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A study examining the effects of athletics on females' mathematical achievement

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A STUDY EXAMINING THE EFFECTS OF ATHLETICS ON FEMALES' MATHEMATICAL ACHIEVEMENT

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ABSTRACT

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The purpose of this study was to explore the possibility of a correlation between females who actively participated in athletics and a high achievement in mathematics. A comparison of females who actively participated in athletics and females who did not actively participate in athletics was made using an independent samples t-test.

The design for this study was the use of a survey, data collection and an independent samples t-test. This study used the sample of forty-one sixth grade females. Each female attended the same middle school and had the same math teacher. Each participant filled out a survey that determined the extent of her athletic participation. Two distinct groups were then made. Each groups' scores on the Terra Nova Assessments and the GPAs were examined and compared using an independent samples t-test.

The analysis of the statistics for both instruments proved no significant difference between the two groups of females. The generated null hypothesis for this study was accepted.

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CHAPTER ONE

Significance of the Study

There has long been the notion of the inferiority of females in the area of mathematics and athletics. Although many steps have been taken and many achievements have been reached, the concept that females are still inferior to males in the area of mathematics still exists. Coincidentally, the same attitude is also apparent in the athletic realm. However, similar to mathematics, females are still viewed as the inferior sex in athletics. Females are becoming more and more involved in both areas of athletics and mathematics due to the passing of Title IX.

Title IX, passed in 1972, has paved the way for more opportunity for females to participate in historically male-dominated areas such as sports and math. "Title IX seeks to level the playing field for both genders by mandating equal opportunities for participation" (Duhamel, Gary, Hart & Homefield, 2003, ¶ 5). Inherently, the participation in female athletics has risen just as the number of women in mathematical related occupations has risen. Title IX has been successful to a degree in "leveling the playing field." However, Title IX has not been completely successful, in that, here in the 21st century, the problems of gender inequity, particularly in mathematics and athletics, are alive and well. The passing of Title IX has women seeing some, but not enough, improvement in gender equity issues.

Gender equity has always been a hotbed of controversy and discussion. The stereotypes of females doing activities such as knitting, sewing, cooking and cleaning, do

still exist in the 21st century. Males are supposed to be the strong, bread-winners. Females are still thought of as weak, even with all the progress made in the past few decades. Certain domains are still male-oriented and female-oriented. Society, although mostly unintentionally, still has a decisive view of what females and males can do and can accomplish.

"Research over the last decade has shown that males and females have different classroom experiences....Achievement expectations for females in some subjects are usually lower" (Hanson &Schwartz, 1992, ¶ 1). One area where the line remains drawn between males and females is mathematics. The subject of mathematics involves thinking about relationships between things in one's surroundings and world. Spatial relationships play an integral part in the area of mathematics. From the beginning of time, males have been more exposed to activities that help foster the concept of spatial relationships. Males are encouraged to grow up building things, using tools, playing sports. All those activities help build a mind that can think in spatial terms. On the other hand, females grow up with activities that aren't as spatially related as the activities that males do growing up. From a very early age, females are at a disadvantage to acquiring the skills needed in mathematics due to the choices of activities they are given as a young child. Females as young children are often presented with activities that do not allow the mind to think in spatial terms, and therefore are at a disadvantage when entering the subject of mathematics.

Athletics deal with spatial relations. To successfully participate actively in athletics, people must be able to visualize the arena in which they are playing. They are able to see where things are in relation to themselves: the ball, the teammates, etc.

Athletics allow those who participate to develop a certain intelligence that permits them to think in terms of space, relationships, logic and order; which are all essential elements of mathematics. Participating in athletics allows a person, male or female, to use certain skills, such as peripheral vision and hand-eye coordination, which are relevant to the skills used in mathematics. Females, in general, are represented less in the area of athletics than males are, and therefore do not have the opportunity to develop certain skills that are helpful in both athletics and mathematics.

Females shy away from mathematics for many reasons. The sex-based stereotypes are still alive and thriving. When filling out a survey for career aspirations and their feelings about sex-stereotypes in certain professional fields, many middle-school females tended to choose sex-stereotyped fields (Pettitt, 1995). Females also have low expectations for themselves in math because they feel that they don't have the ability that they have in the language arts area (Gralinski & Stipek, 1991). Schwartz reported that achievement expectations for females in some subjects, namely math, are usually lower than the expectations for males. Females' low self-esteem in certain subject areas, specifically math, is only one of the keys to reach the goal of "leveling the playing field."

The Feminist Majority Foundation cited that females who participate in sports and fitness programs are more academically successful than females who do not participate in either of those activities. The lessons learned in athletics, an "unconventional classroom", are as important as academic subjects like math and science (Miller, 2002). Athletics develop skills, such as time management, goal-setting, and "pursuing excellence in performance and other achievement-oriented behaviors" (Miller, 2002, ¶ 9). The Institute for Athletics and Education report that high school females who

play sports are three times more likely to graduate, have a GPA 10 percent higher and have higher grades than females who do not play sports. Athletics appear to offer many opportunities to females, one being a high success rate in the classroom.

The inherent difference in females' and males' achievement in mathematics is not apparent from the very first day of school. Females' mathematical achievement in the elementary grades is equal to males' but decreases in the middle school (Schwartz & Hanson). Females' self-esteem, confidence in their abilities, expectations for life, interest in challenging courses and rewarding careers, and pursuits in math and science decline as they get older (American Association of University Women, 1992).

One possible reason for this decline around the middle school years is the transition of elementary school to middle school. Middle school children must contend with intense and rapid changes in physical, emotional, and cognitive development, social approval, a larger student body, choices in sports and/or extracurricular activities. Eccles et al (1993) found that females have lower self-esteem than males in middle school.

Athletic participation may enable females in the middle school to control and shape their lives, to feel empowered in ways other middle school females cannot (Dorrance, 1996). Through participation in sports, females tend to have higher levels of self-confidence, increased self-esteem, and lower levels of anxiety compared to non-athletic females (Duhamel et al, 2003). Those benefits of participation in athletics could lead to an improvement in academic achievement in middle school females.

Achievement in middle school females can be broken down to subject areas and activities. One area of concern is mathematics. Many studies and much research has reported the fact that females, in general, are not achieving as high as males are in math.

The studies show evidence that some of the reasons for inferiority in mathematics are females' confidence in their abilities, females' self-confidence, and females' notion that they are not supposed to excel in math. Females' self-confidence and their self-esteem affect all areas of their lives, even academics. Athletics is one way in which females can build their self-confidence; build their spatial relationship skills and work on their self-esteem. If athletics can help females do all that, maybe athletics can bridge the gap between the two sexes in mathematics, by boosting the achievement of females in math.

Statement of the Problem

Could it be that females in the middle school who participate in organized athletics will achieve better scores and grades in mathematics, as measured by standardized tests (Terra Nova) and grades in math, than females who do not participate in organized athletics?

Purpose of the Study

It is the purpose of this study to determine if females who actively participate and have participated in organized athletics for at least three years will demonstrate an overall better performance and achievement in the subject area of mathematics than females who do not actively participate in organized athletics. Specifically, this study compared the test scores and grade point averages of middle school female athletes as opposed to middle school females who do not participate in athletics. The Terra Novas were used as the primary measure in this study. The grade point averages were used as the redundant measure. The GPAs were used to eliminate testing biases, and to note any trends throughout the study. The study will examine if there is any correlation, for females, between high achievement in mathematics and participation in athletics.

Statement of the Hypothesis

This study will examine two groups of middle school females. The two groups of females are similar except for their participation in athletics. Group I females are those females who have a high participation in organized sports. Group II females are those females who do not participate or have a low participation in organized sports.

The following null hypothesis was developed to investigate the problem discussed:

1) There will be no significant differences in the achievement levels in mathematics of Group I (middle school female athletes) and Group II (middle school female non-athletes) as measured by standardized test scores (Terra Nova) and math grades (grades point averages).

Methods and Procedures

This study included forty-one middle school females (Sixth Grade) in Rohrer Middle School. Twenty of the participants were females who participate in athletics. Twenty-one of the participants were females who do not participate in athletics. For all intensive purposes, the sample was one of convenience, not of random selection.

Design

Each of the participants was given a survey to determine the participation or lack there of in organized sports. The survey (which underwent a reliability test) was based on a rating scale of 0-15. Those who scored a 10 or higher were placed in Group I (those who participate in athletics) and those who scored 0-9 were placed in Group II (those who do not participate in athletics).

The scores each participant received on a standardized test taken were collected. The scores of each group separately were averaged into one mean grade. The grades each student received on their report cards (1st and 2nd term) were also averaged per group. A comparison of their scores was made and assessed. One average was calculated for each group. An independent samples t- test was used to determine the significance, if any at all, of the differences of the two groups' averages as well as individual results.

Limitations

The following are limitations of the study:

1. This research was limited to one team (there are only two teams of sixth graders at the specific middle school; one team's females were used for the survey's reliability and validity testing) of sixth grade females at Rohrer Middle School in Haddon Township, NJ.
2. The researcher was not able to control any extra help any of the subjects received in mathematics.
3. The researcher was unable to control the quality of previous teachers' influence on math grades.
4. The length of the research was not longitudinal; therefore the results may be different if conducted over a longer period of time.
5. Many outside variables were not taken into consideration.

Definition of Terms

1. Spatial- "of space."

2. Spatial reasoning- "the ability to think, form judgments, draw conclusions" about surroundings and manipulatives used in athletics and mathematics.

3. Athletics- "sports, games, exercises requiring physical strength, skill, stamina, and speed."

4. Mathematics- "the study of quantities, magnitudes, and forms, and their relationships"; study of spatial reasoning and manipulations of numbers, areas and tangible manipulatives.

5. "Participation in organized athletics"- For the purpose of this study, participation in athletics can be defined as actively playing in an organized sports program for at least three years.

6. Athletes- For the purpose of the study, an athlete is defined as any female who has actively participated in an organized athletic program for three or more years, as determined by the results of the survey distributed.

Organization of the Study

Chapter I is an overview of the entire study. The problem, hypothesis, significance of the study are stated. The methods and procedures conducted are presented. The limitations are examined, as well as the definition of terms and the overall organization of the study.

Chapter II presents a review of pertinent literature. The literature review includes an introduction to the study and an overview of articles related to females' achievement and problems in mathematics and athletics.

Chapter III describes the study in greater detail. Components such as the sample, population, setting, selection and development of instrument used, and description of

design are looked at in great depth in this chapter. Reliability and validity of the research is also included.

Chapter IV presents the data and analyses of the statistics. The rejection or acceptance of the hypothesis is investigated in this chapter.

Chapter V is a summary of the findings. Certain conclusions are drawn based on the content of the previous chapters, as well as recommendations for further study.

CHAPTER TWO

Literature Review

Females have constantly struggled for decades to find a place in a world that has been consistently male-dominated. Although much improvement has taken place in women's equality, certain areas are still thought of as a "man's world." Areas such as mathematics and athletics are areas where women still come in second place. Certain laws and achievements have paved the way for future females to obtain a place in the areas of math and athletics, however much more needs to be done.

The passing of Title IX in 1972 aided the movement towards women equality. "Title IX seeks to level the playing field for both genders by mandating equal opportunities for participation" (Duhamel, Gary, Hart & Homefield, 2003, ¶ 5). Title IX was an act put into place to promote the equality of women, not only in athletics, but all areas of society. Before the passing of Title IX, females were forbidden to do many things, such as sports, tech classes, etc.. The passing of Title IX has allowed the world to see more women in positions of power and prestige. One of the goals of Title IX is to demonstrate improvement in gender equity.

Gender inequity still exists in the world today, even in the classroom. Stereotypes are alive and well. "Girls are the majority of our nation's schoolchildren, yet they are second-class educational citizens" (Sadker, 1994, p. 1). In the classroom, females' ideas are often an afterthought. The males dominate most of the teacher's time, be it through acting out or calling out, but the females are the ones whose ideas are often overlooked.

"If the cure for cancer is forming in the minds of one of our daughters, it is less likely to become a reality than if it is forming in the mind of one of our sons" (Sadker, 1994, p. 14).

Although it appears that females are slighted in most classrooms in school, research has shown evidence that mathematics, in particular, is a point of downfall for females. In a study designed to note differences in children's self perceptions, Jacquelynne Eccles (1993) analyzed that males tend to feel more competent in math than females do. The fact that gender inequity exists at all in school is disheartening, but to know that inequity is so rampant in math, where females have long lacked behind the males in achievement and confidence, is an issue that needs to be dealt with head on.

Females appear to move away from mathematics for various reasons. "As girls progress through school, they are less likely to continue their math education, either taking more rudimentary courses or dropping the subject altogether" (Schwartz & Hanson, 1992, ¶ 3). Females, in general, do not aspire for careers in mathematics and therefore do not have the confidence or desire to excel in math. Lisa Pettitt (1995) noted that when filling out a survey about career aspirations, many middle-school females chose sex-stereotyped fields. Stereotypes still exist in the area of mathematics, and when those stereotypes are put on those females, usually unconsciously, it almost becomes a self-fulfilling prophecy. Jennifer Gutbezahl (1995) noted that girls often internalize their teachers' and parents' negative expectations, which become self-fulfilling prophecies (¶ 1).

Females, however, are not always at a disadvantage in mathematics. Girls' mathematic achievement in the elementary grades is equal to boys' but decreases in the

middle school (Schwartz & Hanson, 1992). Females' self-esteem, confidence in their abilities, expectations for life, interest in challenging courses and rewarding careers, and pursuits in math and science decline as they get older (American Association of University Women, 1992). It appears that when females' self-esteems and confidences are being tested, their achievement and drive in math is also being tested. The attitude, desire and successfulness in mathematics is not a lifelong struggle, but rather appears during transitions in life and as females grow and mature.

This movement away from mathematics, for different reasons, seems to happen around the period of the middle school years. The middle school years are often difficult because of a workload increase, more personal responsibility, an expectation of increased autonomy, and the transition of different teachers for different subjects (LeCroy & Daley, 2001). Middle school children also are contending with intense and rapid changes in physical, emotional and cognitive development, as well as social approval, a larger student body, and more choices in extracurricular activities (Duhamel, Gary, Hart & Homefield, 2003). There are many adjustments during the middle school years that give way to struggles within a female physically, emotionally, mentally, and socially.

Along with the transitions and physical, emotional and social changes, self-esteem also becomes a major issue in the middle school years. Harter (1986) discovered that self-esteem is most likely to occur during a transition. People tend to re-evaluate themselves in comparisons with a new or different group of people. Eccles et al (1993) found that females in middle school have lower self-esteem than males in middle school.

The transition to middle school and throughout middle school has serious impacts on a female. Harter (1999) found that females are more negatively affected by failure

than males; females start to experience a conflict between feminine goals and competitive achievement; females are more aware of societal and school structures that favor males than they were in elementary school; females are less satisfied with their body image than males; and females worry about problems of all magnitude constantly. When self-esteem is low, many areas of a female's life suffers. The transition to middles school is a period of unsettlement that has many influences on females.

For all the unsettlement, lowering of self-esteem, challenges, decline in confidence, females need a place to turn to assist them. Females are at a very impressionable and vulnerable age when they are in middle school. All of the pressures and extra responsibility burden females. The tendency of females to worry about conforming to pressure and all the assumptions placed on them puts them at a risk for depression (Harter, 1993). Having outlets for females is extremely important in order that middle school females have the opportunity to grow into a healthy, responsible, well-rounded individual.

One such outlet that holds many advantages for middle school females are athletics. Participation in athletics has numerous benefits for females. Athletics have been shown to reduce tension, stress and depression (Page et al, 1998); three issues middle school females unfortunately face. Females who take part in athletics have a more positive body image than females who do not take part in athletics (Miller, 2002). A report from the Feminist Majority Foundation also indicates that females who are involved in athletics experience higher states of psychological well-being than females who are not involved in athletics. Athletic participation can enable females in the middle school to control and shape their lives, to feel empowered in ways other middle school

girls cannot (Dorrance, 1996). Hart (2002) came to the conclusion that for middle school females, an excellent way to gain confidence and empowerment is through athletic participation. Empowerment for females will allow them to gain the self-esteem they need to succeed in all areas of their life. Middle school females are in need of some route to take to prevent the loss of their esteem, confidence and positive attitude. "For the middle school-aged female athlete, self-esteem, empowerment, and self-confidence are often bolstered through participation in interscholastic competitive sports" (Duhamel, Gary, Hart & Homefield, 2003, ¶ 9).

Middle school is the typical time for introduction to competitive sports for most adolescents. Middle school is the usual time when females and males join athletic programs and teams. Just around the time when females are being pounded with all new transitions, feelings, and changes, athletics are becoming more and more of an opportunity to them. Membership on an athletic team is one avenue to acquire, assess, refine and demonstrate skills developmentally appropriate for middle school students (Horn, 1985).

Some general skills that athletics present to females are cooperation, abiding by rules, taking turns, valuing rules, sharing, time management and leadership. Athletics can present a model of fair play (Gregg, 1999). These skills can be adopted and applied in all areas of life.

The lessons and skills learned in athletics, an "unconventional classroom," are as important as academic subjects like science and math (Miller, 2002). Concepts such as goal-setting, time management, assertiveness, and "pursuing excellence in performance and other achievement-oriented behaviors" (Miller, 2002, ¶ 9), are all concepts that can

be learned through athletics. Females in athletics are in tune with their needs and interests in all aspects of their life (Roan, 2001). Athletics present many opportunities to develop talents needed throughout life.

One such area where athletics has been known to benefit females is in the classroom. Females in athletics are more likely to stay in school and go to college (Roan, 2001). The Institute for Athletics and Education (2002) reports that high school females who participate in athletics are three times more likely to graduate than the high school females who do not participate in athletics. St. Mary's College in Winona, Minnesota reported, through a campus survey, in 2002 that the GPA of their females who partook in athletics was 10 percent higher than that of their females who did not partake in athletics. Athletics may give females an advantage in the classroom.

Athletics also deals with the idea of spatial relationships and or reasoning. Spatial reasoning deals with skills dealing with shape, measurement, depiction and navigation. Playing athletics employs each one of those skills. To successfully participate in athletics, one must be able to "see" their surroundings. Peripheral vision, "seeing the field/court" is a huge component of athletics. "Seeing the field" deals with measurement, judging how far and where other players and the ball are from you, the goal, the sidelines, etc.. Navigation is embedded throughout athletics. Knowing where and which way to go to fool a defender, get past a defender or score all entails the concept of navigation. Shape helps players see the playing arena in 3-dimensional terms. Spatial reasoning is seen throughout the world of athletics.

Spatial reasoning, an element of athletics, is also a main component of mathematics. Spatial skills, which help people figure out maps, interpret technical

drawings, use representation, draw diagrams, and use symbolization, are integral parts of a mathematical curriculum. Mathematics is the study of relationships: the relationships of shapes in a 3-dimensional world, the relationships of measurement in terms of length, area and volume. Mathematics explores the growth in navigation and space: envisioning small-scales drawings to actual size. Being that athletics reinforce spatial skills, maybe athletics can help reinforce the spatial skills needed and required in mathematics.

The National Council of Teachers of Mathematics set certain standards in the subject of mathematics. A good deal of the standards set forth involves the concept of spatial skills and reasoning. The standards for algebra involve patterns, relations, representation and models. The standards for geometry entail 2 and 3-dimensional models, coordinates, relationships between locations and visualization. "Instructional programs from pre-kindergarten through grade 12 should enable all students to: use visualization, spatial reasoning, and geometric modeling to solve problems" (NCTM, 2003, ¶ 2). Obviously, spatial relationships are found throughout the subject and study of mathematics.

The research has tried to prove two things: 1. Females, starting at the middle school years, start to shy away from mathematics and in turn start to do worse in math than before, and 2. Athletics has many benefits for females, including high academic achievement. Mathematics is a very important subject and is used in the world each and every day. Math surrounds almost every aspect of the world. It is practically essential that all students excel and achieve in math because they will be faced with it every day. Unfortunately, females, even though gains have been made, are still inferior in the mathematical realm. Around the time of middle school, females tend to become less and

less interested in math and coincidentally start to drop lower and lower in achievement in math. Something needs to be done to prevent this. Athletics have proven to be beneficial in many areas for females. Whether athletics help with self-esteem, confidence, time management, spatial skills, etc., they do help in the academic area of females' lives. Maybe it just might happen that athletics do have a correlation with achievement in mathematics in females.

CHAPTER THREE

Design of Study

The main purpose of this study was to determine if females in the sixth grade who participate in athletics have higher achievement in mathematics than females in the sixth grade who do not participate in athletics. A comparison was made between the two groups based on standardized test scores (Terra Novas) taken in March 2003 and the current percentage grade in mathematics. The comparison of the two groups will help determine whether athletics is a factor for higher achievement in mathematics for sixth grade female students.

In order to determine the degree of athletic participation a survey was distributed to sixth grade females. The results of the survey helped determine the level of athletic participation of each individual. From analysis of the ratings of the surveys, two distinct groups were formed: Group I consisted of those students with a high level of athletic participation; Group II consisted of those students with a low level of athletic participation.

Two academic measures were also employed. Individual scores on the Terra Nova Assessments were compiled to form a group score. The second academic measure employed was the mathematics grade assigned by the teacher. The first academic measure (Terra Novas) was used as the major instrument used in the study. The second academic measure was used as a redundant academic measure to ensure the absence of bias, as well as a reinforcement measure to check the validity of the Terra Nova results.

Setting

The William G. Rohrer Middle School in Haddon Township, NJ was the school where the subjects were attending. Haddon Township is an ever-growing suburb located in South Jersey. The municipality of Haddon Township and the school community hold a diverse economic population.

Haddon Township has a population of 14, 615 people as of March 2003. It is considered to be a middle to upper-middle socioeconomic community. The township has two distinct section; one section being more affluent than the other. The affluent section has an average income between $25,000-$100,000. The other section has an average income between $10,000-$30,000. The overall average of Haddon Township household incomes is around $65,000. With both sections considered as one township, Haddon Township is rated as a middle to upper-middle socioeconomic class community.

The school district of Haddon Township has a very good reputation, which in ways contributes to the community's reputation as a good place to live with children. The reputation of the school district has given way to a rise in the town's population. Middle class areas show the greatest development.

Concurrently, the rise in the town's population has seen a rise in the schools' population. The school district of Haddon Township has a good reputation as an excellent public school district. The Haddon Township school district consists of five elementary schools, one middle school, and one high school. The William G. Rohrer Middle School was opened in 2003 to help with the overcrowding of the elementary schools. The middle school consists of grades sixth-eighth. Since the opening of the middle school, the students who have chosen to transfer to private schools after elementary school have

decided to remain in the district. The population of all the schools, elementary, middle and high school has risen over the past year. The population of the school district continues to grow.

Description of the Population

The population of this study consisted of forty-one sixth grade females from the William G. Rohrer Middle School. All the females were enrolled in one of the four sections of the same mathematics class.

All subjects participating in this study were chosen because of the similarities of major characteristics including:

1. All subjects had the same mathematics teacher during the year.
2. All subjects in the study attended one of the elementary schools in the district and had participated in the Everyday Mathematics curriculum.

Description of the Instruments

This study used two different instruments to measure the achievement levels of the sixth grade females. The first instrument used was the standardized test, the Terra Nova Assessments. The next instrument used was the grade point average (GPA) the female earned in mathematics thus far in the year. The GPA was used as a redundant and reinforcement measure to ensure the elimination of biases as well as a reinforcement to back up the Terra Nova results.

The Terra Nova Assessments are a group of tests that measure basic skills in reading, language arts and mathematics. The assessments are given in a multiple-choice and student constructed free-response format. The students took the Terra Novas in March 2003.

The results are reported in a variety of ways for the Terra Nova Assessments. One way is an individual profile report, which indicates a students' proficiency within each subject area tested. Another way the results were reported was through objective performance summaries. The objective performance summaries provide the average scores for the particular school, district and national norm comparison groups for each subject area tested. An evaluation summary report supplies numerical information to help evaluate the overall effectiveness of an educational program. The various results allow students, teachers, parents and administrators to examine each student's proficiency, the school's proficiency, the curriculum's proficiency and the district's proficiency.

The Terra Nova Assessments were administered in the fifth grade. The time for the test is about one hour per subject, which is typically spread out over a week. The results were sent to the parents and the schools about three months after the testing was completed.

For this individual study, only the mathematics results were examined. The math scores on the Terra Nova Assessments are scored out of a possible 12 points.

The redundant measure, GPA, was used to establish and restate the results of the Terra Nova results for the study. The GPAs of the subjects were used as a secondary measure to support and validate the Terra Nova results. The other instrument used was the GPA the student had received at the point the study was being done. The grade the female earned was based on many different assessment tools. Tests, quizzes, reports, homework and observations were all tools used to determine a student's percentage

grade. The percentage grade used for this study was the mid-year grade. The GPA is based on a possibility of 100 points.

Relationship of the Instruments to the Null Hypothesis

The major purpose of this study is to determine if sixth grade females who actively participate in athletics achieve higher scores in mathematics than sixth grade females who do not participate in athletics. There were two instruments used in this study, the Terra Nova Assessments math scores and the GPAs. The difference in the achievement levels between the two groups of sixth grade females was measured by the Terra Nova Assessments math scores, as the primary measure, and the grade point averages of the subjects, as the secondary measure.

Procedure

In the month of November, forty-one sixth grade females participated in a survey, which was designed to determine athletic participation. The survey consisted of ten questions, which dealt with involvement in athletics, the number of hours and days spent in athletics. Each answer to each question was given a different rating. The first seven questions were the only questions rated (see Appendix A for a copy of the survey, as well as a copy of the survey with a rating scale). Questions #8, #9 and #10 were used by the researcher to get a general idea of what kind of athletic programs the females were participating in and for possible future studies that might be suggested.

Before distributing the survey to the participating, the researcher distributed the surveys to a similar group of sixth grade females, who were not part of the study, in order to test for reliability of the questionnaire. The group, who were filling out the questionnaire for the purpose of reliability, was given the survey the first week of

October. The surveys were rated by the researcher and recorded. Three weeks later, the same group of students was given the exact same survey and once again the surveys were rated and recorded. The two ratings of the survey were then run through a dependent samples t-test to prove reliability.

After reliability of the survey was established, the survey was given to the subjects, who were forty-one sixth grade females. The results of the survey were used to divide the group into two distinct groups; Group I, which consisted of twenty females, with students with a high level of athletic participation and Group II, which consisted of twenty-one females, with students with a low level of athletic participation. The results of the survey were also used by the researcher for a general sense of who the subjects were.

After the two distinct groups were established, the Terra Nova scores and the GPAs were collected. The anonymity of the subjects was established by supplying each subject with a number. Only the researcher was aware of the students' names at first and then was transferred to number labeling as a way to keep the right subjects in the correct groups.

The mathematics scores from the Terra Nova Assessments for both groups were compared, as well as the GPAs for both groups. These scores were used to determine if any significant differences in academic achievement occurred between the two groups.

Methods of Analyzing Data

Two sets of data for each group were tested using an independent samples t-test. The first set of data compared was the Terra Nova math test scores. The second set of data put through the t-test was the GPAs of the students. For this study, the differences

were considered significant at the .05 level of confidence. The mean scores of Group I and Group II, for both the Terra Nova scores and the GPAs, were determined. The degrees of freedom were also calculated.

The t-values were examined to consider any significance between the two groups in order to reject or accept the null hypothesis.

Summary of the Chapter

This chapter describes the setting, population, and testing instruments used. A total of forty-one sixth grade females enrolled in the William G. Rohrer Middle School were the subjects of this study. The students completed a survey to ascertain the degree of athletic participation. From the results of the surveys, the students were split into two distinct groups (Group I- high level of athletic participation & Group II- low level of athletic participation), had their Terra Nova scores and GPAs collected in order to run the scores through an independent samples t-test, to determine any significant differences in the mathematics achievement between the two groups.

CHAPTER FOUR

Analysis of the Data

Summary

The major purpose of this study was to determine if sixth grade females who participate in athletics attain higher achievement scores, primarily based on Terra Nova scores, than the sixth grade females who do not participate in athletics. The GPAs of all the females involved were also tested as a redundant measure to support and back-up the results from the Terra Nova tests. The GPAs were used as a secondary measure to take note of certain trends. The grade point averages of the females were the average the female had earned so far in the year. GPAs were determined with different criteria such as quizzes, tests, observations, homework, presentations and projects.

The sample for this research was one of convenience and restricted to forty-one sixth grade females. All students were enrolled in sixth grade at the William G. Rohrer Middle School in Haddon Township and were students of the researcher.

Each female filled out a survey, which was tested for reliability using a dependent samples t-test, determining the participation or non-participation in athletics. The subjects were then split into two groups based on their rating of the survey.

The Terra Nova test scores as well as the GPAs of the females were run through an independent samples t-test to determine any significant differences among the scores between the two groups.

Presentation and Statistical Analysis of the Data Related to the Null Hypothesis

The Terra Nova Assessment Series and the GPAs were used to measure the subsequent achievement in mathematics for both groups of subjects. The differences between the groups for both measures were tested using an independent samples t-test.

Table 1 depicts the mean, the degrees of freedom and the t value of the independent t-test for the Terra Nova scores, which ultimately accepts the null hypothesis. Looking at the different values in Table 1, it is apparent that the differences are not that significant. Looking at the mean scores of both groups, a difference of .56 points was calculated, not a huge difference.

Table 1 Statistical Analysis of the Independent t-Test (Terra Nova Scores)

Statistic	Value
# of scores (Group I)	20
# of scores (Group II)	21
Mean score of Group I	7.93
Mean score of Group II	7.37
t-value	0.77
Degrees of freedom	39

Table 2 depicts the statistical analysis for the independent t-test of the two groups' GPAs. The t-value calculated leads to the acceptance of the null hypothesis. Similar to Table 1, looking at all values it was apparent before a statistical analysis was done that there was no real significant difference between the two groups' GPAs. The difference in the mean GPA scores was .75 points, not significant.

Table 2 Statistical Analysis of the Independent t-Test (GPA)

Statistic	Value
# of scores (Group I)	20
# of scores (Group II)	21
Mean score of Group I	92.85
Mean score of Group II	92.10
t-value	0.39
Degrees of Freedom	39

Hypothesis: Acceptance or Rejection

The null hypothesis states that there will be no significant difference between the achievement levels, based primarily on Terra Nova scores and the secondary measure, grade point averages, of Group I, sixth grade females who participate in athletics, and Group II, sixth grade females who do not participate in athletics.

The statistical analyses of the Terra Nova scores and the GPAs demonstrated no significant difference between the two groups. Looking at the t-value for the independent samples t-test for the Terra Nova scores (Table 1), it is apparent that there was no significant difference between the two groups. The distribution line of t at the .05 significance level with a degree of freedom of 39 is between –2.012 and 2.012. The t-value of 0.39 falls in between the distribution and therefore leads to the acceptance of the null hypothesis. Looking at Table 2, the distribution of t also falls between –2.012 and 2.012. The t-value for the independent samples t-test for GPA, 0.94, lies between –2.012

and 2.012. The t-value allows for the acceptance of the null hypothesis in terms of the GPAs.

According to both the independent samples t-tests performed, at the .05 level of significance, there were no apparent differences between the achievement levels of the two groups. Therefore, the null hypothesis was accepted. Based on the statistical analyses, there are no significant differences in mathematical achievement between Group I and Group II.

CHAPTER FIVE

Conclusions and Recommendations

Summary of the Problem and Hypothesis

This study was performed to determine if sixth grade females who participate in athletics would have higher achievement in mathematics than sixth grade females who do not participate in athletics. Specifically, this study attempted to determine if sixth grade females who were involved in athletics achieved higher scores on the Terra Nova Assessment Series and higher grade point averages.

The following two groups of sixth grade females were examined throughout this study:

Group I females were those females whose surveys when rated fell between 10-15 on a 0-15 scale (10-15 = participation in athletics).

Group II females were the females whose surveys when rated fell between 0-9 on a 0-15 scale (0-9 = little or no participation in athletics).

The null hypothesis formulated for this particular study stated:

There will be no significant differences in the achievement levels in mathematics, based on Terra Nova scores, between Group I (females who participate in athletics) and Group II (females who do not participate in athletics). GPA scores were also compared as a redundant measure to reinforce the results of the Terra Novas, as well as a measure to note any trends and or differences. Both measures were compared through statistical analyses of an independent samples t-test.

Summary of the Method of Investigation

First the problem to be investigated was determined and put into words. Limitations, definitions of terms to be used, settings, populations, and sample sizes were determined. A review of literature pertinent to the study was performed. One specific hypothesis was formulated. The forty-one subjects involved in the study were taken from the sixth grade class at William G. Rohrer Middle School in Haddon Township, NJ. For this particular survey, only females participated.

A survey was distributed to each of the participants at the beginning of the study to determine the extent of athletic participation, and then place them in the according group. After the groups were in place, the Terra Nova scores from the previous year and the grade point averages thus far that year were looked at and recorded. After collection and recording of the instruments used to measure achievement, two independent samples t-tests were performed. One t-test compared the scores of the Terra Nova scores. The other t-test compared the grade point averages of the groups. The GPAs were based on quizzes, tests, projects, participation and observations made by the teacher.

For this study, differences were considered significant at the .05 level of confidence. The scores of Group I and Group II were compared for both instruments. The data was analyzed based on the results of the two independent samples t-tests.

The statistical analysis of the scores of the Terra Novas showed no significant differences between the two groups. The statistical analysis of the grade point averages of the two groups reinforced the results of the primary measure and also showed no significant differences between the two groups. Based on these analyses, the null hypothesis was accepted because the value of t (0.77 for the Terra Novas; 0.39 for the

grade point averages) fell in between the distribution line of –2.021 and 2.021. There were no significant differences between Group I and Group II. The analyses did not allow for the rejection of the null hypothesis, however some important considerations and points can be learned from this study.

Noted Trends in this Study

The statistical analysis of this study allowed for the acceptance of the null hypothesis, noting no significant differences. Due to the size and convenience of the sample, this study should not be construed as representational of all sixth grade females. This study cannot provide a generalization for females who do or do not participate in athletics.

What this study can do is be a stepping-stone for future studies. Through this study, certain trends were noted. Although no huge difference was seen between the two groups, when looking at the mean scores of both groups for both instruments Group I (the female athletes) had higher averages in the Terra Nova scores and the grade point averages. Although the differences in the mean scores weren't substantial, any slight difference might be of some help in future studies.

Another difference noted, but not analyzed, was the scores on the sub-tests of the Terra Nova Assessment Series. The Terra Nova math sections are divided into sub-tests. The particular sub-test of interest to this study was the "Spatial Reasoning" component. Although the individual sub-tests were not looked at individually, the researcher perused all the different components of the study and noted a difference between the two groups' scores in the particular sub-test. Group I had higher scores in the particular sub-test than

Group II. This noted trend may aid in narrowing down future studies to pinpoint certain areas of math, instead of the whole arena of mathematics.

Another trend worth investigating is the actual sport those involved in athletics were participating in. Once again, this component was not analyzed, but rather noted as an interesting piece to be looked at further in another study. There were a variety of sports the females of this study participated in as shown by their response to certain survey questions. The sports ranged from individual sports, such as swimming and tennis, to team sports such as soccer and basketball. The females who participated in more team-oriented sports, where the individual has to be aware of the space around them in regards to the field or court, the goal or basket, one's teammates and one's opponents, scored higher in both the Terra Novas as well as the grade point averages. This observation might suggest that different sports may lead to better spatial reasoning.

The trends noted in this study were not looked at intensely and therefore were not represented exclusively in the statistical analyses of the study, and not represented in the acceptance of the null hypothesis. What these noted trends do suggest, however, is the need for further research and investigation into a similar topic of this study.

Recommendations for Future Studies

The acceptance of the null hypothesis might lead to the notion that there is no correlation between athletics and mathematics. Hopefully, the trends that were noted will lend to a different notion and more research and studies will be conducted to delve further into this particular problem.

This study can lead to many other studies. This research can serve as a jump-off point for further scrutiny into any correlation between athletics and mathematics. The

trends noted above could all lead to individual studies that look at the arena of athletics and/or mathematics into more individualized components. The noted trends all suggest looking at a smaller piece of the larger puzzle. The trends and ideas of this particular study can be useful for future studies, which are needed.

A lot more research needs to be conducted to study reasons and solutions why females, even with huge improvements reported, still are less represented in mathematical achievement. Some recommendations for further studies are:

1. Investigate the different components that make up the logico-mathematical intelligence and determine if specific athletics will directly relate and encourage any one of the components involved in the intelligence.
2. Investigate the different athletic realms and their effects on mathematics.
3. Investigate the difference between females' and males' achievement in mathematics and their participation in athletics and note any differences/similarities.
4. Investigate the benefits/disadvantages of athletics and their impact on females and their academic achievement.

These are only a few recommendations that came out of this study. Further studies should not discount this study, but rather use it as a piece that allows for future investigation to hopefully find a significant difference that will help answer the long-standing problem of females' lack of representational achievement in the area of mathematics.

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APPENDIX

A

Athletic Participation Survey

Athletic Participation Survey

Please answer each question to the best of your ability. Circle the answer that best describes you. Please write your name on the bottom of the survey.

1) Are you involved in any athletic programs?
   Yes No
2) Which seasons do you participate in athletics? Circle all that apply.
   Fall Winter Spring Summer
3) What best describes your participation in athletics?
   A player A manager A helper to the coach
4) Do you play athletics in an organized athletic program (in other words, there are practices, games, etc. ran by a coach)?
   Yes No
5) How many years have you been participating in any organized athletic participation?
   3+ 1-2 less than 1 (including never)
6) How many days a week do you devote to your athletic programs?
   None 1-3 days 4-7 days
7) How many hours a day do you devote to your athletic programs?
   None 1-2 hours 3+ hours
8) Are your athletic programs team-oriented or individual based?
   Team-Oriented Individual
9) Do you play one sport all year-round?
   Yes No
10) Write all the sports you play.

Name_____

Athletic Participation Survey

Rating Scale (# of points in parentheses next to each answer)

Please answer each question to the best of your ability. Circle the answer that best describes you. Please write your name on the bottom of the survey.

1) Are you involved in any athletic programs?
   Yes (2) No
2) Which seasons do you participate in athletics? Circle all that apply.
   Fall (1) Winter (1) Spring (1) Summer (1)
3) What best describes your participation in athletics?
   A player (1) A manager (0) A helper to the coach (0)
4) Do you play athletics in an organized athletic program (in other words, there are practices, games, etc. ran by a coach)?
   Yes (2) No (0)
5) How many years have you been participating in any organized athletic participation?
   3+ (2) 1-2 (0) less than 1 (including never) (0)
6) How many days a week do you devote to your athletic programs?
   None(0) 1-3 days (1) 4-7 days (2)
7) How many hours a day do you devote to your athletic programs?
   None (0) 1-2 hours (1) 3+ hours (2)
8) Are your athletic programs team-oriented or individual based?
   Team-Oriented Individual
9) Do you play one sport all year-round?
   Yes No
10) Write all the sports you play.

Name_____

APPENDIX

B

IRB Application

INSTITUTIONAL REVIEW BOARD
APPLICATION FOR REVIEW OF RESEARCH

1. Type of approval review requested (check one): Full Review__X____ Expedited Review _____ Review Exemption_____

2. PRINCIPAL INVESTIGATOR: **Genevieve M. Bieg**

3. DEPARTMENT: **Elementary Education**

TITLE OF RESEARCH: **A Study of the Impact of Athletic Involvement on the Achievement of Middle School Females in the Area of Mathematics**

CO-INVESTIGATORS:

PURPOSE OF RESEARCH (INDEPENDENT PROJECT, MASTER'S THESIS, ETC.):**Master's Thesis**

4. IF YOU ARE A STUDENT RESEARCHER PLEASE PROVIDE THE FOLLOWING:

MAILING ADDRESS: **812 Mt. Vernon Ave., Haddonfield, NJ 08033**

EMAIL: **GenBieg@aol.com**
TELEPHONE NO. **(856)795-4126**

FACULTY
SPONSOR NAME: **Dr. Louis Molinari**

DEPARTMENT OF SPONSORING FACULTY: **Elementary Education**

PHONE NO. **(856)256-4739**
EMAIL: **molinari@rowan.edu**

FACULTY
SIGNATURE: Louis Molinari.

DATE: 12/01/03

5. HAS THIS RESEARCH PROJECT BEEN CONSIDERED PREVIOUSLY BY THE IRB? YES ___ NO ___x___

IF YES, GIVE DATE OF LAST REVIEW: _____

6. SOURCE OF FUNDING (IF APPLICABLE):

_____ SBR GRANT

_____ UNIVERSITY GRANTS (INCLUDING FOUNDATION)

_____ CAREER DEVELOPMENT GRANT