

SCHOLASTIC CHESS CLUB PARTICIPATION AND THE
ACADEMIC ACHIEVEMENT OF HISPANIC FIFTH GRADE
STUDENTS IN SOUTH TEXAS

A Dissertation Presented to the
Faculty of the College of Education
University of Houston

In Partial Fulfillment
of the Requirements for the Degree

Doctor of Education

By

Ninfa V. Garcia

May, 2008

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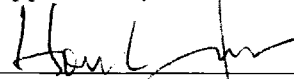
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Approved by Dissertation Committee:




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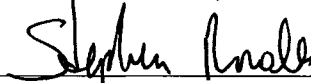
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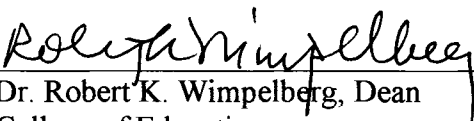
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Abstract

One of the most important components of educational reform is the teaching of higher order thinking skills (Jones, 1980). Smith and Cage (2000) determined that it may be possible that chess instruction can improve spatial ability, improve logical thinking ability, and increase attention to detail among individuals who have not previously been exposed to chess. The purpose of this study was to describe the effect of one academic year of scholastic chess club participation on the mathematics and reading achievement of Hispanic, fifth grade students as measured by the state assessment.

A quasi-experimental pre-test post-test control group design with randomization was used. The subjects were nonexempt fifth grade students during the 2006-2007 academic school year from the Brownsville Independent School District. The Experimental group consisted of twenty-seven chess players. The Control group consisted of twenty-seven non chess players. The Spring 2006 fourth grade mathematics section of the

Texas Assessment of Knowledge and Skills and the Spring 2006 fourth grade reading section of the *Texas Assessment of Knowledge and Skills* served as pre-tests for both groups. The Spring 2007 fifth grade mathematics section of the *Texas Assessment of Knowledge and Skills* and the Spring 2007 fifth grade reading section of the *Texas Assessment of Knowledge and Skills* served as post-tests for both groups. ANCOVA procedures were used to determine the statistical significance of any distinction between the groups. The resultant analysis indicated that there were no statistically significant differences between either the mathematics achievement or reading achievement of the two groups.

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CHAPTER ONE

INTRODUCTION

In both an attempt to develop accountability, as well as to fulfill a key component of the education reform for public schools across the nation (Association of Texas Professional Educators, 2006), public schools have been administering standardized exams to students in both the elementary and secondary school grades. In Texas, campus report cards reflect student scores on standardized tests in the various content areas. This measure of accountability begins with third grade students who are administered the mathematics and reading sections of the *Texas Assessment of Knowledge and Skills* test for the first time. The standardized testing process plays a large part of the students' school experience until high school graduation.

Across the United States, wherever there are large Mexican American populations, Mexican American children do not achieve as well as Anglo-Americans in school. This finding was first reported by Coleman et al. in 1966, who reported that Mexican American children learn less of the school curriculum per grade and complete fewer years of school; this trend has continued to this day. This school achievement gap has been attributed to a variety of factors (Kagan, 1974). The relative failure of Mexican American

children in school has been associated with their lower socioeconomic status, bilingualism (Anderson & Johnson, 1968), lower intelligence (Garth & Johnson, 1934), negative attitudes towards schools (Demos, 1962), and culturally biased testing (Mercer, 1971). The first major national effort to focus attention on high school issues came with the hearings and report of the National Commission on Secondary Education for Hispanics (1984). The 1984 report of this private group of leading scholars, activists, and officials found that 45 percent of Hispanics were dropping out of high school, many not even reaching ninth grade (Orfield, 1986).

The achievement gap in schools is often argued to have lifetime consequences, limiting opportunities for minority students in higher education, employment, and earnings (Carnervale, 1999). Texas demographics show that if the socioeconomic and education gaps between Anglos and non-Anglos do not close by 2040, the state will face a dire economic crisis; if the gaps do close, Texas will be ideally positioned for a global marketplace with a young, multilingual, multi-cultural population providing riches along the line of \$300 billion in aggregate household income (Vine, 2007).

Since its inception in 2002, the federal legislation commonly referred to as the *No Child Left Behind Act* has left school administrators on a quest

to identify resources that might improve student performance. There is considerable diversity in testing policies nationwide. States and school districts around the country vary in the types of tests they use, the grades in which they administer the test, and the seriousness of the sanctions or rewards they attach to test results (Manhattan Institute for Policy Research, 2003). Each public school in Texas is expected to demonstrate yearly progress toward meeting established state standards. Throughout the academic school year, students are monitored by way of benchmark examinations, progress reports, and various other means to determine who will not pass the *Texas Assessment of Knowledge and Skills* test administered in the Spring of every scholastic year. In addition, after-school programs ranging from language acquisition to specific reading objectives to test-taking strategies are all part of the incentives in play for student success on standardized tests.

One of the more novel practices incorporated to raise critical thinking skills and achievement is that of involving students in scholastic chess clubs. Part of the fascination of chess, even for people who cannot understand its intricacies, comes from the light it throws on talent that otherwise might lay hidden. According to Lipking (2003), many proud parents discover that their children, apparently gifted with an innate potential for mastering the game of

chess, progress with startling spurts that leave most grown ups behind. Genius, in chess, is simply a fact of life.

One of the most important components of educational reform is the teaching of higher order thinking skills (Jones, 1980). It is no longer acceptable for instruction inside and out of the classroom to remain at the knowledge level only. Now, it has become increasingly important for teachers to create student-centered lessons designed to challenge students at the levels of synthesis, evaluation, and analysis. According to Storey (2000), by focusing on the teaching of skills such as problem solving and critical thinking, the game of chess has been credited with developing powers of concentration, logical thinking, and analytical thinking skills in learners (Rifner & Feldhusen, 1997).

However, many school districts use standardized tests that are poorly matched to textbooks or to the instructional approach of particular teachers (Good & Brophy, 2000). In addition, Doyle (1983) contended that tasks are critical aspects of academic work. Tasks vary widely in cognitive complexity and in the degree of risk-taking they require of students. Empirical studies suggest that typical tasks assigned to students place only minimal demands for thinking (Good & Brophy, 2000). More recent

research continues to emphasize the importance of the focus on students' meaningful conceptualization (Nutthall, 1997).

Chess is an ancient game currently gaining increased popularity throughout the world and in schools. In an unlikely place at the southern tip of Texas, a place where poverty and language deficiency dominate, chess has emerged within the Brownsville Independent School District (BISD) and is embedded in a story about student success.

Previous studies have attempted to affirm the connection between chess and more sophisticated thought processes in young students, with varying amounts of success. After scholastic chess programs began gaining popularity in the Rio Grande Valley in the early nineties, the stories signifying the educational benefits of chess spread. Educational studies concluded that children of poverty could benefit from chess since they were more entertainment oriented than achievement oriented and tended to be more special in learning style rather than linguistic or mathematical (Vine, 2007). In 1988, Russell Elementary School started the first scholastic chess club in the Brownsville Independent School District, and by 1999 the team had won seven state championships. Rachel Ayala, the principal at Emaline B. Russell Elementary, in Brownsville is credited as the first administrator to tap into the area's chess potential, providing the first games and funds for

the school district's program. Mrs. Ayala rallied not only the allocations, but parental and school board support for students to participate in chess. Jose Juan "J.J." Guajardo, a teacher at Russell Elementary during the late eighties, was asked by Mrs. Ayala to meet every school morning at seven o'clock with a handful of boys who had taken it upon themselves to smash a teacher's square-dancing albums. Guajardo met with them every morning and taught them to play chess. Guajardo was not an expert in chess, but he taught the boys the fundamentals. Some of Guajardo's chess students did not speak English, some had learning disabilities, but all of them were passing their standardized tests and feeling focused and smart. In the Spring of 1993, Russell Elementary caught everyone off guard and won its first state championship. The school won again in 1994 and 1995. For seven years in a row, from 1993 to 1999, Russell Elementary won the Texas Scholastic Chess Championship.

According to Rachel Ayala, during that time in Brownsville unemployment was high, the mayor and several city officials had been indicted, and the drug war in Mexico was spilling over into the streets of Brownsville. Ayala believes chess was embraced by the community because the community saw a great future for the children (R. Ayala, personal communication, October 16, 2007). The students became local celebrities.

Enthusiasm for the game of chess caught on throughout the South Texas school district and many other schools in the district have since formed scholastic chess clubs. By the late nineties Brownsville was holding regional chess tournaments. In the beginning, participants numbered a hundred or so, but over the years the number swelled to three hundred, then one thousand and more. In the Spring of 1999, Morningside Elementary became the first Brownsville school to enter a national tournament and to place second behind the prestigious Hunter College Campus school, from New York City. The 2006-2007 chess budget for Brownsville Independent School District was \$399,000.00. A stipend of \$5,000.00 per school was offered to help pay for chess coaches travel and tournament costs. In 2003, Brownsville students represented more than one-third of the 1,800 players in the state competition as noted by the Paper of South Texas (2006). Since the Brownsville Independent School District adopted the chess program in the 2002-2003 school year, at least one Brownsville school each year has dipped into that funding to attend a national tournament, resulting in at least one of the district's schools being ranked in the top ten annually.

Brownsville is located directly on the Mexican border and contends with problems such as illegal immigration and low levels of education as well as poverty. Since chess is a game otherwise associated with the wealthy

and limited to the refined and highly educated, the unlikely phenomenon of success among Brownsville's students in chess has not gone unnoticed. Clemente Rendon, a former high school chess champion from Brownsville, persuaded the University of Texas at Brownsville and Texas Southmost College to create a chess team, whose scholarships soon began drawing students from across the globe (Vine, 2007). The University of Texas at Brownsville and Texas Southmost College, in support of chess and public school students, has created its own chess team to entice young players toward a college education. Currently, the Brownsville Independent School District has two nine year olds, Fernando Spada and Fernando Mendez, who are respectively ranked number three and number two in the nation. Both of these students have received full scholarships to a local college (The Paper of South Texas, 2006). Two world-class chess players from Brownsville have been battling each other since kindergarten. Both students have won state and national championships, both ranked in the top five in the country and both Fernandos are in the fifth grade.

Need for the Study

Included in some educational strategies is one of the more novel practices incorporated to raise critical thinking skills and achievement. The ancient game of chess is played all over the world. In some countries, for instance Canada, chess is part of the school curriculum (Ferguson, 1983). The Brownsville Independent School District, under the Office of Advanced Academics, is promoting scholastic chess clubs in the hope that they will contribute to student success. Chess has become increasingly important locally as chess players from Brownsville have not only competed on the international level but also have won international recognition. Dr. Juliet Garcia, President of the University of Texas at Brownsville and Texas Southmost College, states that the success of the Hispanic community in chess is a reason for an optimistic, academic future (Hastings, 2006). Therefore, information regarding the extent to which scholastic chess club participation increases academic performance is needed for the South Texas school community which is composed primarily of Hispanics.

According to the President's Advisory Commission on Educational Excellence for Hispanic Americans (2002), the reality is that, to eliminate educational obstacles, we must learn more about what works for a diverse Hispanic community. Van Zyl (1991) conducted a study demonstrating that

chess instruction significantly improved the mathematics achievement of elementary and middle school students. However, the Van Zyl study conducted did not include Hispanic participants. Therefore, the nexus between students in a Hispanic community, who participate in scholastic chess clubs and their academic achievement, is worth exploring.

Studies on the benefits of chess have been conducted since the early 1970s; research has examined self-esteem, memory, and concentration (Ferguson, 1983). Smith and Cage (2000) determined that it may be possible that chess instruction can improve spatial ability, improve logical thinking ability, and increase attention to detail among individuals who have not previously been exposed to chess. In turn, these improved abilities may aid students in improving academic achievement. Few studies, however, have described the effect of participation in a scholastic chess club on the standardized mathematics and reading achievement of fifth grade elementary school students in a predominantly Hispanic community. Furthermore, these studies regarding chess and achievement are not current; this aspect is of importance because publications, websites, and competitions specifically designed for chess in schools have been developed within the last ten years. One of the latest empirical study regarding chess and student achievement conducted in Texas was in 1997 on the *Texas Assessment of Academic Skills*

achievement tests (McDonald, 2001). The study was done on a small scale and lacked generalizability. South Texas schools are promoting and funding scholastic chess clubs more than ever before. This study will assist school districts in South Texas in determining if participation in scholastic chess clubs increases student achievement for Hispanics.

Statement of the Problem

Elementary and secondary schools in South Texas are successfully competing in national and international chess tournaments. Yet, the primary purpose of learning institutions is to help students reach their academic goals. Since the foundation of all academic skills begins in the lower grade levels, additional studies must be conducted to learn what beneficial effect can be derived from playing chess. It has been demonstrated that chess is a game that promotes critical thinking, problem solving, and concentration (Ferguson, 1983). No studies have found significant differences in academic achievement for chess-playing elementary school students from South Texas.

Due to the *No Child Left Behind Act*, educators in Texas and across the country are responding to raised learning standards for students articulated through curriculum framework such as the *Texas Essential*

Knowledge and Skills. Schools and students are held accountable to these learning objectives largely through performance on the state accountability exam, in Texas referred to as *Texas Assessment of Knowledge and Skills*. Educators are focused on implementing programs that raise the achievement level of their students, particularly minority and socioeconomic disadvantaged children. Research demonstrates that schools and districts that do not allocate scarce resources based upon instructional design that align to the state curriculum impair their students' learning as measured by performance on the state assessment (Bryk, Newmann, Smith, & Allensworth, 2001). In conclusion, in order for any program to be seriously considered for use in schools, it must be able to demonstrate educational significance according to the same measure.

Purpose of the Study

The purpose of this study is to investigate scholastic chess club participation and the mathematics and reading achievement of Hispanic, fifth grade students in South Texas.

Research Questions

Inasmuch as the purpose of the study is to investigate the effect of scholastic chess club participation on the mathematics and reading achievement of Hispanic, fifth grade elementary school students in South Texas, the study addresses the following research questions:

Research Question One: What is the effect of scholastic chess club participation on the mathematics achievement of Hispanic, fifth grade students in South Texas?

Research Question Two: What is the effect of scholastic chess club participation on the reading achievement of Hispanic, fifth grade students in South Texas?

Null Hypotheses

The research questions posed in the previous section of this study are the basis for the following null hypotheses:

Null Hypotheses One: There is no statistically significant difference between the mathematics achievement of Hispanic, fifth grade students who have participated in scholastic chess clubs and the mathematics achievement

of Hispanic, fifth grade students who have not participated in scholastic chess clubs.

Null Hypotheses Two: There is no statistically significant difference between the reading achievement of Hispanic, fifth grade students who have participated in scholastic chess clubs and the reading achievement of Hispanic, fifth grade students who have not participated in scholastic chess clubs.

Non-Directional Research Hypotheses

Given the research evidence cited earlier, the study will test the following non-directional research hypotheses:

Research Hypotheses One: There is a statistically significant difference between the mathematics achievement of Hispanic, fifth grade students who have participated in chess clubs and the mathematics achievement of Hispanic, fifth grade students who have not participated in chess clubs.

Research Hypotheses Two: There is a statically significant difference between the reading achievement of Hispanic, fifth grade students who have participated in chess clubs and the reading achievement of Hispanic, fifth grade students who have not participated in chess clubs.

Definition of Terms

Academic Excellence Indicator System. The term “Academic Excellence Indicator System (AEIS)” is defined as a report describing the academic performance of all public schools and districts in the State of Texas.

Fifth Grade Student. For the purpose of this study the term “fifth grade student” will be defined as a male or female student from the Brownsville Independent School District in the fifth grade for the academic year of 2006-2007.

Hispanic. For the purpose of this study, the term “Hispanic” will encompass a person of Spanish culture or origin (Marchesani, 2007).

Mathematics Achievement. For the purposes of this study, “mathematics achievement” will be defined as an individual score on the numerical calculation and mathematical application section of the Spring 2005-2006 and Spring 2006-2007 *Texas Assessment of Knowledge and Skills*.

Mexican American. For the purpose of this study, the term “Mexican American” will be defined as an American of Mexican descent (Marchesani, 2007). In this study, the term Hispanic is preferred and used throughout.

Reading Achievement. For the purpose of this study, “reading achievement” will be defined as an individual score on the reading section of the Spring 2005-2006 and Spring 2006-2007 *Texas Assessment of Knowledge and Skills*.

Scholastic Chess Club Participation. For the purpose of this study the term “scholastic chess club participation” will be defined as a period of at least one scholastic year in a scholastic chess club for the Brownsville Independent School District elementary level which may meet before school, during lunch, and after school. Scholastic chess club participation is not part of an elective or any part of the regular school curriculum for the purpose of this study. Students participating in scholastic chess club do not use a set curriculum, but are coached in basic chess moves and rules by club sponsors and parents.

South Texas. For the purpose of this study, the term “South Texas” will refer to the City of Brownsville area serviced by the Brownsville Independent School District.

Texas Assessment of Knowledge and Skills. The term “*Texas Assessment of Knowledge and Skills*” is a test administered to all students in public education from third grade to eleventh grade in various disciplines to

assess whether students have received the necessary knowledge and skills in the state based curriculum.

Texas Education Agency. The term “Texas Education Agency” is defined as the governing body in Texas in educational matters of public schools.

Texas Essential Knowledge and Skills. The term “Texas Essential Knowledge and Skills” is defined as the statewide curriculum all educators must teach to students in the state of Texas.

The succeeding chapter describes a review of the literature and empirical studies pertinent to the game of chess and academic achievement. The chapter will describe the reasons and views which support utilizing the game of chess to increase critical thinking skills and academic achievement.

CHAPTER TWO

REVIEW OF THE LITERATURE

The purpose of this study is to describe the effect of scholastic chess club participation on the mathematics and reading achievement of Hispanic, fifth grade elementary school students in the South Texas. There is a limited amount of literature pertaining to the game of chess and its effect on student achievement. Previous studies indicating the effects of chess on scholastic achievement have received little notice, and have been criticized for small sample size, or for scholastic chess clubs being self selected elite groups, or for being too anecdotal (Liptrap, 1998). This chapter presents a review of the literature relevant to this purpose.

Historical Background of Educational Games and Chess

Innovative approaches to learning and teaching are starting to be more widely published (Baldor, Field, & Gurwitz, 2001). The educational value of games is that it provides participants with opportunities to learn from their involvement with the structured experience. Using gaming ensures that all participants are winners in that all have the opportunity for involvement and to engage with experiential learning. The use of gaming can also aid skill development in a relatively risk-free environment, for example, decision-

making, negotiations, problem solving, creativity, and initiative (Allery, 2004).

Historically, chess was a game taught to the children of royalty to help them become future leaders. In many countries, today, chess is part of the school curriculum. Studies regarding the benefits of chess have been conducted in the last two decades. Chess has been credited with enhancing problem-solving abilities, analytical reasoning, concentration, and academic performance in mathematics and reading. Chess has long been considered a way for children to increase their mental prowess, concentration, memory, and analytical skills. To anyone who has known the game it comes as no surprise that these assumptions were actually demonstrated in several studies on how chess can improve the grades of students (Ippolito, 2006).

Chess is an adversarial game where one has to take into account the opponent's intentions and not just focus on one's own plans. It is not unusual for a chess game to take several hours. In that time the two players are alone, fighting each other with their knowledge and will-power. Chess is also a game where just a small mistake can ruin the efforts of the previous long hours. Chess is a game of constant conflicts where each side tries to overwhelm and out hustle the other. Horgan and Morgan concluded in a 1990 study that children who are good chess players score higher on

intelligence tests than their peers who are less accomplished players. Elite children players were more curious, had broader intellectual and cultural interests, and were more accomplished in school than weaker players (Harris, 2004). Therefore, we can infer that intelligence is an important aspect of chess skill in young children. It is possible that other characteristics, such as the amount of time spent playing chess and motivation, have a more direct influence on chess skills (Bilalic, McLeod, & Gobet, 2006).

Dullea determined that "...we have scientific support for what we have known all along – chess makes kids smarter!" (1992, p.12). That principle explains why chess is included as a tool to enhance brain capacity. Research dates back to 1925 when Djakow, Petrowski, and Rudik studied grandmasters to determine the underlying factors of chess talent (Christiaen, 1976). These early researchers determined that high achievement in chess is based on exceptional visual memory, combination power, speed of calculation, and power of concentration (Englehardt & Hauser, 1999).

Previous research suggests that recently chess players have been reaching high performance levels at younger and younger ages, consistent with rising population ability (Howard, 2005). One research school holds that the amount of practice is far more important to expertise than native

talent. Perhaps top players now just get more practice. There are indeed more opportunities to play at the international level and perhaps younger players simply play much more (Gobet, Campitelli, & Waters, 2002). The chess age effect is real, is something new, and is likely due to rising ability. It seems to be due to very talented players coming on to the list early and rising quickly (Howard, 2005). Chess thinking often involves a complex, hierarchical structure of problems and sub-problems, in the capacity of retaining complex structures of data, and for keeping objectives clear and well organized, all which correlate with having a high IQ (Horgan & Morgan, 1990).

While mathematical achievement can be measured with a standardized test, no such method exists for chess. The best determinant of chess skills is competition against rated players. However, Smith (1998) concludes that chess is similar to mathematics in that perceptual patterns develop on the board which require particular solutions. In this way chess problems can be classified according to type and the chess player can rely on experience or deductive thinking to find a solution. It is in recognition of these patterns and methods used to solve previous problems that any hope of transfer of skills lie (Smith, 1998).

Theoretical Framework

According to Ferguson (1983), in Piaget's theory of cognitive development, an important growth period occurs approximately between the ages of eleven and fifteen. In this stage, the child moves beyond physical trial and error and begins hypothesizing and deducing, thus developing more complex logic and judgment. Piaget refers to this as moving from the "concrete" stage to the "formal" operations stage. Piaget contends that the environment of a child can help speed up or slow down cognitive maturation.

Draper (2002) examined constructivism as part of the mathematics reform and literacy. Constructivists do not advocate the transmission model of teaching, but embrace questioning, managing, and cognitive structuring (Eisner, 1985). The game of chess may serve as an application of this theory. This opinion is shared by chess master Jerry Meyers who concludes that chess provides opportunities for abstract thinking, cognitive achievement, and concrete analysis (McDonald, 2001). Constructivists argue that learning results from exploration and discovery (Alesandrini, 1982). Chess players experience a new problem to solve every time a move is made by the opponent and prior knowledge must be applied by each competitor in chess. Therefore, in the game of chess, assessment occurs throughout the process.

According to the tenets of constructivism, formative evaluation is of key importance because the actual process of evaluation is equally as important as the outcome of such evaluation (Alesandrini, 1982).

From a theoretical viewpoint, the game of chess falls into the constructivist curriculum. The constructivist educator encourages hands on, learner centered activities that promote problem-solving abilities, and the game of chess provides a student-centered approach to problem-solving. Chess has also been shown to be effective with at-risk populations because games appeal to the majority of children. Constructivist theory implicates motivation as a necessary prerequisite for learning. From an educational perspective, the term “motivation” can apply to any process that activates and maintains learning behavior (Palmer, 2005). Chess is being used to optimize student motivation. Palmer (2005) describes extrinsic motivation as including factors external to the individual and the task, such as rewards, praise, and attention. For Palmer (2005) intrinsic motivation leads individuals to do something because it is inherently interesting or enjoyable. Chess provides students with both extrinsic and intrinsic motivators. Chess participants enjoy the game and receive attention from coaches, school staff, faculty, and parents. Students participating in chess learn to collaborate for

the sake of the team and school and practice decision making in a meaningful way.

According to Englehardt and Hauser (1999), teaching a child to play chess at an early age engages the neurons in the portion of the brain responsible for Mathematics/Logic; firing neurons in this portion of the brain inhibits their loss in the early adolescent years when the brain begins the process of pruning unused neurons. Eisner (1985) states that student's cognitive processes should be developed and strengthened so that students learn how to learn and strengthen aptitudes associated with making inferences, speculating, problem solving and visualization. Psychologists from the progressive era in American education believed that subjects, such as mathematics, promoted student's ability to reason (Eisner, 1985).

Van Zyl (1991) argued that students who play chess have greater reasoning ability, more intense concentration, greater task perseverance, better sequencing skills, and greater attention spans. Smith (1998) and Van Zyl (1991) each concluded that chess instruction brought about changes in the subject that produce more patience, perseverance, concentration, and creativity; these qualities can then be applied to other academic areas. According to Van Zyl (1991) a chess player's ability to reason is further developed when assessing moods and variations which involve intense

concentration, anticipation, classification, transcending and increased logical thinking ability.

Chronology of Current Literature

Several authors have compiled studies and papers on chess and education indicating that the ancient game of chess is associated with increased academic achievement. McDonald (2001) examined studies from various nations and papers on the benefits of chess on student achievement. Ferguson, (1983) wrote his doctorate dissertation on chess and compiled a list of chess studies. McDonald (2001) and Ferguson (1983) each begin with an examination of a study conducted by Dr. Albert Frank during 1973 and 1974 where an Experimental group of chess playing students, from the ages of sixteen through eighteen, demonstrated significant increases in the areas of numerical and verbal aptitudes compared to the Control group. Frank conducted this study in Zaire, employing 92 students and recommended the introduction of chess programs in secondary schools (Frank & D'Hondt, 1989).

An Experimental study of chess playing fifth graders, conducted in Belgium, during the years 1974 through 1976, used Piaget's tests for cognitive development, and noted significant gains in cognitive development

over the Control group (Ferguson, 1983). Christiaen proposed to vary the learning environment with either chess or no chess in the Belgium study (Ferguson, 1983). The trial group consisted of forty, fifth grade students; the average age of the students was ten. The students were divided randomly into two groups, Experimental and Control, of twenty students in each group. All students were given a battery of tests; the tests were administered to all of the students at the end of the fifth grade and again at the end of the sixth grade. The Experimental group received forty-two one hour chess lessons using a text book. A first analysis of the investigations results compared the trial and Control groups using analysis of variance. The results showed significant differences between the two groups in favor of the chess players (McDonald, 2001).

The government of Venezuela recognized a problem between ethnic groups and achievement among its citizens and began Project Intelligence in 1980 (Gonzales, 1990). The purpose of this project was to improve the thinking abilities of Venezuelan high school students. One of the intervention methods used in the project was the introduction of chess into the nation's schools. Chess was selected on the assumption that playing chess enhances certain intellectual abilities related to abstract thinking, problem solving, and analysis of spatial relationships. It was also assumed

that the abilities acquired through playing the game would eventually be transferred to other cognitive areas (Gonzales, 1990). The pilot project involved 230 children ages seven to nine from varied social economic backgrounds. They were taught chess for two years and were given formative assessment throughout the time period. According to Gonzales (1990), the investigators concluded that the statistically significant improvement observed in some mental capacities of the Experimental group was due to the chess program. However, this program was discontinued after 1984 due to budget cuts.

In 1986, Faneuil Adams, Jr., an executive with Mobil Oil, began teaching chess to children in the lowest income areas of New York City. Students quickly learned to play the game and became very skillful (Chess in the Schools, 1997). Teachers and chess masters provided instruction in the first year. Instruction was enhanced in the second year by the addition of computers and software supplied by International Business Machines (IBM). Teachers reported improved behavior, attitude, and scholastic performance. IBM Corporation funded a study in 1991 to determine the effects of chess instruction in Communities School District 9 in New York City. Students must have taken a Degree of Reading Power Test at the end of the school year and in the prior year. Comparisons were made between chess

participants and Control groups made up of non-participants. After one year, the students participating in the Chess in the Schools Program showed an average gain of 5.37 percentile points against the national average on reading performance (Chess in the Schools, 1997).

Horgan and Morgan (1990) used a sample of 24 elementary school children and 35 junior high and high school students to study chess expertise. The authors correlated student grades and skilled rating for chess and found that elementary players were among the top ranked players and concluded that children could perform a highly complex cognitive task as well as most adults. Horgan (1988) found that while adults progress from a focus on detail to a more global focus, children seem to begin with a more global, intuitive emphasis. She deduced that this may be a more efficient route to expertise as evidenced by the ability by pre-formal operational children to learn chess well enough to compete successfully with adults. She noted that young children can be taught to think clearly and that learning these skills early in life can greatly benefit later intellectual development. (Horgan & Morgan, 1990).

A large scale study in Canada, conducted in 1989 through 1992, examined 437 fifth graders in an Experimental study with the addition of chess to the mathematics curriculum. Chess was included as part of the

mathematics curriculum and increased gains were found in mathematics problem solving and comprehension tests (Ferguson, 1983).

Van Zyl (1991) followed the progress of one hundred sixty South African middle school students, eighty chess and eighty non chess players, for a three year period. Initially, there were no significant differences in the intelligence scores of the two groups. Compared to the pre-test results, the intelligence scores of the chess playing group were significantly higher than the Control group during the post-test. These results while not demonstrating that chess is the causal agent of the improved intelligence scores certainly require further investigation.

In Texas during 1997, the Klein Independent School District compared third grade and fifth grade scores on the Texas Assessment of Academic Skills of students who participated in a school scholastic chess club with scores of students who did not participate in a scholastic chess club. Reading and mathematics scores were higher for chess players than for non chess players (McDonald, 2001).

In 1997, Liptrap (1998) conducted a study to document the effect of participation in a scholastic chess club upon the standardized test scores of elementary students. The study was conducted in four of the elementary schools in a large suburban school district near Houston, Texas. The study

compared the third grade and fifth grade scores on the Texas Assessment of Academic Skills of students who participated in a school scholastic chess club in fourth and/or fifth grade with the scores of students who did not participate in a scholastic chess club. Significant improvement in mathematics and reading scores were found among the regular tracked chess students.

Rifner and Feldhusen (1997) describe chess as the epitome of games that provide opportunities to use critical and analytical thinking skills, creative problem-solving skills, and meta-cognition in a setting that is abstract, complex, competitive, social, and fun. According to the authors, gifted students seem to benefit from chess participation because they require a curriculum that is abstract and complex. Rifner and Feldhusen (1997) designed and implemented a scholastic chess program for the gifted population at the middle school level. The study, conducted during the 1991-1992 school term, sought to determine whether sixth graders who learned general problem-solving skills in one domain could apply them in another domain. Data indicated that inter-domain transfer can be achieved if teaching for transfer is an instructional goal. The students were in their first year of an organized chess program and participation was voluntary.

In order to evaluate the effect chess might have on student's problem-solving skills, the researchers asked randomly selected students to analyze and interpret a Shakespearean sonnet, a measure of problem-solving ability unrelated to chess itself. The task was performed both in the fall before chess instruction began and in the Spring after chess competition was complete. Twenty students, ten gifted, five learning chess and five not; ten average ability students, five taking chess and five not participated in this evaluation. The qualitative analysis revealed six aspects of the students' problem-solving behavior which seemed to differentiate both those students who received chess instruction from those who did not and the gifted from the average-ability students. The result of the study was that the program produced by Rifner and Feldhusen (1997) most benefited the more highly able students and that players with average ability experienced only limited benefits. The analysis indicated that, relative to those students who did not learn chess, the chess players tended to use more than one problem-solving method as they worked on the sonnet.

Smith (1998) conducted a study to investigate the effects of chess instruction on the mathematics achievement of a group of southern, rural, black, secondary students. The instruments used included the mathematics section of the *California Achievement Test* among others. The treatment

group, which received 18 weeks of chess instruction, consisted of 11 females and eight males and the control group was comprised of ten females and ten males. All participants were high school juniors and seniors. While there were no significant differences between the treatment and control group in the pre-test the treatment group scored significantly higher than the control group on post-test measures of mathematics achievement.

In Louisiana, a study to determine the effect of chess instruction on the mathematics achievement of Southern, rural, black secondary students was conducted by Smith and Cage (2000). The question asked in the study was: Would chess instruction improve the mathematics achievement of rural, southern, black high school students? The subjects were 40 students, ages 16 and 17. The class received twelve weeks of chess instruction. Text books for the class included *Chess Rules for Students* by Bain (1994), *Chess Tactics for Students* by Bain (1993), and *Essential Chess Endings Explained Move by Move* by Silman (1992). The lessons taught on a daily basis were taken from *Comprehensive Chess Course (Vols. 1 &2)* by Pelts and Albur (1992). The instructor for the class had been an active chess player for more than twenty years. The methods used in this case could be best described as adhering to the philosophy of the Russian School (Pelts & Albur, 1992). The control group was randomly selected from the general population and

was not enrolled in the chess class as an elective. The instruments used in the study were the mathematics section of the *California Achievement Test* and spatial ability was measured with the Guilford-Zimmerman Test of Spatial Visualization. Smith and Cage (2000) concluded that it may be possible that chess instruction may improve spatial ability, improve logical thinking ability, and increase attention to detail among individuals who have not been previously exposed to chess.

One of the most significant studies for the South Texas area was held during the 2001-2002 school year by Joseph Eberhard, now an eighth grade social studies teacher at William Adams Middle School in Alice, Texas (Vine, 2007). Eberhard studied children and chess for his dissertation at Texas A and M University-Corpus Christi, and noted that 69 percent of children in the region qualified for the free-or-reduced-lunch program. He focused on the way chess instruction for children affected a poverty-stricken area. He found that children in Alice who received chess instruction dramatically increased their test results in the area of non-verbal ability and slightly improved their test results in verbal aptitude. Eberhard also came to believe that children of poverty could benefit from chess since they were more entertainment oriented than achievement oriented and tended to be more spatial in learning style (Vine, 2007).

Summary

Studies conducted over the last two decades have focused on many aspects of the game of chess and on several populations. Populations that have been specifically studied include, but are not limited to, elementary students, at-risk students, the gifted and minority groups. For the last two decades, educational reform has focused on standardized tests as measures of student achievement. According to Hall and Hord (2001), the bottom line in schools is the expectation to have ever-increasing student scores on standardized tests. To improve performance, many policymakers and executives are placing heavy emphasis on evaluating the end results. For schools, this is seen in the wide spread focus on high-stakes testing. Annual testing of students have been mandated, and by the *No Child Left Behind Act* there are negative consequences for schools that do not show adequate increases in test scores. An implicit assumption with this approach to change seems to be that schools will incorporate the necessary changes to make test scores go up. However, little support is being made available to schools to implement changes. School leaders are challenged to find effective practices that promote student achievement. For the purpose of this study, a relationship between chess participation and student achievement was explored.

In South Texas, the chess success of students from the Brownsville Independent School District has not gone unnoticed. Students from both elementary and secondary levels from this largely Hispanic population lay claim to top titles in chess competitions. It may be possible that chess instruction can improve logical thinking ability and increase attention to detail among individuals who have not been previously exposed to chess. In turn, these improved abilities may assist the student in improving mathematics and reading achievement. The only research that has included Hispanics is the Eberhard study that took place in Alice, Texas (Vine, 2007). Therefore, it is of utmost importance to study the effect of chess participation on the mathematics and reading achievement of Hispanic, fifth grade students in South Texas.

The following chapter will provide the research design, a description of the participants and instrumentation, the treatment and the data collection procedures, the data analysis procedures and the limitations for this study.

CHAPTER THREE

METHODOLOGY

The purpose of this study was to investigate scholastic chess club participation and the mathematics and reading achievement of Hispanic, fifth grade students from South Texas. This chapter describes the methodology that was used in the conduct of this study. The chapter is divided into the following subsections: (1) research design; (2) participants; (3) instrumentation; (4) treatment; (5) data collection procedures; (6) data analysis procedures; and (7) limitations.

Research Design

A quasi-experimental pre-test, post-test comparison group design with randomization was used to test the hypotheses in this study. This design was selected because the study attempted to investigate scholastic chess club participation and the mathematics and reading achievement of Hispanic, fifth grade students in South Texas. The research design was also selected 1) because the manipulation of a treatment variable was possible, 2) because a control group was possible, 3) because a post-test could be utilized. The use of a pre-test was possible. Pre-testing was used to establish a baseline for

any gains measured by the post-testing. Post-testing was used to determine the level of student achievement after the time in which the Experimental group had participated in scholastic chess club. The following is the research paradigm that was utilized in this study:

$$\begin{array}{ccc} & \text{O} & \text{X} & \text{O} \\ \hline \text{R} & \text{O} & & \text{O} \end{array}$$

The R in research paradigm stands for randomization. The O in research paradigm stands for observation. The X in research paradigm stands for the Experimental treatment which was encountered by the Experimental group. In this study, the independent variable was participation in a scholastic chess club for Hispanic, fifth grade students for the 2006-2007 academic year. The dependent variables are mathematics achievement as measured by the Spring 2007, *Texas Assessment of Knowledge and Skills* and reading achievement as measured by the Spring 2007, *Texas Assessment of Knowledge and Skills*. A randomization procedure was used to select the comparison group. This procedure is described in a later section of this chapter.

Participants

The participants for this study were drawn from the population of all Hispanic, fifth grade students in the Brownsville Independent School District for the entire 2006-2007 school year. According to the Brownsville Independent School District, the school community is comprised of a 97.9 percent Hispanic population of students and 92 percent of the student population is regarded as economically disadvantaged. According to United States Census of 2000, the population of Brownsville is 156,178 residents. Of that population, 91 percent were reported to be Hispanic. Thirty-six percent of the population of Brownsville is reported to live below the poverty level (United States Census, 2000).

The Experimental group for this study was selected from the five public schools from the Brownsville Independent School District who agreed to participate in this study. According to Stephen Shull, United Interscholastic League Coordinator for the Brownsville Independent School District's Scholastic Chess Program the following elementary schools have the largest scholastic chess clubs: Cromack Elementary, Hudson Elementary, Russell Elementary, and Paredes Elementary (S. Shull, personal communication, November 8, 2007). In addition, Stell Middle School agreed to participate in the study by compiling a list of students in the sixth grade

who had attended several feeder elementary schools the previous year and who had been identified as Hispanic, fifth grade chess players during the 2006-2007 school year. The Experimental group consists of all elementary school students from the accessible Hispanic, fifth grade population of scholastic chess club participants from each of the public schools listed above, all of which agreed to participate in this study.

It is important to note that this study did not compare the achievement of students within the participating public schools. The Texas Education Agency Academic Excellence Indicator System (AEIS, 2008) was used for the sole purpose of providing individual public school demographics. Based on the 2006-2007 Texas Education Agency Academic Excellence Indicator System, Cromack Elementary had a 99.9 percent Hispanic student population, based on enrollment of 790 students. 100 percent of the students enrolled at Cromack Elementary were economically disadvantaged and 63.4 percent of these students were limited English proficient. The Texas Education Agency school rating for Cromack Elementary School for 2006-2007 was “Academically Acceptable.”

Based on the 2006-2007 Texas Education Agency Academic Excellence Indicator System, Hudson Elementary had a 93.1 percent Hispanic student population, based on enrollment of 1,147 students. 77.7

percent of the students enrolled at Hudson Elementary were economically disadvantaged and 48 percent of these students were limited English proficient. The Texas Education Agency school rating for Hudson Elementary School for 2006-2007 was “Recognized.”

Based on the 2006-2007 Texas Education Agency Academic Excellence Indicator System, Russell Elementary had a 97.5 percent Hispanic student population, based on enrollment of 1,001 students. 99.7 percent of the students enrolled at Russell Elementary were economically disadvantaged and 51.5 percent of these students were limited English proficient. The Texas Education Agency school rating for Russell Elementary School for 2006-2007 was “Academically Acceptable.”

Based on the 2006-2007 Texas Education Agency Academic Excellence Indicator System, Paredes Elementary had a 93.8 percent Hispanic student population, based on enrollment of 1,180 students. 74.3 percent of the students enrolled at Paredes Elementary were economically disadvantaged and 44.1 percent of these students were limited English proficient. The Texas Education Agency school rating for Paredes Elementary School for 2006-2007 was “Exemplary.”

Based on the 2006-2007 Texas Education Agency Academic Excellence Indicator System, Stell Middle School had a 97.3 percent

Hispanic student population, based on enrollment of 1,008 students. 99.8 percent of the students enrolled at Stell Middle School were economically disadvantaged and 24.3 percent of these students were limited English proficient. The Texas Education Agency school rating for Stell Middle School for 2006-2007 was "Recognized."

The Control group consists of 27 fifth grade students who did not participate in a scholastic chess club at any time during the 2006-2007 school year. The students in the Control group were randomly selected from a combined list of non chess playing students provided by the participating public schools. The researcher could not determine if students in the Control group had played chess in prior years due to the nature of the data. Participants were selected from the Experimental and Comparison group based on being students who met the state guidelines of having 90 percent attendance to receive credit for two semesters, and those who have taken both the pre-test, the fourth grade mathematics and reading sections of the *Texas Assessment of Knowledge and Skills* and the post-test, the fifth grade mathematics and reading sections of the *Texas Assessment of Knowledge and Skills*. The population included all students who were first time test takers including non-exempt limited English students and non-exempt special education students. Those in the population that only

had either pre-test only or post-test only were not included in either Experimental or Comparison groups. The Comparison group was greater in number than the Experimental group, so a random table of numbers was used to determine which of these participant's were to be used. A total of twenty-seven participants for the Experimental group were available. A table of random numbers was used to select twenty-seven participants from the Comparison group. The ideal groups were comprised of twenty-seven scholastic chess club participating students and twenty-seven non chess playing students from the Comparison group. This is a form of purposeful random sampling of which the purpose is to establish that the sampling procedure is not biased (Gall, Borg, & Gall, 1996). Resource limitations and time constraints restricted the researcher to draw samples from a very small, accessible population.

Administrators from the participating public schools gathered the data for the researcher in order to comply with the Family Educational Rights and Privacy Act. The student permanent records cards were used by the records clerks to access archive *Texas Assessment of Knowledge and Skills* scores for Spring 2006 and Spring 2007.

Instrumentation

The dependent variable, student achievement, was measured by the mathematics and reading sections of the 2006-2007 Spring *Texas Assessment of Knowledge and Skills* tests for the fifth grade. The mathematics section of the 2006-2007 Spring *Texas Assessment of Knowledge and Skills* test has a minimum score of zero while the maximum score is a forty-four. The reading section of the 2006-2007 Spring *Texas Assessment of Knowledge and Skills* test has a range of zero through forty-two items. The instruments used in this study were selected because of their reported high validity and high reliability as established by the Texas Education Agency. The *Texas Assessment of Knowledge and Skills* (TAKS) was administered for the first time in the 2002-2003 school year. The TAKS test is constructed to assess problem solving and higher order thinking skills and is aligned with the State of Texas mandated curriculum, the Texas Essential Knowledge and Skills (TEKS). The state exam is administered to students from the third grade through eleventh grade.

Test reliability indicates the consistency of measurement (Gall, Borg, & Gall, 1996). *Texas Assessment of Knowledge and Skills* test reliabilities are based on internal consistency measures, in particular on the Kuder-Richardson Formula 20 (KR20) for tests involving dichotomously scored

(multiple-choice) items and on the stratified coefficient alpha for *Texas Assessment of Knowledge and Skills* tests involving a combination of dichotomous and polytomous (short-answer and extended response) items. Most internal consistency reliabilities are in the high .80s to low .90s range with reliabilities for *Texas Assessment of Knowledge and Skills* assessments ranging from 0.81 to 0.93 (Texas Education Agency, 2006a).

According to Gall, Borg, and Gall (1996), validity is a process of collecting evidence to support inferences made from the scoring results of an assessment. As per the Texas Education Agency, the *Texas Assessment of Knowledge and Skills* exam test results are used to make inferences about students' knowledge and understanding of the *Texas Essential Knowledge and Skills*. The Texas Education Agency (2006b) states standards-referenced assessments, such as the *Texas Assessment of Knowledge and Skills* test, are based on an extensive definition of the content they assess. Test validity is therefore content based and tied directly to the statewide curriculum. In order to ensure the highest level of content validity, the process of aligning *Texas Assessment of Knowledge and Skills* to the curriculum was carefully approached and included numerous committees of Texas educators. The Texas Education Agency (2006) explains that when *Texas Assessment of Knowledge and Skills* was designed as the standards-referenced assessment

for the *Texas Essential Knowledge and Skills*, advisory committees consisting of educators from school districts across the state were formed for each subject area at each grade level. The Texas Education Agency (2006) goes on to state that teachers, test development specialists, and Texas Education Agency staff members worked together in these committees to develop test objectives, instructional targets, specifications, and test item types.

Treatment

The twenty-seven Hispanic, fifth grade students in the Experimental Group participated in a scholastic chess club for an average of three hours per week during the 2006-2007 academic school year. In addition to the three hours of weekly practice students had the opportunity to participate in district, regional, state, national and international tournaments. According to the Brownsville Independent School District's scholastic chess book, chess players are responsible for the following: good sportsmanship, good behavior, good manners, and improvement in play, opportunities to grow that are provided by sponsors, parents, coaches, and tournament officials. All students involved in a chess program must have passing grades in all of their classes. University Interscholastic League procedures for no pass, no

play are in effect. Coaches for scholastic chess were responsible for teaching students to exhibit appropriate behavior, to play according to the rules, to show appropriate respect to all people involved in the tournament. The office of Advanced Academics, from the Brownsville Independent School District utilized scholastic chess club sign in sheets, attendance records for scholastic chess club tournaments and parental consent forms to code students who participated in scholastic chess clubs and for the purpose of tracking standardized test results for student chess players. Each campus must have attended at least five Brownsville Independent School District tournaments to have qualified for the funds allocated by the Brownsville Independent School District. In addition, elementary teams must have competed at the regional tournament in order to compete at the state tournament, and elementary teams must have qualified at the state tournament in order to compete at the national tournament.

During this period, the students in the Experimental Group practiced playing the game of chess with other scholastic chess club members under the supervision of the scholastic chess club sponsor for each school. It could not be determined if any of the subjects from the Experimental Group received formal chess instruction. Scholastic chess club sponsors serve as facilitators. Student attendance records for chess participation and parent

consent forms from scholastic chess club participation are used to verify that students in the Experimental Group were in attendance for at least 90 percent of scholastic chess club practice time.

Unlike many chess studies, scholastic chess is not an elective or a part of a curriculum framework within the Brownsville Independent School District. To qualify for 1 coach an elementary campus chess team must consist of five to twenty students. When a campus has 21 or more students participating in chess, a second coach may be added. There is a maximum of two coaches allowed per campus. All chess coaches must hold practice a minimum of three hours per week for eight months (Brownsville Independent School District Scholastic Chess Handbook, 2007). In order to determine the fidelity of the treatment and overall perception of the chess program, the researcher conducted personal communications, interviews, and observations with chess coaches and attended various practice sessions. It is important to note that each coach used different criteria for determining which chess participants would partake in tournaments. In addition, the number of hours that students practiced per week varied from school to school because of other activities the students were involved in such as tutorials, Boy Scouts of America, and personal engagements.

The students in the Control Group did not participate in scholastic chess club by choice for the 2006-2007 academic school years as verified by campus administrators. Due to the nature of the data, it could not be determined if students in the Control group had played chess in prior years. Pre-test scores and post-test scores for the students in the Experimental Group and the Control Group were provided by campus administrators. After identification of the chess players, campus administrators randomly selected control group members from each subject area *Texas Assessment of Knowledge and Skills* score sheets.

Data Collection Procedures

Following approval of the Committee for The Protection of Human Subjects from the University of Houston and approval from the Assessment and Evaluation Department of the Brownsville Independent School District, the participants were selected according to the aforementioned procedures. Appendix A provides a letter from the Brownsville Independent School District approving this research study. The scale scores from the 2006 Spring fourth grade mathematics section of the *Texas Assessment of Knowledge and Skills* and the 2007 Spring fifth grade mathematics section of the *Texas Assessment of Knowledge and Skills* were collected from

permanent records cards at the participants' respective school campuses. The scale scores from the 2006 Spring fourth grade reading section of the *Texas Assessment of Knowledge and Skills* and the 2007 Spring fifth grade reading section of the *Texas Assessment of Knowledge and Skills* were collected from permanent records cards at the participants' respective school campuses. The researcher used the Raw Score Conversion Tables, included as Appendix B, for the *Texas Assessment of Knowledge and Skills* to convert scale scores to raw scores. The tests were administered under controlled conditions and scored by the Texas Education Agency.

Data Analysis Procedures

Data for this study were analyzed using the SYSTAT computer program. Analysis of Covariance, ANCOVA, is a statistical method used to compare the Experimental group's post-test mathematics assessment scores with the Comparison group's post-test mathematics scores. The mathematics pre-test scores of both the Experimental group and the Comparison group served as a covariant. Analysis of Covariance, ANCOVA, was a statistical method used to compare the Experimental group's post-test reading assessment scores with the Comparison group's post-test reading scores. The

reading pre-test scores of both the Experimental group and the Comparison group served as a covariant.

The 95 percent confidence level ($p < .05$) was used as the criterion level for determining statistical significance. The results of this study were considered to be educational meaningful if the effect size exceeded one third of a standard deviation ($d > \pm 0.33$).

Limitations

The study presents an analysis comparing a group of Hispanic, fifth grade chess playing students against a group of Hispanic, fifth grade non chess playing students. Instruments used are the mathematics and reading sections of the *Texas Assessment of Knowledge and Skills* test for fourth and fifth grade levels. The following limitations are factors beyond the researcher's control that may have affected the results of this study:

1. **Sample Size.** Due to the size of the sample, results may not be generalizable beyond the specific population from which the sample was drawn.
2. **Lack of Longitudinal Perspective.** In order to minimize the effect of extraneous variables the study was conducted during the course of one

scholastic year. It is beyond the scope of this study to track students for more than the entire elementary year.

3. **Extraneous Variables.** Many possible extraneous variables (*i.e.* motivation, learning styles, and environmental and social factors) could have an effect on the dependent variables. It was not feasible to attempt to measure all factors that contribute to academic achievement. These same students that participate in chess club participate in other activities such as Boy Scouts of America, Ballroom Dancing, and various other University Interscholastic League events. However, every attempt was made to minimize the effect of extraneous variables on the results of this study.
4. **Student Variables.** The researcher could not determine the age, gender, or socioeconomic status of the participants in the Experimental and Control groups. It is possible that students played chess in prior years but did not play in the fifth grade and would therefore be in the non chess playing group. In the event that this occurred it would create a conservative error and would decrease the probability of finding a statistically significant difference.
5. **Chess Sponsor Fidelity.** The criteria for determining attendance at tournaments for the chess club participants varied from school to

school. This in turn, may have affected how students were determined to be labeled chess club participants. This may affect the validity of this study.

6. **Time Allotted for Chess Practice.** Throughout the academic school year, weather conditions, holidays, benchmarks, and personal matters all contributed to cancellation of chess club participation. Therefore, the amount of time allotted for chess practice, which was three days a week, varied from school to school.

Summary

The purpose of this study was to investigate the effect of scholastic chess club participation on the mathematics and reading achievement of Hispanic, fifth grade students. Given this purpose, the study addressed the following research questions:

Research Question One: What is the effect of scholastic chess club participation on the mathematics achievement of Hispanic, fifth grade students?

Research Question Two: What is the effect of scholastic chess club participation on the reading achievement of Hispanic, fifth grade students?

This chapter also describes the methodology that was used to test the research hypotheses in the study. The research design, participants, treatment, instrumentation, data collection procedures, data analysis procedures, and limitations were also discussed. The research study was based on the methodology presented in this chapter. The succeeding chapter describes the results that were obtained when the hypotheses were tested.

CHAPTER FOUR

RESULTS

The purpose of this study was to describe the effect of chess club participation on the mathematics and reading achievement of Hispanic, fifth grade students. In order to achieve this purpose, the study utilized an Analysis of Covariance to test the non-directional research hypotheses. This chapter describes the results that were obtained when the hypotheses were tested. The results are reported in tabular and narrative form.

Results

The purpose of the study was to address the following research questions:

Research Question One: What is the effect of chess club participation on the mathematics achievement of Hispanic, fifth grade students?

Research Question Two: What is the effect of chess club participation on the reading achievement of Hispanic, fifth grade students?

Therefore, the following non-directional hypotheses were tested:

Research Hypotheses One: There is a statistically significant difference between the mathematics achievement of Hispanic, fifth grade students who have participated in chess clubs and the mathematics achievement of Hispanic, fifth grade students who have not participated in chess clubs.

Research Hypotheses Two: There is a statistically significant difference between the reading achievement of Hispanic, fifth grade students who have participated in chess clubs and the reading achievement of Hispanic, fifth grade students who have not participated in chess clubs.

Results Obtained for Research Question One

To determine the effect of chess club participation on the mathematics achievement of Hispanic, fifth grade students, an Analysis of Covariance was administered. The results from that test are reported on Table 1.

Table 1*Results Obtained from Analysis of Covariance for Mathematics Achievement*

Analysis of Covariance							
Source	Sum of Squares	<i>df</i>	Mean Squares	<i>F</i>	<i>P</i>		
Group	2.91	1	2.91	0.41	0.525		
Pre	945.66	1	945.66	133.38	<0.001		
Error	361.6	51	7.09				

Means								
Group	N	Mean	Pre-test		Post-test		Adjusted Mean	<i>d</i>
			Mean	SD	Mean	SD		
Experimental	27	38.30	4.03		40.70	3.73	37.30	+0.49
Control	27	29.56	6.61		33.30	6.03	36.70	
Total	54	33.93	6.99		37.00	6.22		

As shown in Table 1, the analysis of covariance yielded an F -ratio of 0.41 that was not statistically significant ($p = 0.525$). The adjusted mean for the Experimental group (37.30) was not statistically significantly higher than that of the Control group (36.70) and the obtained effect size ($d = +0.49$) that was educationally meaningful. Therefore the research hypothesis is rejected. The graph in Figure 1 depicts the 2005-2006 pre-test raw scores and 2006-2007 post-test raw scores for the mathematics section of the *Texas Assessment of Knowledge and Skills* for the Experimental Group of Hispanic, fifth grade chess club participants and the 2005-2006 pre-test raw scores and 2006-2007 post-test raw scores for the mathematics section of the *Texas Assessment of Knowledge and Skills* scores for the Control Group of Hispanic, fifth grade non chess club participants.

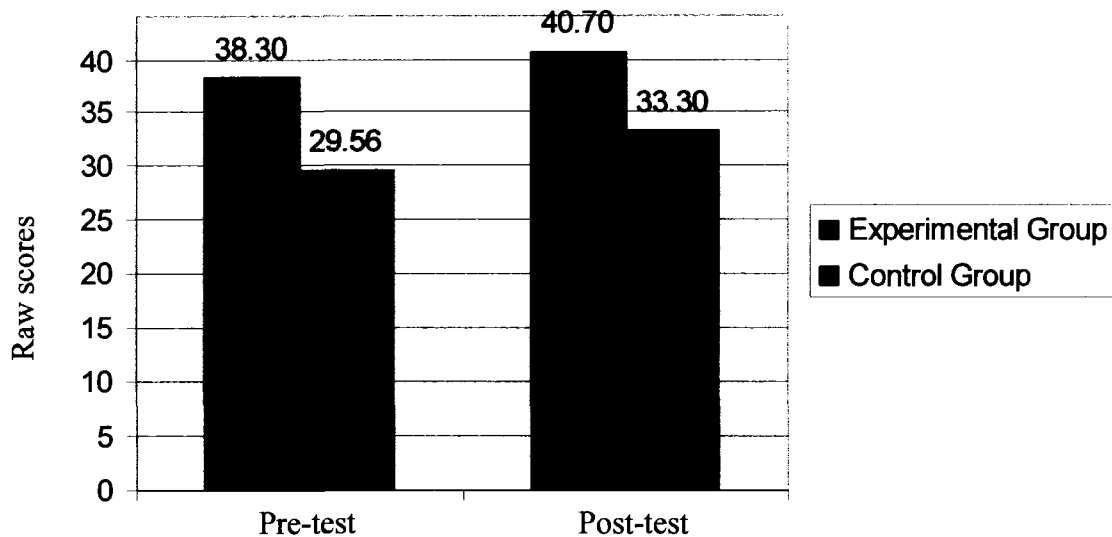


Figure 1. Comparison of pre-test and post-test raw scores for the mathematics section of the *Texas Assessment of Knowledge and Skills*

Results Obtained for Research Question Two

To determine the effect of chess club participation on the reading achievement of Hispanic, fifth grade students, an Analysis of Covariance was administered. The results from that test are reported on Table 2.

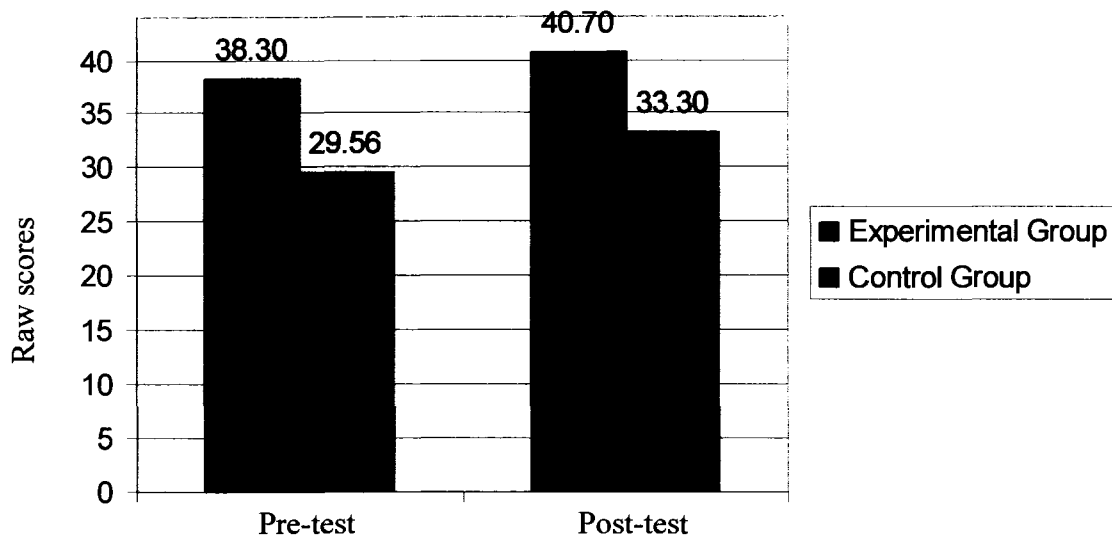


Figure 1. Comparison of pre-test and post-test raw scores for the mathematics section of the *Texas Assessment of Knowledge and Skills*

Results Obtained for Research Question Two

To determine the effect of chess club participation on the reading achievement of Hispanic, fifth grade students, an Analysis of Covariance was administered. The results from that test are reported on Table 2.

Table 2*Results Obtained from Analysis of Covariance for Reading Achievement*

Analysis of Covariance							
Source	Sum of Squares	<i>df</i>	Mean Squares	<i>F</i>	<i>P</i>		
Group	16.12	1	16.12	1.81	0.185		
Pre	301.95	1	301.95	33.82	<0.001		
Error	455.39	51	8.93				

Means								
Group	N	Mean	Pre-test		Post-test		Adjusted Mean	<i>d</i>
			Mean	SD	Mean	SD		
Experimental	27	34.37	3.32		37.78	3.61	35.72	+0.38
Control	27	26.74	5.39		32.22	4.01	34.28	
Total	54	30.56	5.87		35.00	4.71		

As shown in Table 2, the Analysis of Covariance yielded a F -ratio of 1.81 that was not statistically significant ($p = 0.185$). The adjusted mean for the Experimental group (35.72) was not statistically significantly higher than that of the Control group (34.28) and the obtained effect size ($d = +0.38$) that was educationally meaningful. Therefore, the research hypothesis is rejected. The graph in Figure 2 depicts the 2005-2006 pre-test raw scores and 2006-2007 post-test raw scores for the reading section of the *Texas Assessment of Knowledge and Skills* for the Experimental Group of Hispanic, fifth grade chess club participants and the 2005-2006 pre-test raw scores and 2006-2007 post-test raw scores for the reading section of the *Texas Assessment of Knowledge and Skills* scores for the Control Group of Hispanic, fifth grade non chess club participants.

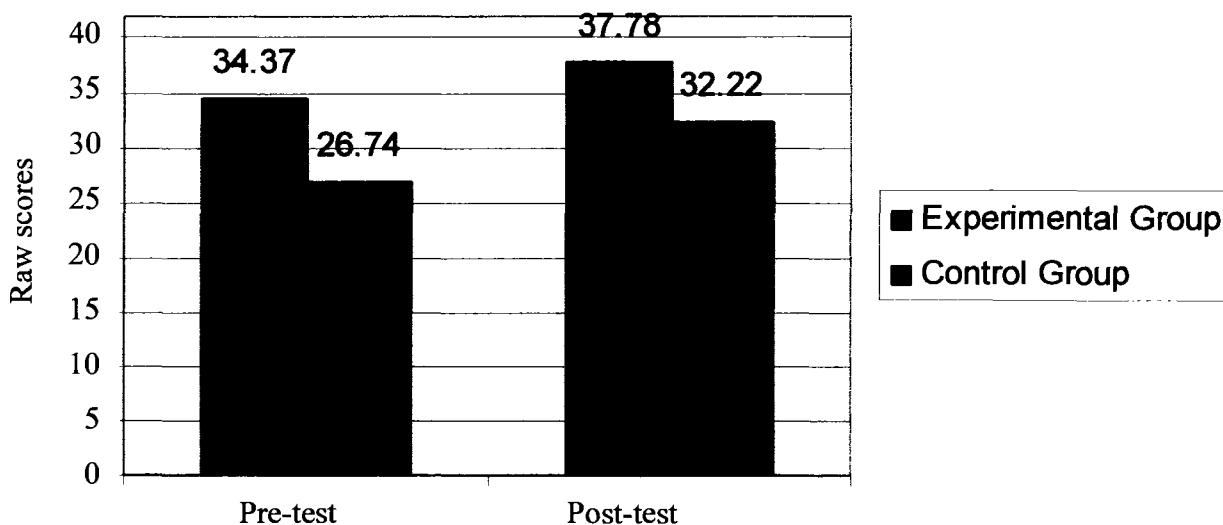


Figure 2. Comparison of pre-test and post-test raw scores for the reading section of the Texas Assessment of Knowledge and Skills

Summary

The purpose of this study was to describe the effect of chess club participation on the mathematics and reading achievement of Hispanic, fifth grade students from the Brownsville Independent School District. This chapter presented the results from the analyses used to test the hypotheses set forth in this study. The next chapter presents the conclusions, interpretations, and implications suggested by the results.

CHAPTER FIVE

CONCLUSIONS, INTERPRETATIONS, AND IMPLICATIONS

The purpose of this study was to describe the effect of chess club participation on the mathematics and reading achievement of Hispanic, fifth grade students from the Brownsville Independent School District. In order to achieve this purpose, two non-directional research hypotheses were tested. The model for this study was based on the assumption that knowledge and skills in one domain could be transferred to other domains by the individual. The previous section provided the results obtained through analyses of the data that were collected to test the hypotheses. This chapter provides a description of the conclusions, interpretations, and implications that derive from the results presented in the previous chapter.

Conclusion Regarding Mathematics Achievement

The following is **research question one** addressed by this study:
What is the effect of chess club participation on the mathematics achievement of Hispanic, fifth grade students?

In addressing research question one, the study tested the following non-directional research hypothesis: There is a statistically significant difference between the mathematics achievement of Hispanic, fifth grade students who have participated in scholastic chess clubs and the mathematics achievement of Hispanic, fifth grade students who have not participated in scholastic chess clubs.

With regard to the mathematics achievement of Hispanic, fifth grade students who participated in scholastic chess clubs the results presented in Table 1 indicate that the adjusted mean obtained for the Experimental group (37.30) is not statistically significantly higher than the adjusted mean obtained for the Control group (36.70). Therefore, the research hypothesis is rejected.

Conclusion Regarding Reading Achievement

The following is research question two addressed by this study: What is the effect of chess club participation on the reading achievement of Hispanic, fifth grade students?

In addressing **research question two**, the study tested the following non-directional research hypothesis: There is a statistically significant difference between the reading achievement of Hispanic, fifth grade students

who have participated in scholastic chess clubs and the reading achievement of Hispanic, fifth grade students who have not participated in scholastic chess clubs.

With regard to the reading achievement of Hispanic, fifth grade students who participated in scholastic chess clubs the results presented in Table 2 indicate that the adjusted mean obtained for the Experimental group (35.17) is not statistically significantly higher than the adjusted mean obtained for the Control group (34.28). Therefore, the research hypothesis is rejected.

Interpretation Regarding Mathematics Achievement

The mathematics achievement of students who have participated in scholastic chess clubs is not statistically significantly higher than the mathematics achievement of students who did not participate in scholastic chess clubs. However, inasmuch as the obtained effect size ($d = +0.49$) was in excess of one-third of a standard deviation, it can be argued that the difference favoring the students who participated in scholastic chess clubs is educationally meaningful.

According to Gall, Borg, and Gall (1996), it is difficult to establish causality on the basis of the collected data when using an analysis

of covariance in a causal comparative study. According to the Texas Education Agency (2008), in order for a student to have met the state standard a score of thirty on the *Texas Assessment of Knowledge and Skills* mathematics section for the 2006-2007 year must be obtained and in order for a student to have met commended performance a score of forty on the *Texas Assessment of Knowledge and Skills* mathematics section for the 2006-2007 year must be obtained. During the 2006-2007 academic year 32 percent of Hispanics in the fifth grade in Texas achieved commended performance and 81 percent met state standards (Texas Education Agency, 2008). However, from the Experimental group of chess players, all Hispanic, included in the study 70 percent achieved commended performance and 96 percent met the state standard for the mathematic section of the *Texas Assessment of Knowledge and Skills* for 2006-2007.

In conclusion it can be argued that Hispanic students who participate in extracurricular activities, such as scholastic chess clubs, score above the state average on the state assessment. These comparisons are certainly intriguing, even if the method by which chess improves academic performance is not fully understood.

Interpretation Regarding Reading Achievement

The reading achievement of students who participated in scholastic chess clubs is not statistically significantly higher than the reading achievement of students who did not participate in scholastic chess clubs. However, inasmuch as the obtained effect size ($d = +0.38$) was in excess of one-third of a standard deviation, it can be argued that the difference favoring the students who participated in scholastic chess clubs is educationally meaningful.

According to Gall, Borg, and Gall (1996), it is difficult to establish causality on the basis of the collected data when using an analysis of covariance in a causal comparative study. According to the Texas Education Agency (2008), in order for a student to have met the state standard a score of twenty nine on the *Texas Assessment of Knowledge and Skills* reading section for the 2006-2007 year must be obtained and in order for a student to have met commended performance a score of forty on the *Texas Assessment of Knowledge and Skills* reading section for the 2006-2007 year must be obtained. During the 2006-2007 academic year 17 percent of Hispanics in the fifth grade in Texas achieved commended performance and 76 percent met state standards (Texas Education Agency, 2008). However, from the Experimental group of chess players, all Hispanic, included in the study 37

percent achieved commended performance and 100 percent met the state standard for the reading section of the *Texas Assessment of Knowledge and Skills* for 2006-2007. In conclusion it can be argued that Hispanic students who participate in extracurricular activities, such as scholastic chess clubs, score above the state average on the state assessment. These comparisons are certainly intriguing, even if the method by which chess improves academic performance is not fully understood.

Implications

Although this study sought to extend the knowledge base regarding scholastic chess club participation for Hispanic, fifth grade students in South Texas, it should be replicated with larger samples from a wider geographical region thus increasing the generalizability of the findings. The results of this study suggest that students who participate in scholastic chess clubs did not obtain higher achievement in mathematics or reading.

However, it is important to note that the mathematics section of the *Texas Assessment of Knowledge and Skills* for the Spring 2007 for fifth grade has a maximum score of 44. The Experimental group of chess players had a mean post-test score of 41, which could have created a ceiling effect as it left very little room for improvement.

In addition, it is important to note that the reading section of the *Texas Assessment of Knowledge and Skills* for the Spring 2007 for fifth grade has a maximum score of 42. The Experimental group of chess players had a mean post-test score of 38 and left room for improvement as evident in the results of this quantitative analysis. While this study yielded mixed results, it has not solved the problem of isolating and testing all the variables that might predict the effect of scholastic chess club participation on the academic achievement of Hispanic fifth grade students in mathematics and reading.

Therefore, additional research including research-based approaches for playing chess and learning, as well as specific methodologies related to the particular needs of the individual learner are needed. The recommendations for further studies regarding chess are the use of a larger sample size, the use of a structured chess curriculum, and the use of subjects from a variety of racial, cultural, and socioeconomic backgrounds in order to determine the impact of chess instruction.

In addition to the reported benefits of chess instruction on academic performance many other assertions have also been made. Van Zyl (1991) argued that students that play chess have greater reasoning ability, more intense concentration, greater task perseverance, better sequencing skills, and greater attention span. Horgan (1987) stated that chess has been used to

help children think clearly and with discipline. While mathematics and reading achievement can be measured with standardized tests; no such method exists for chess. More research is needed using task specific tests.

According to Van Zyl (1991), chess instruction brought about changes in the subjects that produced more patience, perseverance, concentration, and creativity. These qualities should be researched in qualitative studies including, but not limited to attendance, graduation rate and leadership characteristics. The phenomenon that has occurred within the Brownsville Independent School District with regards to student success at international and national levels with respect to the game of chess warrants extensive educational research.

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APPENDIX A

**Letter of approval for research study from
Brownsville Independent School District**



Brownsville Independent School District

708 Palm Blvd. - Suite 210 Brownsville, Texas 78520 (956) 554-2806 Fax: (956) 546-5579

Raul N. Vasquez, Administrator AR&E
Paul C. Johnson, Student Assessment Coordinator
Ben Estrada, Evaluator II
Pam Van Ravenswaay, Evaluator I

September 27, 2006

Ninfa V. García
 400 De León Avenue
 Rancho Viejo, TX 78575

Re: Application for Research

Dear Ms. Garcia:

Please be advised that your application for Research Study has been approved. The research ID number assigned to your request is 2006-008-6.

We are respectfully requesting that you forward your research results and/or a copy of the publication, if any, to our office upon completion of the project.

Good luck with your endeavor and thank you for your interest in the Brownsville Independent School District and its students.

Should you have any questions or require further assistance, please do not hesitate to contact me at 554-2806.

Sincerely,

A handwritten signature in black ink, appearing to read "Raul Vasquez".

Raul Vasquez, Administrator
 Assessment, Research & Evaluation

RV/jlv

APPENDIX B

Conversion tables for TAKS scores

Texas Assessment of Knowledge and Skills
Raw Score Conversion Table
Mathematics - Spring 2006 Administration
Grade 4

<u>Raw Score</u>	<u>Scale Score</u>
0	1281
1	1425
2	1529
3	1592
4	1638
5	1675
6	1706
7	1733
8	1758
9	1780
10	1801
11	1821
12	1839
13	1857
14	1873
15	1890
16	1906
17	1921
18	1937
19	1952
20	1967
21	1981
22	1997
23	2011
24	2026
25	2047
26	2057
27	2073
28	2100 *
29	2106
30	2124
31	2142
32	2161
33	2182
34	2204
35	2229
36	2256
37	2287
38	2324
39	2400 **
40	2433
41	2536
42	2680

* Met Standard level

** Commended Performance level

Texas Assessment of Knowledge and Skills
Raw Score Conversion Table
Mathematics - April 2007 Administration
Grade 5

<u>Raw Score</u>	<u>Scale Score</u>	<u>Quantile Measure</u>
0	1086	EM
1	1258	EM
2	1383	EM
3	1458	EM
4	1513	EM
5	1557	40Q
6	1595	80Q
7	1628	115Q
8	1657	150Q
9	1684	175Q
10	1709	205Q
11	1732	225Q
12	1754	250Q
13	1775	275Q
14	1796	295Q
15	1815	315Q
16	1834	335Q
17	1853	355Q
18	1871	375Q
19	1889	395Q
20	1907	410Q
21	1925	430Q
22	1943	450Q
23	1960	470Q
24	1978	485Q
25	1996	505Q
26	2014	525Q
27	2037	550Q
28	2052	565Q
29	2071	585Q
30	2100 *	615Q
31	2111	630Q
32	2133	650Q
33	2156	675Q
34	2179	700Q
35	2205	725Q
36	2232	755Q
37	2263	790Q
38	2296	825Q
39	2334	865Q
40	2400 **	925Q
41	2436	925Q
42	2512	925Q
43	2637	925Q
44	2808	925Q

Texas Assessment of Knowledge and Skills
Raw Score Conversion Table
Reading - Spring 2006 Administration
Grade 4

<u>Raw Score</u>	<u>Scale Score</u>	<u>Lexile Measure</u>
0	1313	210L
1	1445	210L
2	1543	210L
3	1603	210L
4	1648	210L
5	1685	210L
6	1716	210L
7	1743	210L
8	1768	210L
9	1791	210L
10	1812	210L
11	1832	210L
12	1851	220L
13	1869	245L
14	1887	270L
15	1904	290L
16	1920	315L
17	1937	340L
18	1953	360L
19	1969	385L
20	1984	405L
21	2000	425L
22	2016	450L
23	2039	480L
24	2049	495L
25	2069	520L
26	2082	540L
27	2100 *	565L
28	2118	590L
29	2137	615L
30	2156	645L
31	2177	670L
32	2200	705L
33	2225	740L
34	2252	775L
35	2283	820L
36	2319	870L
37	2400 **	980L
38	2423	980L
39	2521	980L
40	2653	980L

Standard level
needed Performance level

Texas Assessment of Knowledge and Skills
Raw Score Conversion Table
Reading - April 2007 Administration
Grade 5

<u>Raw Score</u>	<u>Scale Score</u>	<u>Lexile Measure</u>
0	1186	320L
1	1343	320L
2	1457	320L
3	1527	320L
4	1578	320L
5	1619	320L
6	1654	320L
7	1684	320L
8	1711	320L
9	1736	320L
10	1759	335L
11	1780	360L
12	1801	385L
13	1820	405L
14	1839	430L
15	1857	450L
16	1874	470L
17	1891	490L
18	1908	510L
19	1924	530L
20	1940	545L
21	1957	565L
22	1973	585L
23	1989	600L
24	2005	620L
25	2025	645L
26	2038	660L
27	2062	685L
28	2073	700L
29	2100 *	730L
30	2110	740L
31	2130	765L
32	2150	790L
33	2173	815L
34	2197	845L
35	2223	875L
36	2253	905L
37	2286	945L
38	2326	990L
39	2400 **	1075L
40	2444	1080L