend on their athletic status. For the athletes, the effects of SES on upper class athletes and middle class (4.1) and lower class athletes 2.81 are significant. Both (4.1) and 2.81) are greater in absolute values than the Tukey HSD of 1.42. Therefore, the mean Academic performance of upper class athletes (57.45) is greater than the mean academic performance of middle class athletes (54.35) which is equally greater than the mean academic performance of lower class athletes (50.54).

For the non-athletes the effects of SES on upper class non-athletes (-0.16) and middle class and lower class non-athletes (0.86) are less in absolute values than the Tukey HSD of 1.42. Therefore, the mean academic performance of upper class non-athletes (48.53) is greater than the mean academic performance of middle non-athletes (48.69) and lower class non-athletes (47.83). However these

differences are not statistically significant ($P > 0.05$). Thus, the F -observed of 113.17 indicates that the main effects of SES on academic performance (1.97 and 1.84) differ significantly and are higher in absolute values than the Tukey HSD of 1.42. As such, the mean academic performance of upper class students, (52.99), middle class 51.02 and lower class 49.18 differ significantly.

4.4.3 MAIN EFFECTS OF INTERACTION

Figure 3 presents the interaction effects of athletic status and SES on academic performance.

From fig. 3, there is a significant interaction between athletic status, SES and Academic performance. Simple main effects indicate that upper class student scored higher than the middle and lower class students. In all the SES classes the athletes performed significantly better than the non-athletes. The eta square for the main effect of athletic status (0.37) indicates that athletic status accounts for much proportion (37%) of the variance in academic performance whereas SES accounted for 11.6% of the variance.

Figure 3: Interaction effects of SES and Athletic status on Academic performance

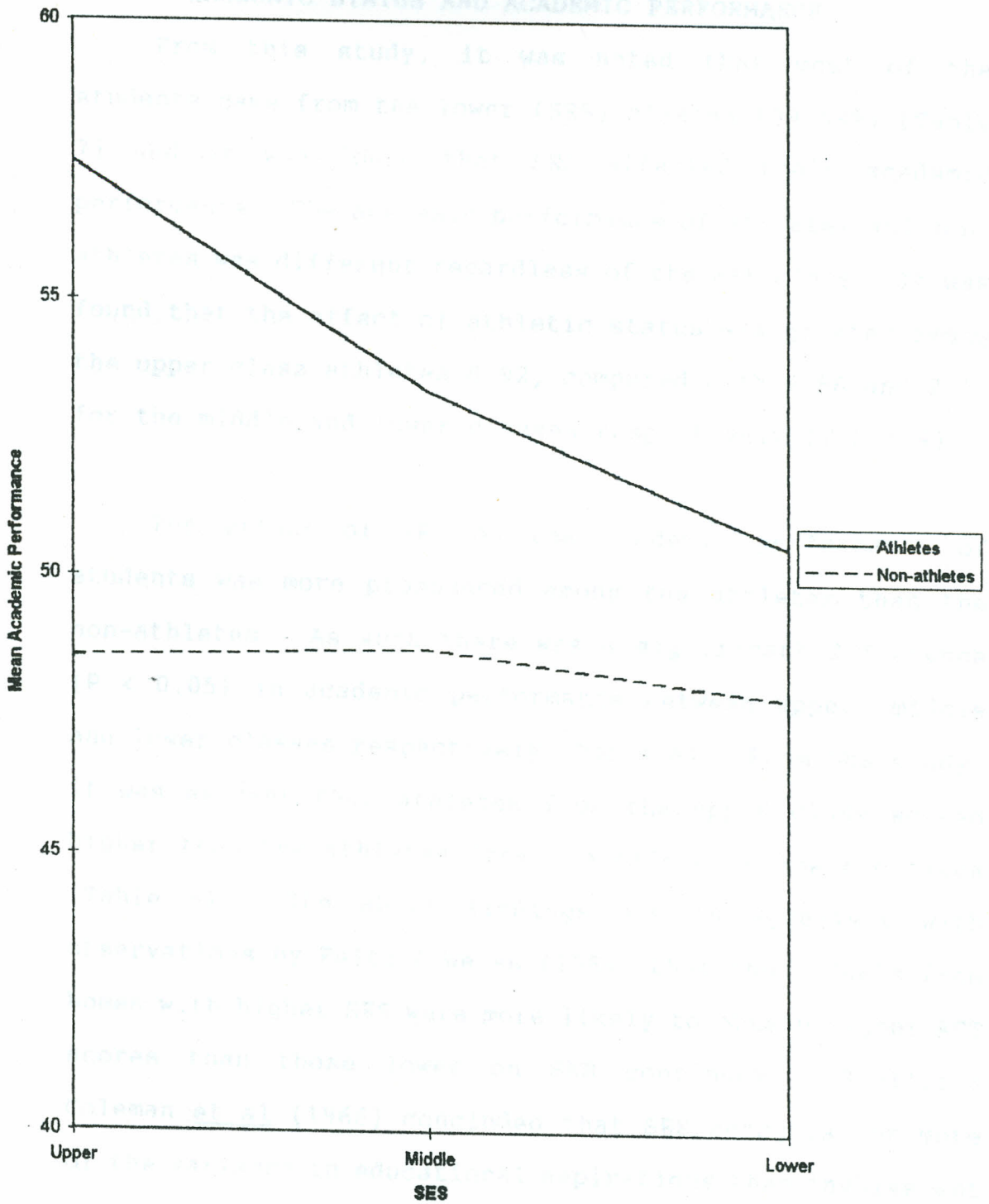


Figure 3: Interaction effects of SES and Athletic status on Academic performance

4.4.4 DISCUSSION OF FINDINGS ON ATHLETIC STATUS, SOCIAL ECONOMIC STATUS AND ACADEMIC PERFORMANCE

From this study, it was noted that most of the students came from the lower (SES) classes (39.59%) (Table 7) and it was found that SES affected their academic performance. The academic performance of athletes and non-athletes was different regardless of the SES class. It was found that the effect of athletic status was greater among the upper class athletes 8.92, compared with 4.66 and 2.11 for the middle and lower classes respectively (Table 9).

The effect of SES on the academic performance of students was more pronounced among the athletes than the non-athletes. As such there was a significant difference ($P < 0.05$) in academic performance between upper, middle and lower classes respectively (Table 8). From the study, it was evident that athletes from the upper class scored higher than the athletes from the middle or lower classes (Table 9). The above findings are in agreement with observations by Feltz & Weiss (1984) that individuals from homes with higher SES were more likely to obtain higher ACT scores than those lower on SES continuum. Similarly Coleman et al (1966) concluded that SES accounts for more of the variance in educational aspirations than involvement in school activities.

It was also found out from this study, that there was no significant difference in academic performance among the

non-athletes from different SES classes (Table 9). Previous studies on male academic orientation suggest that athletics may be an important means for achievement of higher educational aspirations for individuals of lower SES (Rehberg & Schafer, 1968; Buhrman, 1972; Picou & Curry, 1974). However, this was not reflected in this present study. The significant effect of SES on the students academic performance concurs with Buhrmans (1972) contention that athletic participation was more strongly linked with educational success among boys and girls from poor SES class.

The significant interaction effects of both athletic status and SES revealed that upper class athletes performed higher than middle and lower class athletes. Thus the contention of Otto & Alwin (1977), that children from higher SES tend to have higher educational aspirations while those from lower SES tend to have lower educational aspirations holds true in this study. Apart from the SES, athletes performed significantly higher than non-athletes and this is in agreement with the studies of Rehberg (1969) and Hanks & Eckland (1976) and Hendry (1978).

In this study 37% of the variance in the students academic performance was accounted for by athletic status while SES accounted for 11.6%. Thus, the findings are contrary to Colemans et al (1966) conclusion that SES accounts for more of the variance in educational

aspirations than does involvement in school activities. The possibilities as to why upper class students performed higher than the other class students according to Kathuri (1984) is that parents in the higher SES bracket are able to provide both support and bring pressure to bear on teachers so that they can do their best. Equally, Nkinyangi (1980) found out that lower SES families experienced persistent expulsion of their offspring from school for inability to pay tuition and other payments. Similarly, Litcher (1962) pointed out that SES disadvantage is the equivalent of an educational disadvantage which in turn leads to poor school performance, repetition, disinterest and even withdrawal. Thus, in this study the athletes and non-athletes were not immune from the influences of SES.

4.5.0 ATHLETIC STATUS, K.C.P.E MARKS AND ACADEMIC PERFORMANCE

Table 10 presents the classification of students into three scholastic aptitude groups based on their K.C.P.E. marks

Table 10: Categories of students by K.C.P.E marks.

K.C.P.E CLASS	ATHLETIC STATUS		TOTAL
	ATHLETES	NON-ATHLETES	
A (536-646)	35	45	80 (16.32%)
B (423-535)	110	80	190 (38.78%)
C (310-422)	110	110	220 (44.90%)
TOTAL	255	235	490 (100.00%)

From the table, 80 (16.32%) students were in category A, 190 (38.78%) students were in category B, while 220 (44.90%) were in category C.

Table 11 presents the summary of the MANOVA on athletic status, K.C.P.E marks on academic performance.

Table 11: Summary of the MANOVA on athletic status and K.C.P.E marks on Academic performance

SOURCE	SS	df	MS	F
Athletic Status	3883.44	1	3883.44	17.69 [†]
Intelligence	34265.09	2	34265.09	156.11 [†]
Athletic Status X Intelligence	2901.23	2	2901.23	13.21 [†]
Error	106233.69	484	219.49	
Total	147283.45	489		

* $P < 0.05$

The observed statistical results, necessitated for rejection of the 2 null hypotheses (H_{07} and H_{08}) hence adapting the alternatives. In each case the calculated value of probability reached the level required of significance and thus there was evidence that academic performance of athletes and non-athletes differ from students with different K.C.P.E marks. Further analysis of the data through Tukey HSD is presented in Table 12.

Table 12: Main effects of athletic status and K.C.P.E.

Marks on Academic performance

K.C.P.E MARKS	ATHLETIC STATUS			MAIN K.C.P.E MARKS EFFECTS
	ATHLETES		NON-ATHLETES	
A (536-646)	65.10	<u>1.58</u>	63.52	63.31
	<u>6.56</u>		<u>11.95</u>	<u>8.25</u>
B (423-535)	58.54	<u>6.97</u>	51.57	55.06
	<u>11.78</u>		<u>12.12</u>	<u>11.96</u>
C (310-422)	46.76	<u>7.31</u>	39.45	43.10
Main athletic effects	57.14	<u>5.63</u>	51.51	54.32

4.5.1 MAIN EFFECTS OF ATHLETIC STATUS

The effects of athletic status on the academic performance of students with different K.C.P.E marks (A, B, and C); 1.58, 6.97, and 7.31 respectively are less in absolute values than the Tukey HSD of 8.73. Therefore the academic performance of both athletes and non-athletes did depend on their athletic status. Equally, the main effect of athletic status (5.63) is less than the Tukey H.S.D of 8.73 and is not statistically significant ($P > 0.05$). The F-observed of 17.69 for the main effects of athletic status is statistically significant ($P < 0.05$) indicating that the mean score for the athletes 57.14 and non-athletes (51.51) differ significantly (5.63). Therefore, the difference in academic performance between athletes and non-athletes can be attributed to other factors and not to participation in

competitive sport.

4.5.2 MAIN EFFECTS OF K.C.P.E MARKS

The results indicate that the effects of K.C.P.E marks on students academic performance is dependent on their athletic status. Although the mean score of athletes (65.10) is greater than the mean score of category B athletes (58.54) it is not statistically significant ($P > 0.05$). But the effects of K.C.P.E marks on academic performance of category B athletes (11.78) is greater in absolute values than the Tukey HSD of 8.73. Thus, the mean score of B athlete (58.54) is statistically higher than the mean score of category C-athletes (46.76).

For the non-athletes, the effects of K.C.P.E marks (11.95 and 12.12) are greater in absolute values than the Tukey HSD of 8.73 and are statistically significant ($P < 0.05$). Thus, the mean scores of academic performance of categories A-non-athletes (63.52), category B-non-athletes (51.57) and category C non-athletes (39.45) are statistically different. The main effects of K.C.P.E marks in category A-non-athletes and category non-B-athletes (8.25) is not higher in absolute values than the Tukey HSD of 8.73 but the main effect of K.C.P.E marks in categories of B- and C-non-athletes (11.96) were greater in absolute values than the Tukey HSD (8.73) and is statistically significant ($P < 0.05$).

The F-observed of 156.11 for the main effects of K.C.P.E marks is statistically significant ($P < 0.05$) indicating that the mean academic performance of categories A non-athletes (63.31) and C non-athletes (43.10) differ significantly.

4.5.3 MAIN EFFECTS OF INTERACTION

Figure 4 presents the interaction effects of athletic status and K.C.P.E marks on academic performance.

From the figure 4, it is evident that there is a significant interaction between athletic status, K.C.P.E marks and academic performance. Athletes performed significantly better than non-athletes across all the K.C.P.E marks categories. Equally, students from category A performed better than students from categories B and C. The eta Square for the main effects of K.C.P.E marks (0.23) accounted for (23%) of the variance in academic performance whereas athletic status accounted for 2.6% of the variance.

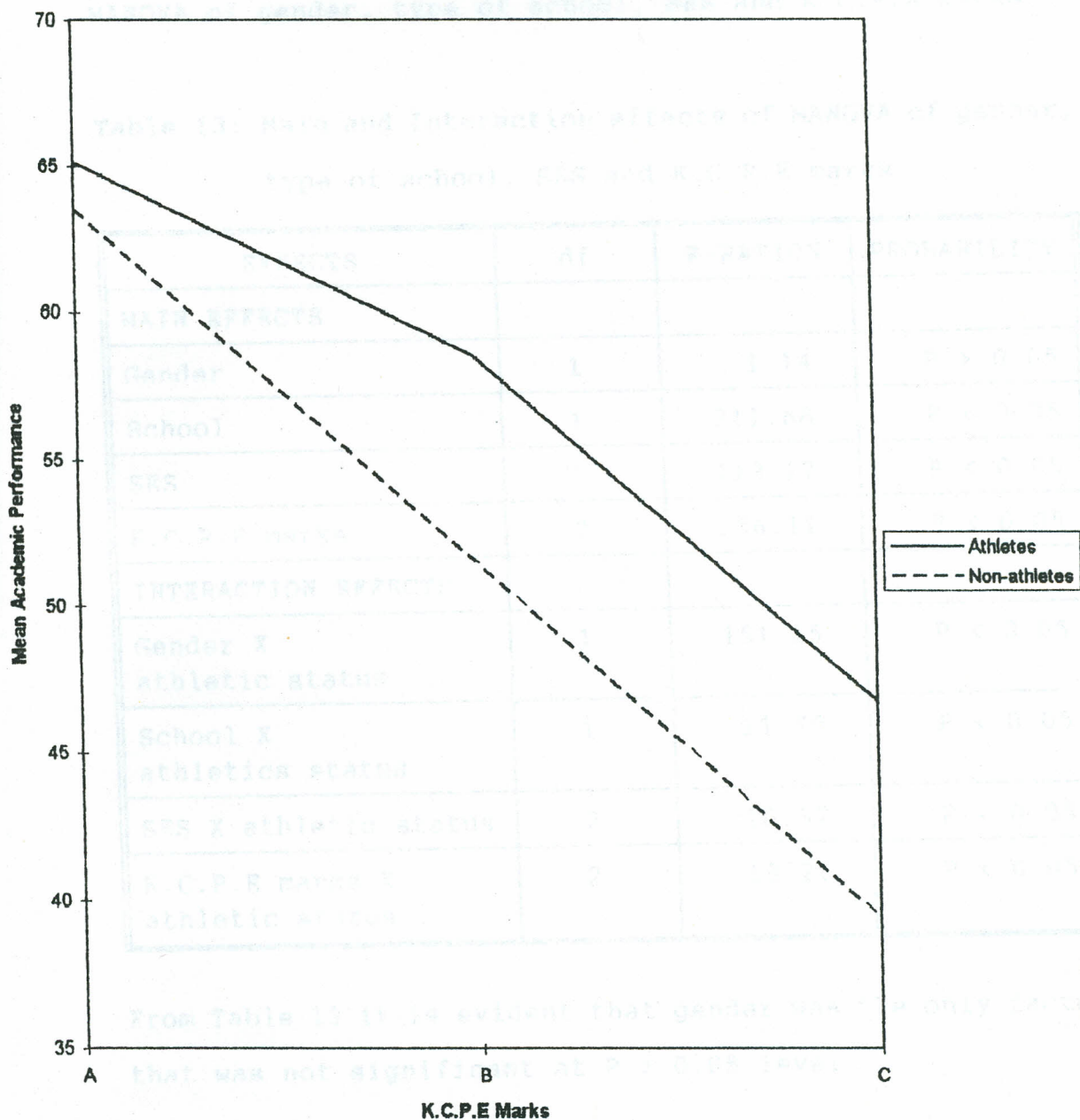


Figure 4: Interaction effects of K.C.P.E Marks and Athletic status on Academic performance

Table 13 presents the main and interactions effect of MANOVA of gender, type of school, SES and K.C.P.E marks

Table 13: Main and Interaction effects of MANOVA of gender, type of school, SES and K.C.P.E marks

EFFECTS	df	F-RATION	PROBABILITY
MAIN EFFECTS			
Gender	1	1.14	P > 0.05
School	1	311.68	P < 0.05
SES	2	113.17	P < 0.05
K.C.P.E marks	2	156.11	P < 0.05
INTERACTION EFFECTS			
Gender X athletic status	1	151.15	P < 0.05
School X athletics status	1	11.75	P < 0.05
SES X athletic status	2	10.37	P < 0.05
K.C.P.E marks X athletic status	2	13.21	P < 0.05

From Table 13 it is evident that gender was the only factor that was not significant at P > 0.05 level.

4.5.4 DISCUSSION OF FINDINGS ON K.C.P.E MARKS, ATHLETIC STATUS AND ACADEMIC PERFORMANCE

In this study, scholastic aptitude of students was inferred through the performance in the Kenya Certificate of Primary Education (K.C.P.E) examination. It is the same examination results which are used for selection in joining

secondary schools and placement in employment. According to Hanks & Eckland (1976) students who participate in extracurricular activities besides sports are likely to be those who previously had good grades and Read (1972) pointed out that the best students academically came from the more prestigious schools, have a greater tendency for engaging in extra curricular activities including sports. However, in the present study, the effect of K.C.P.E marks on academic performance depended on the students athletic status.

The athletes who had higher K.C.P.E. scores, scored higher than those with less K.C.P.E. scores (Table 12). However, the difference were not significant ($P > 0.05$). But, comparison of B- and C-athletes revealed that the difference in academic performance was significant ($P < 0.05$). Thus Coakley's (1986), contention that physical fitness associated with participation in interscholastic sports would have a direct impact on the intellectual abilities of adolescents holds true in this study. On the other hand, there was a significant difference ($P < 0.05$) between the academic performance of categories A, B and C non-athletes as reflected in their mean marks of 63.52, 61.57 and 39.45 respectively (Table 12).

The interaction effects of athletic status and K.C.P.E marks revealed that athletes performed significantly ($P < 0.05$) higher on academic performance than non-athletes

(fig.4). Further, it was revealed that the students who had good K.C.P.E scores continued to perform better even in the secondary schools (fig.4). This is in agreement with Synder & Spreitzer's (1978) argument that athletes are physically and mentally superior to non-athletes. From the study, 23% of the variance in the students academic performance is accounted for by K.C.P.E marks. This implies that the superior physical condition of the athletes improves their mental performance. According to Synder & Spreitzer (1978), the most logical explanation for higher goals and grades among athletes is that interscholastic sports attracts students with self-confidence, above average academic abilities and favourable attitudes towards school. On the same note, Maundu (1988) had shown that the secondary school entry qualifications are important determinants of students achievement. Thus, it implies that K.C.P.E scores determines who is going to succeed in secondary education.

In conclusion, it appears that only gender was not a significant factor in determining academic performance of students in Nairobi secondary schools. The other factors of type of school, social economic status and K.C.P.E scores were highly significant (Table 13).

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

This chapter presents summary of the findings, conclusions drawn from the findings and recommendations based on the findings.

5.2 SUMMARY OF THE FINDINGS

This study was mainly concerned with investigating the effects of participation in competitive sports and academic performance of secondary school students in Nairobi Province. The variables of study included sex, type of school, social economic status (SES) Kenya Certificate of Primary Education (K.C.P.E) marks and participation in competitive sports and how these related to academic performance. The study involved an analysis of data derived from 490 subjects (255 athletes and 235 non-athletes) randomly selected from fifteen (15) secondary schools in Nairobi province. The mean academic performance scores of both athletes and non-athletes were compared to establish whether there were differences.

The major findings of the study were as follows:-

- (a) There was no significant difference in mean academic performance of male and female secondary school students.

- (b) There was a significant difference in mean academic performance of student-athletes and student-non-athletes.
- (c) There was a significant effect of participation in competitive sport on the mean academic performance of male and female athletes and male and female non-athletes.
- (d) There was a significant difference in mean academic performance of athletes and non-athletes from National and Provincial schools.
- (e) There was a significant effect of participation in competitive sports on the mean academic performance of male and female students in national and provincial schools.
- (f) There was a significant difference in mean academic performance of student athletes and student non-athletes having different social economic status.
- (g) There was a significant effect of participation in competitive sports on the mean academic performance of male and female students having different social economic status.

(h) There was a significant difference in mean academic performance of athletes and non-athletes with different K.C.P.E scores.

(i) There was a significant effect of participation in competitive sports on the mean academic performance of male and female students having different K.C.P.E scores.

5.3 CONCLUSIONS

The conclusions that can be drawn from the findings of this study are as follows:-

(a) Athletes tend to perform better than non athletes on measures of academic performance.

(b) Female athletes performed better than male athletes in measures of academic performance in this sample.

(c) Students from national secondary schools performed better than students from provincial schools in academic achievement.

(d) The students belonging to the upper social economic status scored higher than students from either the middle or lower social economic status on measures of academic performance.

- (e) Students who had done well in the Kenya Certificate of Primary Education (K.C.P.E) examination tended to also do well academically in secondary school.

5.4 RECOMMENDATIONS

From the findings of this study, the following recommendations are made:

- (a) Interscholastic (competitive) sports should be emphasized at all levels of education as engagement in them is not in any way detrimental to academic achievement.
- (b) Due to the fact that boys' academic performance is slightly affected by their engagement in competitive sport, Headteachers and games masters should ensure that boys practice during times which are scheduled for sports and games and not any other times.
- (c) The Ministry of Education through its inspectorate should ensure that all the schools have basic sports infrastructure (facilities and equipment) for students to venture into sports.
- (d) The society should change its belief that students who are good in sports are academic dwarfs. Instead they should encourage them to excel in sports.
- (e) Parents should socialize their children through sports

and give them sufficient parental encouragement while pursuing both sports and academics.

(f) Social background factors are becoming increasingly important in determining scholastic success and are being reinforced by disparities in instructional resources. The Government through the assistance of parents-teachers association (P.T.A) should make greater efforts to minimize these disparities in provision of instructional resources to the provincial schools.

(g) K.C.P.E marks determines the success of a pupil in secondary education. The teachers should therefore ensure that the pupils are thoroughly prepared for the examination.

5.5 RECOMMENDATIONS FOR FURTHER RESEARCH

For the purpose of establishing further effects of participation in competitive sports on academic achievement, it is recommended that the following studies be carried out.

(1) A similar study controlling other factors that affect academic performance e.g. motivation, intelligence, study habits, school characteristics and environmental factors.

(2) A similar study should be carried out at other levels

of education e.g. primary schools, colleges and universities.

(3) A similar study be done incorporating all the other types of secondary schools (district and private) and with larger samples.

(4) A similar study would be done in secondary schools encompassing other co-curricular activities with the view to find out their effects on academic performance.

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Zakrajsek, D. (1991). Bringing good things to life;
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I'm a student taking a course in history
of education at Kentucky University. I'm utilizing an online
physical education database to investigate the relationship
between participation in physical education and physical
performance among secondary students in the Eastern
Province

You are requested to fill out this questionnaire.
This is not a test. Answer all the questions honestly and
truthfully as they apply to you. Your responses will be
used for research purposes and they will be treated with
confidence.

Please answer all the questions.

Thanking you in advance for your cooperation.

Yours sincerely,

Dr. D. Zakrajsek

SECTION II

Questions in this section ask your opinion. Please
Please be honest and give your answers as completely
yourself.

Name _____

Name of your school _____

Your sex _____

Age _____ Class _____

Your F.C.P.E. number _____ Grade _____

APPENDIX A

STUDENTS QUESTIONNAIRE

KENYATTA UNIVERSITY,
DEPARTMENT OF
PHYSICAL EDUCATION,
P.O. BOX 43844,
NAIROBI.

SEPT. 1997

Dear Student,

I'm a post-graduate student taking a degree in Master of education at Kenyatta University, specializing in physical education. I intend to investigate relationship between participation in competitive sport and academic performance among secondary school students in Nairobi Province.

You are requested to fill the attached questionnaire. This is not a test. Answer all the questions honestly and truthfully as they apply to you alone. The answers will be used for research purpose and they will be treated in confidence.

Please answer all the questions.

Thanking you in advance for your co-operation

Yours sincerely

Gitonga R. Rintaugu.

SECTION II

Questions in this section seek your background information. Please be honest and give true responses as concerns yourself.

Names (in full) _____

Name of your school _____

Your sex _____

Age _____ Class _____

Your K.C.P.E. marks _____ Grade _____

SECTION III

This section seeks your parental Background information.
Please be honest and give true answers individually.

Your Father's:

Age _____

Highest Educational background _____

Occupation _____

Did your father undergo any formal training? _____

If yes, specify _____

Your mother's:

Age _____

Highest Educational background _____

Occupation _____

Did your mother undergo any formal training? _____

If yes, specify _____

APPENDIX B

LETTER OF TRANSMITTAL

Kenyatta University
Department of P.E.
P.O. Box 43844
Nairobi.

Date _____

Through The Headmaster,
_____ Sec. School,
P.O. Box _____
Nairobi.

TO THE GAMESMASTER

I'm a post-graduate student taking a degree in master of education at Kenyatta University specializing in Physical Education. I intend to investigate the relationship between participation in sports and academic performance among secondary school students in Nairobi Province.

I intend to interview you on matters pertaining to students participation in sports. The results of the interview will be purely used for academic purposes and as such will be treated in confidence. the findings will assist towards the improvement of sports and the general learning in our Kenyan Secondary Schools.

Thanking you in advance for your co-operation,

Yours faithfully

Gitonga E.R.

APPENDIX C

INTERVIEW SCHEDULE

NAME OF SCHOOL _____

TYPE OF SCHOOL _____ STATUS _____

NAME(S) OF STUDENT _____ CLASS _____

AGE _____

◆ Which sports does the student engage in while in school?

◆ Has the student represented your school team in the sport(s) mentioned above? _____

◆ Which year did the student join the school team in the sport/game? _____

◆ How many times has he/she represented the school team in the sport/game? _____

APPENDIX D

STANDARDIZATION OF SCORES

The following formula was used to convert scores into standard scores:

$$\frac{x - \bar{x}}{\sigma_x} = \frac{Y - \bar{Y}}{\sigma_Y}$$

Where

x = Desired standard score

\bar{x} = Constant mean

σ_x = Standard deviation constant

Y = A given raw score

\bar{Y} = A given mean score for the raw data

σ_Y = Standard deviation for the raw data for which Y is the mean score

Simply stated $x = \frac{Y - \bar{Y}}{\sigma_Y} \sigma_x + \bar{x}$

Source: Ebel 1979.

APPENDIX E

THE ABC METHOD FOR CALCULATING A TWO WAY FACTORIAL ANOVA

$$A = \Sigma x^2$$

$$B = \Sigma x^2 / N$$

$$C \text{ (Rows)} = (\Sigma x_{r1})^2 + (\Sigma x_{r2})^2 + \dots + (\Sigma x_{ri})^2 / n_{ri}$$

$$D \text{ (columns)} = (\Sigma x_{c1})^2 + (\Sigma x_{c2})^2 + \dots + (\Sigma x_{ci})^2 / n_{ci}$$

$$C \text{ (r x c)} = (\Sigma x_{cell1})^2 + (\Sigma x_{cell2})^2 + \dots + (\Sigma x_{celli})^2 / n_{celli}$$

Summary Table for ANOVA

Sources	Sum of Squares (SS)	Degrees of freedom (df)	Mean of squares ms	F-ratio F
Rows (IV ₁)	C-B	r-1	SS _r /df _r	MS _r /MS _e
Columns (IV ₂)	D-B	c-1	SS _c /df _c	MS _c /MS _e
R x C	(E-B)-(C-B)-(D-B)	(r-1)(c-1)	SS _c /df _c	
Error	(A-B)-(E-B)	(N-1)-(r-1)-(c-1) +(r-1)(c-1)	SS _e /df _e	
Total	A-B	N-1		

Where r = number of rows or level of IV₁ (Independent variable one)

c = number of columns or level of IV₂ (Independent variable two)

Adapted from Thomas & Nelson (1985) pp.139.

TUKEY TEST

It allows us to compare each pair of conditions to see if their difference is significant.

$$\text{HSD} = \frac{q \sqrt{M_s \text{ error}}}{N}$$

Where q = the difference between any two means
the standard error of the difference
between the two means.

Adapted from Hinton (1995).

KENYATTA UNIVERSITY