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The relationship between academic performance and physical fitness: An analysis of academic performance scores and Fitnessgram scores in San Bernardino and Riverside counties

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THE RELATIONSHIP BETWEEN ACADEMIC PERFORMANCE AND PHYSICAL FITNESS: AN ANALYSIS OF ACADEMIC PERFORMANCE SCORES AND FITNESSGRAM SCORES IN SAN BERNARDINO AND RIVERSIDE COUNTIES

A Project

Presented to the

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by

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ABSTRACT

A review of scientific research shows that a physically active lifestyle improves health, enhances neural (brain) function and contributes to an individuals overall well being. Research also indicates that appropriate cognitive learning should incorporate movement concepts and skills, noting bodily kinesthetic intelligence as one of the eight multiple intelligences. The literature review for this project examines the impact of physical activity on brain function, along with the effects of physical activity on the academic learning of children. The focus of this project is an analysis of the relationship between the results of the Academic Performance Index (API) and the Fitnessgram for seventh grade students in California's Riverside and San Bernardino counties. Results of the analysis show a positive relationship between academic scores and fitness scores. Statistical analysis, using the Spearman-Rho correlation, indicates a significant relationship exists between academic scores and fitness scores for the students examined. The results of this study clearly support the notion that a physically active,

healthy lifestyle has a positive effect on student academic performance and elevated test scores.

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CHAPTER ONE

INTRODUCTION

As the push for accountability in public schools intensifies, an insightful tool used in the measurement of student performance is the standardized test. Created by commercial test publishers, standardized tests are designed to provide a common measure of student achievement. Through the standardization of testing, schools are able to measure the skills and abilities of their students in relation to students throughout the state or country. The tests additionally provide schools with a barometer to evaluate programs, instructional methods, and teacher effectiveness.

Critics of standardized testing argue that such tests may not be a true measure of academic performance. They also suggest that the reliance on them may force educators to spend more time preparing students for testing at the expense of other subjects and curricula. It is also likely that a child's scores on a particular test may vary depending on whether the child guesses, receives clear directions, follows the directions carefully, takes the test seriously, is comfortable taking the test, ate breakfast that morning or any one of numerous intangibles.

Although it is true that a paper and pencil test does not always give us a complete picture of a child's strengths or weaknesses, such tests can be combined with other methods to gain insights into the skills, abilities, and knowledge of a child.

In spite of all it's possible imperfections, standardized testing will more than likely remain part of the assessment process in the public and private school setting. Increased accountability through standardized annual reading and math tests in the third through eighth grades is a key element of the education reform law President Bush recently steered through Congress. In response to critics of standardized testing President Bush replied, "If you don't want to measure, it kind of makes me worry that maybe ... you're not confident about either your teacher quality or your curriculum" (Gerstenzang 2002). An extensive national public opinion survey, commissioned by Educational Training Systems, showed conclusively that an overwhelming majority of Americans demand that public schools be held to strict standards of accountability. The public also believed that such accountability can be achieved, at least in part, through the appropriate use of standardized testing (Landgraf, 2002).

California middle schools presently incorporate two forms of standardized testing. Each spring students receive academic testing and physical fitness testing. The academic performance testing is referred to as the Standardized Testing and Reporting (STAR) program. Results of the STAR program are used to evaluate and rank schools through the use of an Academic Performance Index (API) score. Fitness testing is conducted through the use of the Fitnessgram, a nationally norm-referenced series of performance tasks that measure fitness. Results of both the STAR and Fitnessgram testing are accumulated and reported to districts, schools, the governor and the legislature

The emphasis and implementation of standardized testing has coincided with a reduced emphasis on school physical education curricula. School districts and administrators often view physical education classes as taking valuable time away from core academic classes (King, 1999). Evidence suggests there is a relationship between academic performance and fitness (Shephard, 1996). The present study investigates this relationship by using the results of California's standardized testing scores for academic performance and physical fitness.

Statement of Problem

In an effort to enhance academic instruction time, school districts have cut back, and in some cases eliminated physical education programs. This strategy appears to contradict research that supports the theory that a physically active child will perform better academically. Should exemplary academic performance parallel exemplary fitness performance, and conversely, poor academic performance parallel poor fitness performance, it would provide important evidence that physical education programs should be a vital part of a school's core curriculum and that academic learning might well be enhanced by quality physical education programs.

Hypothesis

The analysis of California's standardized academic test scores and fitness test scores will show a relationship between exemplary academic scores and exemplary fitness scores and a positive correlation between academic performance and fitness performance.

Academic Performance Index

The Public Schools Accountability Act of 1999 (PSAA) was signed into California law in April of 1999. The PSAA

authorized the creation of an educational accountability system for California public schools. The primary goals of the legislation were to help schools improve the academic achievement of all students and measure their performance. The main component of the PSAA is the Academic Performance Index (API).

The Academic Performance Index (API) is the cornerstone of the school accountability system. In 1997 Senate Bill 376 authorized the Standardized Testing and Reporting (STAR) program, which replaced a voluntary Pupil Testing Incentive Program. Beginning with the 1997-98 school year, the STAR program required that all California public school students in grades two through eleven take a nationally norm-referenced standardized examination each spring to measure achievement in basic academic skills.

In November 1997, the California State Board of Education designated the Stanford 9 published by Harcourt Educational Measurement as the Standardized Testing and Reporting Program's national norm-referenced achievement test. The STAR Program has two additional components: the California Standards Tests (CST), produced for California public schools; and the Spanish Assessment of Basic

Education, an achievement test in Spanish published by CTB/McGraw-Hill.

These tests were first administered to all California students in spring 1998 and have been administered each spring since. The Stanford 9 is a national norm-referenced achievement test, and the test questions and scoring are the same from year-to-year. This enables schools to monitor progress and compare results from previous years.

All students, including English learners and students in special education programs, must take the Stanford 9 and the CST. The Stanford 9 and CST can assist administrators in determining how well California students are achieving academically compared to a national sample of students tested in the same grade at the same time of the school year. Only students whose individualized education programs (IEPs) or 504 plans (for children with specific needs) that explicitly exempt them from the STAR testing requirements are tested with alternative assessments.

Students in grades 2 - 11 are tested in reading, language (written expression) and mathematics. Students in grades 2 - 8 are tested in reading, language, mathematics and spelling, while students in grades 9 - 11 are tested in

reading, language, mathematics, spelling, science and social science.

The California standards portion (CST) of the STAR are aligned to state-adopted standards that describe what students should know and be able to do in each grade and subject tested. The CSTs in English-language arts and mathematics for grades two through eleven became part of the STAR program in 1999, while tests in history-social science and science for grades nine through eleven were added in 2001 along with writing tests for grades four and seven.

Results of the Stanford 9 and the CST are used to determine a school's Academic Performance Index (API). The 2001 API is a numeric index (or score) between 200 and 1000, with 1000 being the best possible score. The API reflects a school's performance on the two types of academic assessments. In calculating the 2001 API for grades 2-8, the Stanford 9 received 64 percent of the weight, and the CST 36 percent of the weight. For grades 9-11, the Stanford 9 received 76 percent of the weight, and the CST received 24 percent of the weight.

Once a school receives a "base" API score they are ranked in ten categories of equal size (deciles) from one

(lowest) to ten (highest). A school's base API score and ranking are compared to schools statewide and to schools with similar demographic characteristics. An API score of 800 is the performance target for California Schools, while a decile ranking below 5 designates a school as an "academically under-achieving school".

School, district, county, and state-level reports, with categories for students' language fluency, gender, economic status, and special education participation, must be distributed to district and county officials by the California Department of Education (CDE) by August 15 of each year. Individual written reports of student performance for the STAR program are required to be reported to parents within 20 working days after districts receive the reports.

Fitnessgram

Signed into law in October 1995, California Assembly Bill 265 established a statewide physical performance-testing program. The Bill mandated that during the spring, each school district maintaining any of grades five, seven, and nine shall administer to each pupil in those grades the

physical performance test designated by the State Board of Education.

In February 1996, the California State Board of Education designated the *Fitnessgram* as the required physical performance test to be administered to California students. Senate Bill 896, approved in 1998, further required the California Department of Education (CDE) to report results to the Governor and Legislature at least once every two years. All students in the specified grades are expected to take the physical fitness test, regardless of whether they are in a physical education class or not.

The *Fitnessgram* was developed by the Cooper Institute for Aerobics Research in Dallas, Texas and has been endorsed by the American Alliance for Health, Physical Education, Recreation, and Dance. The primary goal of the *Fitnessgram* test is to assist students in establishing physical activity as part of their daily lives. Mindful of this goal, the *Fitnessgram* provides a number of options for each performance task so that all students, including those with special needs, have the maximum opportunity to complete the test. The availability of options is especially important in measuring body composition, the component of physical fitness that tends to be the most

controversial due to assessment methods. With an additional alternative for body composition measurement, districts are more comfortable completing this section of the fitness test.

Physical fitness consists of three components: 1) aerobic capacity, 2) body composition, and 3) muscular strength, endurance, and flexibility. To ensure thorough measurement of all three components, the *Fitnessgram* test assesses the following six major fitness areas, with performance tasks alternatives for each area listed.

Aerobic Capacity

This is perhaps the most important indicator of physical fitness and assesses the capacity of the cardiorespiratory system by measuring endurance. Options for assessment are:

- The Pacer (Progressive Aerobic Cardiovascular Endurance Run). This is a multi-stage fitness test set to music, which provides a valid, engaging alternative to the customary distance run. It is strongly encouraged for students K - 3 but may be used for all ages. The objective is to run as long as possible back

and forth across a 20-meter distance at a specified pace that increases each minute.

- One Mile Walk/Run. The objective is to walk and/or run a mile distance at the fastest pace possible.
- Walk Test. The objective is to walk a one-mile distance as quickly as possible while maintaining a constant walking pace the entire distance. This test is for ages 13 and older. It is scored in minutes, seconds, and heart rate.

Body Composition

Body composition results provide an estimate of the percent of a student's weight that is fat in contrast to the "fat-free" body mass made up of muscles, bones, and organs. Testing options are:

- Percent Fat. Measurements of the thickness of the skinfold on the back of the upper arm and the inside of the right calf are taken using a device called a skinfold caliper. A formula is used to calculate percent body fat using these measurements.
- Body Mass Index. This test provides an indication of a student's weight relative to his or her height. Height and weight measurements are used to calculate a body

mass index number. Although not as accurate an indicator of body composition, districts and schools find this measurement less controversial than skinfold measurements.

Abdominal Strength and Endurance

Abdominal strength and endurance are important in promoting good posture and correct pelvic alignment. Strength and endurance of the abdominal muscles are important in maintaining lower back health.

- Curl-up Test. The objective of this test is to complete as many curl-ups as possible, up to a maximum of 75, at a specified pace.

Trunk Extensor and Flexibility

This test is related to lower back health and alignment.

- Trunk Lift. The objective of this test is to lift the upper body 12 inches off the floor using the muscles of the back and to hold the position to allow for the measurement.

Upper Body Strength and Endurance

This test measures the strength and endurance of the upper body and is related to maintenance of correct

posture. It is important to have strong muscles that can work forcefully and/or over a period of time. Options for testing are:

- Push-up. The objective of this test is to complete as many push-ups as possible.
- Modified Pull-up. The objective of this test is to successfully complete as many modified pull-ups as possible.
- Pull-up. The objective of this test is to correctly complete as many pull-ups as possible.
- Flexed Arm Hang. The objective of this test is to hang with the chin above a bar as long as possible.

Overall Flexibility

This Test measures joint flexibility, which is important to functional health. Options are:

- Back Saver Sit and Reach. The objective is to assess the flexibility of the lower back and posterior thigh. The student should be able to reach a specified distance while sitting at a sit-and-reach box. Both the right and left side of the body is measured.
- Shoulder Stretch. This is a simple test of upper body flexibility. The student should be able to touch the

fingertips together behind the back by reaching over the shoulder and under the elbow.

To complete the *Fitnessgram,* students are required to be tested in one of the options from aerobic capacity, one of the options from body composition, one of the options from upper body strength, the curl-up test, the trunk lift test, and one of the options from flexibility for a total of six individual fitness tests.

The *Fitnessgram* uses criterion-referenced standards to evaluate fitness performance. The standards, established by the Cooper Institute for Aerobics Research, represent a level of fitness that offers some degree of protection against diseases that result from sedentary living. Findings from current research based on United States national norms have been used as the basis for establishing the *Fitnessgram* standards. Performance is classified into two general areas: "in the healthy fitness zone (HFZ)" and "needs improvement." All students should strive to achieve a score within the HFZ. It is possible that a student will score above the HFZ. For the purpose of reporting, scores are designated as meeting the standard (falling in the fitness zone) or not meeting the standard (falling lower than the HFZ).

CHAPTER TWO

LITERATURE REVIEW

> "It is helpful to think of the brain as a muscle. One of the best ways to maximize the brain is through exercise, movement. Everybody feels better after exercise. There is a reason for it." (Ratey, 1997 as quoted by McDonald, 1998)

The theory "healthy body, healthy mind" has been given new stature as researchers continue to study the positive effects of exercise on the human body. According to the Centers for Disease Control, two-thirds of deaths among people 25 years of age and older result from cardiovascular disease and cancer. The majority of risk behaviors associated with these two diseases, including unhealthy dietary habits and physical inactivity, are initiated during the teenage years. Studies have shown that regular physical exercise not only enhances health, but also increases the brain's processing speed and enhances the intelligence of children (Choi, et al., 1995).

Regular physical activity has been shown to prevent heart disease, diabetes, obesity, and possibly cerebral vascular disease (Wildorf, 2001). Ramifications of a sedentary lifestyle seem to extend beyond the obvious

health related consequences. Inactivity may have detrimental effects on mind and body alike. Cognitive scientists recognize that mind is body, and body is mind and the most beneficial forms of exercise engage both (Krucoff, 1995). Researchers at California State University, Fullerton, conducted studies investigating the effects of physical exercise on one's ability to think quickly. It was determined that participants in the exercise program were able to increase their reaction times on cognitive questioning after a thirty-minute exercise period (Fit and fast brains, 1991).

A similar study investigated whether aerobically active people perform better than inactive people in cognitive functions such as reaction time, choice reaction time and digit symbol substitution performance. Results showed that physically active people were able to process data faster (Lupinnacci, et al., 1997). A study of eleven female subjects showed that after a treadmill test, in which the subjects burned 350 calories, a mood questionnaire showed them to be less bewildered, forgetful or unable to concentrate (Munson & Yeykal, 1994).

Researchers are aware that physical activity makes a regular exerciser feel better mentally and physically. New

studies have led scientists to view the relationship between exercise and mood as more complex. Among the explanations for the effect of exercise on mental health is the idea that exercise raises the body's temperature, improving blood flow to the brain (Mcdonald, 1998). An aerobically fit body takes up more oxygen, and for its size the brain requires a bigger supply of oxygen than any other organ in the body in order to function at its peak (Mental Vigor, 1995).

The increase in blood flow provides the brain with the needed nutrients of oxygen and glucose. Glucose is to the brain what gasoline is to a car, brain fuel. Each time a person thinks the brain uses up glucose. This is apparent when we realize that brain activity is measured by glucose utilization. An individual exchanges about 10% of his oxygen with each normal breath, meaning that about 90% of the oxygen in our brain is stale until we breathe deep or exercise. A lack of oxygen to the brain can result in disorientation, confusion, fatigue, sluggishness, and concentration and memory problems. An increased blood flow not only provides the brain with needed nutrients, but it increases the number of tiny blood vessels in the brain,

enabling the brain to get more fuel and work better (Krucoff, 1995).

Pierce J. Howard, a Charlotte, North Carolina-based organizational psychologist and author of The Owner's Manual for the Brain, states new research indicates that aerobic exercise increases the amount of certain brain chemicals that both stimulate the growth of nerve cells while promoting the regeneration of brain cells (Krucoff, 1995). A research study on laboratory animals indicated that exercise programs promoted the growth of new brain cells (Wildorf, 2001).

To test the effect of exercise on brain activation a study was conducted to test the validity of interpreting post-exercise alpha enhancement and to provide information on the affective and cognitive effects of exercise-related EEG activity. The study showed there were higher levels of theta and alpha activity and lower levels of beta activity in the individuals participating in exercise conditions (McDonald, 1998). Physical activity also increases the brain-derived neurotrophic factor (BDNF), which is the primary cause for the survival and function of neurons. The BDNF gene expression is also increased by physical exercises. This indicates that mental functioning is

influenced by the physical exercises performed (McDonald, 1998).

Engaging in aerobic activity results in the release of endorphins, a neurotransmitter that relaxes us into a state of cortical alertness and reduces the symptoms of depression. After physical activity, the brain responds hemodynamically, metabolically, and psychically. The activation of neurotransmitters in the brain such as acetylcholine, catecholamine, and serotonin is known to balance behavior and cause positive changes in mood, sleep, memory, pain, and blood pressure (Hollman & Struder, 1996). A consistent effort to engage in physical fitness is rewarded with enhanced energy, outlook and less of a tendency to become depressed over troublesome situations (Choi et al., 1995).

While these reports promote the benefits of fitness, other studies report childhood obesity as a rapidly emerging epidemic that is sure to have profound public health consequences should overweight children become overweight adults (Strauss & Pollock, 2001). Currently, at least one in five children in the United States are overweight or obese, and the numbers are continuing to increase (Troiano, Flegal, Kuczmarski, Campbell, & Johnson,

1995). Estimates report that children today expend approximately 600 kcal * [day.sup.-1] less than their counterparts 50 years ago (Boreham & Riddoch, 2001). The CDC reports that the emergence of television, computers and video games have contributed to children being more sedentary and less fit then ever before. Part of the problem may lie in the environment within which children now find themselves, an environment full of what researchers describe as sedentary alternatives (Epstein et al., 1995).

As these studies promote the benefits of fitness and report the inactivity of children, participation of students in school physical education programs has continued to decline through two decades. Currently only one state, Illinois, requires mandatory physical education for K-12 students. As an increased emphasis is applied to standardized testing, administrators have begun to view physical education curricula as reducing instruction time in core academic subjects (Shephard, 1997). Research suggests that the reduction or replacement of school physical education programs may in fact impair academic learning rather than enhance it.

Researchers have been cautious in making claims that physical education increases test scores, noting the many variables involved in learning. Environment, genetics, attitudes, individual learning capacity, curriculum delivery, and teaching strengths all play a part in the learning process. But as Dr. Germund Hesslow reported at the International Learning Conference, all things being equal, a physically active child will have an advantage in learning and an inactive child is at a disadvantage for learning (Levin & Martin, 2002). Studies seem to support Dr. Hesslow's claims.

As early as 1950 an unpublished study was conducted in Vannes, France analyzing the relationship between academic performance and physical activity (Shephard, 1997). During the study, academic instruction was curtailed by 26% and replaced with an additional 13 hours a week of physical activity. Academic instruction was limited to the mornings with afternoons occupied by a wide range of physical activities including gymnastics, swimming, team sports and various outdoor activities. Results of standardized academic testing showed the test subject's performance to be comparable to other schools in the Paris area despite the 26% decrease in academic instruction. Furthermore, the

experimental group appeared more calm and attentive in the classroom setting, displayed fewer discipline problems, and had fewer average number of days absent than their counterparts (Shephard, 1997).

Two separate studies on academic performance and exercise were conducted in Adelaide, Australia. In the first study, 519 fifth graders from seven schools were allocated to one of three 14-week programs: fitness, skill, or control. The results showed that students in the fitness programs had on average larger decreases in body fat measurements coupled with larger gains in arithmetic and behavior scores (Dwyer, Coonan, Leitch, Hetzel & Baghurst, 1983). A second study of 9,000 Australian students from 109 schools showed that high weekly levels of physical activity were significantly associated with high academic achievement scores (Dwyer, Blizzard, & Dean 1996).

A study conducted in Southern California assessing 759 fourth grade students who participated in the Sports, Play, and Active Recreation for Kids (SPARK) program showed interesting results. SPARK physical education classes are designed to promote high levels of physical activity that improve health-related fitness, promote movement skills that add to success and enjoyment in physical activity,

encourages self-management curricula that promote physical activity outside of school and encourages positive socialization (Sallis, McKenzie, Kolody, Lewis, Marshall, & Rosengard 1999). The experimental SPARK classes were taught by SPARK trained personnel while the control students received their regular physical education instruction. When correlated with academic achievement tests, the results showed that of 8 statistical comparisons the SPARK students showed advantages in 4, were comparable in 3 and in only one comparison (language) performed below the control group (Sallis et al., 1999)

An extensive and significant study on the relationship between academic performance and physical education participation was conducted on 546 primary students in Trois Rivieres, Quebec (Shephard & Lavallee 1994). An experimental group of students undertook one additional hour per day of physical education taught by a physical education specialist. The control group received only the standard Quebec physical education program, 40 minutes a day taught by a non-specialist. Both groups were exposed to comparable academic environments with the control group receiving some 13-14% more academic instruction than the experimental group.

Results of the Trois Riveieres study showed that grade point averages of students in grades 2 through 6 of the experimental group (extra physical education) were significantly higher than averages of students in the control group. When individual subject areas were analyzed in terms of categoric comparisons between entire classes of experimental and control groups the experimental group's grades exceeded the control group's in 26 comparisons, matched the control group in 46 comparisons and were poorer in only 7 comparisons, 6 in French language. A standardized provincewide multiple choice examination in grade 6 showed a significant advantage to the experimental group in mathematics scores (Shephard & Lavallee 1994).

Researchers concluded the study generally supports the theory that academic performance is maintained or even enhanced by an increase in student physical activity, despite the 13-14% decrease in academic instruction time.

Numerous studies have related that the physically active child who engages in regular physical activity does better in school than their sedentary classmates (Krucoff, 1995). Until recently the edge was thought to come from the increased self-confidence gained from successful

experiences. New research has begun to investigate the possible physiological connections.

CHAPTER THREE

METHODOLOGY

Numerous studies have investigated the relationship between academics and physical activity. Through the use of California's 2001 standardized testing, this study investigates the relationship of academic performance (API scores) and fitness (Fitnessgram scores).

The subjects in this study are seventh grade students in California's Riverside and San Bernardino County middle schools. Both girls and boys are included in the testing. No other specific demographics (socio-economic, ethnicity, etc.) were used in this study. Testing was implemented during the spring of 2001.

Data Collection

Every middle school in each of the two counties participated in the STAR program and received a 2001 Academic Performance Index (API) score based on their schools performance. Of the 108 middle schools reporting API scores, 96 of these schools also reported seventh grade Fitnessgram test scores. The 96 middle schools in the two counties that reported both academic and fitness scores were used in the study.

The first procedure was to list all school districts in both counties, followed by the listing of every middle school in the respective districts. Determining each school's API score and rank was achieved by accessing school district web sites. Scores that were unavailable through web sites were gained through the California Department of Education (CDE). Academic scores and ranks are listed in Appendix A.

The second procedure was to list Fitnessgram test scores for each of the middle schools. California Superintendent of Schools, Diane Eastin, reported these scores during December 2001 in a report prepared for the Governor and Legislators. Results were calculated for individual reporting schools by percentages of students who achieved 6 of 6 standards, 5 of 6, 4 of 6, 3 of 6, 2 of 6, 1 of 6, and 0 of 6.

Two separate results were used for this study, percentages of students who achieved 6 of 6 standards and those achieving 5 of 6 standards. Achieving 6 of 6 standards classifies students as meeting all standards of the healthy fitness zones, while achievement of 5 of 6 standards classifies a student as achieving 83% of the healthy fitness standards. These fitness scores were then

cataloged for the 96 middle schools used in the study. Fitnessgram test results are listed in Appendix B.

Analysis Procedure

With each of the school's API and fitness scores documented, schools were then ranked by their API (academic) scores with 1 being the highest number (best score) and 96 the lowest. These rankings enabled the relationship of API scores and fitness scores to be analyzed descriptively in two separate ways. The first analysis was done by grouping the 96 schools into 4 quadrants of 24 schools (Appendix C). A second analysis was conducted through use of the State of California's decile grouping (Appendix D).

To determine a correlation between API scores and Fitnessgram scores, schools were then ranked on their fitness test results. Schools were first ranked in order based on the percentage of students achieving 6 of 6 standards. The school with the highest percentage of students achieving 6 of 6 standards received a 1 and lowest receiving a 96. Fitness results of 5 of 6 standards were ranked in the same manner, with the highest percentage receiving a 1 and the lowest a 96. Percentages of 5 of 6

standards were cumulative and included students that achieved all 6 standards.

Two Spearman-Rho correlations (Siegel, 1956) were conducted. The first determined the significance of the relationship between a school's academic rank and their highest (6 of 6) fitness rank. The second correlation determined the significance between the academic rank and 5 of 6 fitness rank (Appendix E).

Results

Table 1 illustrates the quadrant breakdown of the 96 schools.

Table 1. Quadrant Comparison of Academics and Fitness

QUADRANT	PERCENT ACHIEVING STANDARD	
	6 of 6	5 of 6
1st Quadrant average	36.9%	66.0%
2nd Quadrant average	27.8%	54.8%
3rd Quadrant average	19.5%	46.2%
4th Quadrant average	14.5%	40.0%

The table suggests a relationship between academic performance and fitness scores. As API scores declined, fitness scores declined in both percentages of students achieving 6 of 6 standards and 5 of 6 standards.

Significant differences are observed between the highest and lowest performing schools, while the decline of fitness percentages through the four quadrants mirrored the decline in academic scores.

Table 2 illustrates the decile breakdown of the 96 schools in the study. The highest achieving schools in the two counties reached the 9th decile. With the 9th decile being the highest achieving academic schools, Table 2 illustrates the decile breakdown relative to percentage of students achieving the fitness standards. Similar to the quadrant breakdown, the decline of academic scores mirrored a decline in percentages achieving fitness standards. Notable in the table is both the steady decline and large differences between higher and lower performing schools.

Table 2. Decile Comparison of Academics and Fitness

DECILE	PERCENT ACHIEVING STANDARD	
	6 of 6	5 of 6
9th Decile	41.0%	70.1%
8th Decile	33.9%	64.0%
7th Decile	34.5%	63.3%
6th Decile	32.3%	60.4%
5th Decile	25.0%	51.7%
4th Decile	20.6%	46.9%
3rd Decile	18.5%	44.5%
2nd Decile	13.0%	38.5%
1st Decile	15.0%	40.4%

The descriptive analysis indicates a relationship between academic performance and fitness. A Spearman-Rho correlation (Siegel, 1956) was conducted to determine the significance of that relationship. The Spearman-Rho test is sensitive to rank ordering of ordinal data, and ignores interval or ratio differences between ranks. Academic scores were rank-ordered highest to lowest and classified as the X category. Fitness results of 6 out of 6 standards achieved were rank-ordered (highest percentages to lowest) and assigned to the Y_1 category. Fitness results of 5 of 6 standards were rank-ordered in the same fashion and assigned to the Y_2. The calculations were performed according to the following formula:

$$r_S = 1 - \frac{6 \sum_{i=1}^{N} d_i^2}{N^3 - N}$$

This test indicated a positive Spearman-Rho correlation of +0.71 between the X and Y_1 category and +0.74 between the X and Y_2 category. Due to the large sample size and inherent degrees of freedom, the nonparametric Spearman-Rho uses the parametric t-distribution to determine significance (Siegel, 1956). The resulting t-

score of 3.15 for the Y_1 category (6 of 6 standards) and 3.47 for the Y_2 category (5 of 6 standards) indicates a correlation between both X and Y_1, and X and Y_2 at the .01 confidence level. The Spearman-Rho correlation coefficients of +0.71 and +0.74 therefore indicate an obvious, significant and measurable relationship between the academic test scores and fitness test scores. As one increases, so does the other, in a statistically significant manner not attributable to chance.

Discussion/Conclusion

The study's primary finding indicates a relationship between academic performance and fitness performance. Furthermore, the study indicated a statistically significant relationship between the academic scores and fitness scores of seventh grade students. The study supports previous research that suggests daily, quality physical education programs and increased physical activity can impact a student's academic performance.

We need to be cautious in simply suggesting that better physical fitness increases test scores. Many factors contribute to academic performance. It is quite possible to evaluate this study through a mirror and suggest that

rather than fitness enhancing academics, it is academics that enhances fitness. This is why we need to be hesitant in suggesting a causal relationship without considering other factors. What we can suggest is that a significant and positive relationship does exist between academic test results and physical fitness test results. That positive relationship gives credibility to the argument for school physical education programs. Furthermore, the relationship identified here is useful for justifying movement programs in the school curriculum.

As the emphasis in education turns towards assessment, it is the latest neurological research that appears to be most crucial in promoting regular exercise. Movement prepares the brain for optimal learning. It provides the needed nutrients of oxygen and glucose while balancing brain chemistry. Aerobic activity releases endorphins that provide cortical alertness and reduce the symptoms of depression. Evidence indicates exercise strengthens key areas of the brain and increases synaptic connections.

Physical activity increases cognitive responses and reaction time, which enhances recall and reasoning skills. Studies have shown a direct correlation between increased activity and increased math scores (Shephard & Lavallee,

1994). A regular exercise program improves the mood, health and overall well being of an individual while decreasing stress and anxiety.

As research continues to explore this relationship and we learn more about how the brain works, it may be quite possible to conclude that programs that promote daily exercise, such as physical education classes, are the key ingredient in enhanced academic performance. Such a conclusion would solidify the central location of physical education in the required school curricula.

APPENDIX A:

ACADEMIC PERFORMANCE INDEX SCORES AND DECILES

SCHOOL	API SCORE	DECILE
ALDER MIDDLE	535	2
ALMERIA MIDDLE	540	2
ALTA LOMA MIDDLE	750	8
APPLE VALLEY MIDDLE	661	5
ARIZONA INTERMEDIATE	678	6
AUBURNDALE INTERMEDIATE	660	5
BADGER SPRINGS MIDDLE	504	1
BARSTOW MIDDLE	701	6
BIG BEAR MIDDLE	709	7
BLYTHE MIDDLE	603	4
BROWN (DAVID A.) MIDDLE	646	5
CAHUILLA DESERT ACADEMY	506	1
CANYON HILLS JR. HIGH	807	9
CENTRAL MIDDLE	576	3
CHEMAWA MIDDLE	620	4
CITRUS HILLS INTERMEDIATE	691	6
CLEMENT MIDDLE	750	8
COFFMAN (NELLIE N.) MIDDLE	593	3
COLTON MIDDLE	545	2
COOMBS (SUSAN B.) MIDDLE	570	3
COPE MIDDLE	746	8
CORONA FUNDAMENTAL INTER.	789	9
CREE (RAYMOND) MIDDLE	604	4
CUCAMONGA MIDDLE	708	7
CURTIS MIDDLE	454	1
DAGGETT MIDDLE	609	4
DARTMOUTH MIDDLE	669	6
DAY (JAMES L.) MIDDLE	771	8
DEL VALLEJO MIDDLE	554	2
DESERT SPRINGS MIDDLE	564	3
EARHART (AMELIA) MIDDLE	717	7
ETIWANDA INTERMEDIATE	755	8
FONTANA MIDDLE	519	2
FRISBIE MIDDLE	553	2
GAGE (MATHEW) MIDDLE	671	6
GOLDEN VALLEY MIDDLE	576	3
HARRIS (RUTH O.) MIDDLE	590	3
HESPERIA JUNIOR HIGH	621	4
INDIO MIDDLE	578	3
JEFFERSON (THOMAS) MIDDLE	439	1
JURUPA MIDDLE	572	3
KENNEDY MIDDLE	592	3
KOLB MIDDLE	544	2
KUCERA (ETHEL) MIDDLE	594	3
LA QUINTA MIDDLE	647	5

Landmark Middle	628	4
Loma Vista Intermediate	634	4
Lucerne Valley Middle	636	5
Magnolia Junior High	696	6
Margarita Middle	776	8
Mary P. Henck Intermediate	745	8
Menifee Middle	740	7
Mesa Linda Middle	600	4
Mira Loma Middle	611	4
Mission Middle	574	3
Mountain View Junior High	684	6
Mountain View Middle	561	2
Musser (Ruth) Middle	743	8
Nicolet Middle	563	2
Norco Intermediate	673	6
North Mountain Middle	573	3
Palm Desert Middle	722	7
Palm Middle	647	5
Pinacate Middle	558	2
Pinon Mesa Middle	668	5
Pioneer Junior High	779	9
Quail Valley Middle	712	7
Ramona Junior High	608	4
Ranchero Middle	645	5
Raney (Letha) Intermediate	648	5
Rialto Middle	560	2
Riverview Middle	769	8
Sequoia Middle	585	3
Serrano Middle	582	3
Shandin Hills Middle	553	2
Sheppard (Harry R.) Middle	455	1
Shivela Middle	786	9
Sierra Middle	627	4
Southridge Middle	627	4
Summit Intermediate	757	8
Sunnymead Middle	509	1
Temecula Middle	803	9
Terrace Hills Middle	612	4
Thompson Middle	790	9
Townsend (Robert O.) Jr. High	717	7
Truman Harry S. Middle	570	3
Twentynine Palms Junior High	667	5
University Heights Middle	587	3
Vail Ranch Middle	758	8
Vineyard Jr. High	767	8
Vista Campana Middle	707	7
Vista Heights (Middle)	686	6

WELLS INTERMEDIATE	553	2
WILSON (WOODROW) MIDDLE	491	1
WOODCREST JUNIOR HIGH	658	5
WORKMAN (JAMES) MIDDLE	629	4

APPENDIX B:

FITNESSGRAM STANDARDS MET BY PERCENTAGES

SCHOOL	6 OF 6	5 OF 6 *
ALDER MIDDLE	9.7%	32.6%
ALMERIA MIDDLE	19.5%	45.9%
ALTA LOMA MIDDLE	49.3%	81.8%
APPLE VALLEY MIDDLE	18.0%	47.3%
ARIZONA INTERMEDIATE	26.6%	54.0%
AUBURNDALE INTERMEDIATE	43.1%	72.0%
BADGER SPRINGS MIDDLE	19.0%	48.7%
BARSTOW MIDDLE	47.8%	72.7%
BIG BEAR MIDDLE	26.7%	66.3%
BLYTHE MIDDLE	40.7%	66.3%
BROWN (DAVID A.) MIDDLE	29.1%	56.3%
CAHUILLA DESERT ACADEMY	14.4%	46.9%
CANYON HILLS JR. HIGH	42.5%	66.8%
CENTRAL MIDDLE	24.6%	51.5%
CHEMAWA MIDDLE	29.0%	56.8%
CITRUS HILLS INTERMEDIATE	29.3%	60.5%
CLEMENT MIDDLE	27.5%	62.0%
COFFMAN (NELLIE N.) MIDDLE	11.4%	30.6%
COLTON MIDDLE	11.1%	34.0%
COOMBS (SUSAN B.) MIDDLE	24.3%	35.3%
COPE MIDDLE	37.3%	66.7%
CORONA FUNDAMENTAL INTER.	40.0%	66.7%
CREE (RAYMOND) MIDDLE	6.1%	32.4%
CUCAMONGA MIDDLE	17.2%	58.3%
CURTIS MIDDLE	12.4%	39.0%
DAGGETT MIDDLE	5.4%	32.4%
DARTMOUTH MIDDLE	32.0%	62.0%
DAY (JAMES L.) MIDDLE	30.5%	59.9%
DEL VALLEJO MIDDLE	12.6%	36.2%
DESERT SPRINGS MIDDLE	23.5%	51.7%
EARHART (AMELIA) MIDDLE	53.0%	51.7%
ETIWANDA INTERMEDIATE	27.2%	61.3%
FONTANA MIDDLE	18.0%	44.3%
FRISBIE MIDDLE	11.2%	43.0%
GAGE (MATHEW) MIDDLE	43.8%	69.1%
GOLDEN VALLEY MIDDLE	19.3%	49.4%
HARRIS (RUTH O.) MIDDLE	15.3%	45.1%
HESPERIA JUNIOR HIGH	14.3%	44.3%
INDIO MIDDLE	32.5%	59.5%
JEFFERSON (THOMAS) MIDDLE	14.7%	39.2%
JURUPA MIDDLE	10.0%	29.7%
KENNEDY MIDDLE	19.7%	44.4%
KOLB MIDDLE	0.6%	46.0%

* 5 OF 6 % IS CUMULATIVE AND INCLUDES 6 OF 6 %

Kucera (Ethel) Middle	8.7%	30.4%
La Quinta Middle	31.7%	54.8%
Landmark Middle	21.4%	52.7%
Loma Vista Intermediate	21.2%	44.3%
Lucerne Valley Middle	12.7%	26.6%
Magnolia Junior High	32.4%	63.9%
Margarita Middle	27.8%	52.1%
Mary P. Henck Intermediate	30.8%	64.0%
Menifee Middle	53.2%	77.8%
Mesa Linda Middle	7.6%	30.5%
Mira Loma Middle	21.5%	48.9%
Mission Middle	12.7%	36.5%
Mountain View Junior High	14.3%	38.6%
Mountain View Middle	17.7%	44.2%
Musser (Ruth) Middle	46.1%	77.0%
Nicolet Middle	17.0%	39.8%
Norco Intermediate	28.5%	57.2%
North Mountain Middle	40.5%	68.3%
Palm Desert Middle	45.5%	55.3%
Palm Middle	20.5%	55.5%
Pinacate Middle	18.7%	42.7%
Pinon Mesa Middle	41.0%	66.3%
Pioneer Junior High	40.9%	74.9%
Quail Valley Middle	35.0%	62.8%
Ramona Junior High	19.8%	46.3%
Ranchero Middle	14.3%	44.7%
Raney (Letha) Inter.	19.9%	46.7%
Rialto Middle	0.0%	19.4%
Riverview Middle	39.1%	60.9%
Sequoia Middle	11.7%	35.0%
Serrano Middle	13.3%	43.7%
Shandin Hills Middle	10.8%	29.8%
Sheppard (Harry R.) Middle	12.7%	31.2%
Shivela Middle	42.3%	74.2%
Sierra Middle	31.4%	53.8%
Southridge Middle	30.2%	58.0%
Summit Intermediate	25.8%	60.2%
Sunnymead Middle	11.4%	28.4%
Temecula Middle	37.1%	63.1%
Terrace Hills Middle	15.6%	40.5%
Thompson Middle	43.1%	74.9%
Townsend (Robert O.) Jr.	20.7%	80.8%
Truman Harry S. Middle	11.7%	50.0%
Twentynine Palms Junior High	24.5%	48.7%
University Heights Middle	16.2%	51.6%
Vail Ranch Middle	37.3%	63.7%
Vineyard Jr. High	27.5%	58.0%

VISTA CAMPANA MIDDLE	24.6%	53.3%
VISTA HEIGHTS (MIDDLE)	36.0%	65.3%
WELLS INTERMEDIATE	22.0%	42.7%
WILSON (WOODROW) MIDDLE	20.1%	49.2%
WOODCREST JUNIOR HIGH	20.3%	49.4%
WORKMAN (JAMES) MIDDLE	24.1%	49.1%

APPENDIX C:

QUADRANT RANKINGS

SCHOOL	API SCORE	6 OF 6	5 OF 6
CANYON HILLS JR. HIGH	807	42.5%	66.8%
TEMECULA MIDDLE	803	37.1%	63.1%
THOMPSON MIDDLE	790	43.1%	74.9%
CORONA FUNDAMENTAL INTER.	789	40.0%	66.7%
SHIVELA MIDDLE	786	42.3%	74.2%
PIONEER JUNIOR HIGH	779	40.9%	74.9%
MARGARITA MIDDLE	776	27.8%	52.1%
DAY (JAMES L.) MIDDLE	771	30.5%	59.9%
RIVERVIEW MIDDLE	769	39.1%	60.9%
VINEYARD JR. HIGH	767	27.5%	58.0%
VAIL RANCH MIDDLE	758	37.3%	63.7%
SUMMIT INTERMEDIATE	757	25.8%	60.2%
ETIWANDA INTERMEDIATE	755	27.2%	61.3%
ALTA LOMA MIDDLE	750	49.3%	81.8%
CLEMENT MIDDLE	750	27.5%	62.0%
COPE MIDDLE	746	37.3%	66.7%
MARY P. HENCK INTERMEDIATE	745	30.8%	64.0%
MUSSER (RUTH) MIDDLE	743	46.1%	77.0%
MENIFEE MIDDLE	740	53.2%	77.8%
PALM DESERT MIDDLE	722	45.5%	55.3%
EARHART (AMELIA) MIDDLE	717	53.0%	51.7%
TOWNSEND (ROBERT O.) JR. H.	717	20.7%	80.8%
QUAIL VALLEY MIDDLE	712	35.0%	62.8%
BIG BEAR MIDDLE	709	26.7%	66.3%
1ST QUADRANT FITNESS AVERAGE		**36.9%**	**66.0%**
CUCAMONGA MIDDLE	708	17.2%	58.3%
VISTA CAMPANA MIDDLE	707	24.6%	53.3%
BARSTOW MIDDLE	701	47.8%	72.7%
MAGNOLIA JUNIOR HIGH	696	32.4%	63.9%
CITRUS HILLS INTERMEDIATE	691	29.3%	60.5%
VISTA HEIGHTS (MIDDLE)	686	36.0%	65.3%
MOUNTAIN VIEW JUNIOR HIGH	684	14.3%	38.6%
ARIZONA INTERMEDIATE	678	26.6%	54.0%
NORCO INTERMEDIATE	673	28.5%	57.2%
GAGE (MATHEW) MIDDLE	671	43.8%	69.1%
DARTMOUTH MIDDLE	669	32.0%	62.0%
PINON MESA MIDDLE	668	41.0%	66.3%
TWENTYNINE PALMS JUNIOR H.	667	24.5%	48.7%
APPLE VALLEY MIDDLE	661	18.0%	47.3%
AUBURNDALE INTERMEDIATE	660	43.1%	72.0%
WOODCREST JUNIOR HIGH	658	20.3%	49.4%
RANEY (LETHA) INTERMEDIATE	648	19.9%	46.7%
LA QUINTA MIDDLE	647	31.7%	54.8%
PALM MIDDLE	647	20.5%	55.5%

BROWN (DAVID A.) MIDDLE	646	29.1%	56.3%
RANCHERO MIDDLE	645	14.3%	44.7%
LUCERNE VALLEY MIDDLE	636	12.7%	26.6%
LOMA VISTA INTERMEDIATE	634	21.2%	44.3%
WORKMAN (JAMES) MIDDLE	629	24.1%	49.1%
2ND QUADRANT FITNESS AVERAGE		**27.8%**	**54.8%**
LANDMARK MIDDLE	628	21.4%	52.7%
SIERRA MIDDLE	627	31.4%	53.8%
SOUTHRIDGE MIDDLE	627	30.2%	58.0%
HESPERIA JUNIOR HIGH	621	14.3%	44.3%
CHEMAWA MIDDLE	620	29.0%	56.8%
TERRACE HILLS MIDDLE	612	15.6%	40.5%
MIRA LOMA MIDDLE	611	21.5%	48.9%
DAGGETT MIDDLE	609	5.4%	32.4%
RAMONA JUNIOR HIGH	608	19.8%	46.3%
CREE (RAYMOND) MIDDLE	604	6.1%	32.4%
BLYTHE MIDDLE	603	40.7%	66.3%
MESA LINDA MIDDLE	600	7.6%	30.5%
KUCERA (ETHEL) MIDDLE	594	8.7%	30.4%
COFFMAN (NELLIE N.) MIDDLE	593	11.4%	30.6%
KENNEDY MIDDLE	592	19.7%	44.4%
HARRIS (RUTH O.) MIDDLE	590	15.3%	45.1%
UNIVERSITY HEIGHTS MIDDLE	587	16.2%	51.6%
SEQUOIA MIDDLE	585	11.7%	35.0%
SERRANO MIDDLE	582	13.3%	43.7%
INDIO MIDDLE	578	32.5%	59.5%
CENTRAL MIDDLE	576	24.6%	51.5%
GOLDEN VALLEY MIDDLE	576	19.3%	49.4%
MISSION MIDDLE	574	12.7%	36.5%
NORTH MOUNTAIN MIDDLE	573	40.5%	68.3%
3RD QUADRANT FITNESS AVERAGE		**19.5%**	**46.2%**
JURUPA MIDDLE	572	10.0%	29.7%
COOMBS (SUSAN B.) MIDDLE	570	24.3%	35.3%
TRUMAN HARRY S. MIDDLE	570	11.7%	50.0%
DESERT SPRINGS MIDDLE	564	23.5%	51.7%
NICOLET MIDDLE	563	17.0%	39.8%
MOUNTAIN VIEW MIDDLE	561	17.7%	44.2%
RIALTO MIDDLE	560	0.0%	19.4%
PINACATE MIDDLE	558	18.7%	42.7%
DEL VALLEJO MIDDLE	554	12.6%	36.2%
WELLS INTERMEDIATE	553	22.0%	42.7%
FRISBIE MIDDLE	553	11.2%	43.0%
SHANDIN HILLS MIDDLE	553	10.8%	29.8%
COLTON MIDDLE	545	11.1%	34.0%
KOLB MIDDLE	544	0.6%	46.0%

ALMERIA MIDDLE	540	19.5%	45.9%
ALDER MIDDLE	535	9.7%	32.6%
FONTANA MIDDLE	519	18.0%	44.3%
SUNNYMEAD MIDDLE	509	11.4%	28.4%
CAHUILLA DESERT ACADEMY	506	14.4%	46.9%
BADGER SPRINGS MIDDLE	504	19.0%	48.7%
WILSON (WOODROW) MIDDLE	491	20.1%	49.2%
SHEPPARD (HARRY R.) MIDDLE	455	12.7%	31.2%
CURTIS MIDDLE	454	12.4%	39.0%
JEFFERSON (THOMAS) MIDDLE	439	14.7%	39.2%
4TH QUADRANT FITNESS AVERAGE		**14.5%**	**40.0%**

APPENDIX D:

DECILE RANKINGS

SCHOOLS	DECILE	6 OF 6	5 OF 6
CANYON HILLS JR. HIGH	9	42.5%	66.8%
TEMECULA MIDDLE	9	37.1%	63.1%
THOMPSON MIDDLE	9	43.1%	74.9%
CORONA FUNDAMENTAL INTER.	9	40.0%	66.7%
SHIVELA MIDDLE	9	42.3%	74.2%
PIONEER JUNIOR HIGH	9	40.9%	74.9%
9TH DECILE AVERAGES		**41.0%**	**70.1%**
MARGARITA MIDDLE	8	27.8%	52.1%
DAY (JAMES L.) MIDDLE	8	30.5%	59.9%
RIVERVIEW MIDDLE	8	39.1%	60.9%
VINEYARD JR. HIGH	8	27.5%	58.0%
VAIL RANCH MIDDLE	8	37.3%	63.7%
SUMMIT INTERMEDIATE	8	25.8%	60.2%
ETIWANDA INTERMEDIATE	8	27.2%	61.3%
ALTA LOMA MIDDLE	8	49.3%	81.8%
CLEMENT MIDDLE	8	27.5%	62.0%
COPE MIDDLE	8	37.3%	66.7%
MARY P. HENCK INTERMEDIATE	8	30.8%	64.0%
MUSSER (RUTH) MIDDLE	8	46.1%	77.0%
8TH DECILE AVERAGES		**33.9%**	**64.0%**
MENIFEE MIDDLE	7	53.2%	77.8%
PALM DESERT MIDDLE	7	45.5%	55.3%
EARHART (AMELIA) MIDDLE	7	53.0%	51.7%
TOWNSEND (ROBERT O.) JR.H.	7	20.7%	80.8%
QUAIL VALLEY MIDDLE	7	35.0%	62.8%
BIG BEAR MIDDLE	7	26.7%	66.3%
CUCAMONGA MIDDLE	7	17.2%	58.3%
VISTA CAMPANA MIDDLE	7	24.6%	53.3%
7TH DECILE AVERAGES		**34.5%**	**63.3%**
BARSTOW MIDDLE	6	47.8%	72.7%
MAGNOLIA JUNIOR HIGH	6	32.4%	63.9%
CITRUS HILLS INTERMEDIATE	6	29.3%	60.5%
VISTA HEIGHTS (MIDDLE)	6	36.0%	65.3%
MOUNTAIN VIEW JUNIOR HIGH	6	14.3%	38.6%
ARIZONA INTERMEDIATE	6	26.6%	54.0%
NORCO INTERMEDIATE	6	28.5%	57.2%
GAGE (MATHEW) MIDDLE	6	43.8%	69.1%
DARTMOUTH MIDDLE	6	32.0%	62.0%
6TH DECILE AVERAGES		**32.3%**	**60.4%**
PINON MESA MIDDLE	5	41.0%	66.3%
TWENTYNINE PALMS JUNIOR H.	5	24.5%	48.7%

Apple Valley Middle	5	18.0%	47.3%
Auburndale Intermediate	5	43.1%	72.0%
Woodcrest Junior High	5	20.3%	49.4%
Raney (Letha) Inter.	5	19.9%	46.7%
La Quinta Middle	5	31.7%	54.8%
Palm Middle	5	20.5%	55.5%
Brown (David A.) Middle	5	29.1%	56.3%
Ranchero Middle	5	14.3%	44.7%
Lucerne Valley Middle	5	12.7%	26.6%
5th Decile Averages		**25.0%**	**51.7%**
Loma Vista Intermediate	4	21.2%	44.3%
Workman (James) Middle	4	24.1%	49.1%
Landmark Middle	4	21.4%	52.7%
Sierra Middle	4	31.4%	53.8%
Southridge Middle	4	30.2%	58.0%
Hesperia Junior High	4	14.3%	44.3%
Chemawa Middle	4	29.0%	56.8%
Terrace Hills Middle	4	15.6%	40.5%
Mira Loma Middle	4	21.5%	48.9%
Daggett Middle	4	5.4%	32.4%
Ramona Junior High	4	19.8%	46.3%
Cree (Raymond) Middle	4	6.1%	32.4%
Blythe Middle	4	40.7%	66.3%
Mesa Linda Middle	4	7.6%	30.5%
4th Decile Averages		**20.6%**	**46.9%**
Kucera (Ethel) Middle	3	8.7%	30.4%
Coffman (Nellie N.) Middle	3	11.4%	30.6%
Kennedy Middle	3	19.7%	44.4%
Harris (Ruth O.) Middle	3	15.3%	45.1%
University Heights Middle	3	16.2%	51.6%
Sequoia Middle	3	11.7%	35.0%
Serrano Middle	3	13.3%	43.7%
Indio Middle	3	32.5%	59.5%
Central Middle	3	24.6%	51.5%
Golden Valley Middle	3	19.3%	49.4%
Mission Middle	3	12.7%	36.5%
North Mountain Middle	3	40.5%	68.3%
Jurupa Middle	3	10.0%	29.7%
Coombs (Susan B.) Middle	3	24.3%	35.3%
Truman Harry S. Middle	3	11.7%	50.0%
Desert Springs Middle	3	23.5%	51.7%
3rd Decile Averages		**18.5%**	**44.5%**
Nicolet Middle	2	17.0%	39.8%
Mountain View Middle	2	17.7%	44.2%

RIALTO MIDDLE	2	0.0%	19.4%
PINACATE MIDDLE	2	18.7%	42.7%
DEL VALLEJO MIDDLE	2	12.6%	36.2%
WELLS INTERMEDIATE	2	22.0%	42.7%
FRISBIE MIDDLE	2	11.2%	43.0%
SHANDIN HILLS MIDDLE	2	10.8%	29.8%
COLTON MIDDLE	2	11.1%	34.0%
KOLB MIDDLE	2	0.6%	46.0%
ALMERIA MIDDLE	2	19.5%	45.9%
ALDER MIDDLE	2	9.7%	32.6%
FONTANA MIDDLE	2	18.0%	44.3%
2ND DECILE AVERAGES		**13.0%**	**38.5%**
SUNNYMEAD MIDDLE	1	11.4%	28.4%
CAHUILLA DESERT ACADEMY	1	14.4%	46.9%
BADGER SPRINGS MIDDLE	1	19.0%	48.7%
WILSON (WOODROW) MIDDLE	1	20.1%	49.2%
SHEPPARD (HARRY R.) MIDDLE	1	12.7%	31.2%
CURTIS MIDDLE	1	12.4%	39.0%
JEFFERSON (THOMAS) MIDDLE	1	14.7%	39.2%
1ST DECILE AVERAGES		**15.0%**	**40.4%**

APPENDIX E:

SPEARMAN-RHO CORRELATION

	API RANK	6/6 RANK	DIFF	SQRD	API RANK	5/6 RANK	DIFF	SQRD
Alder Middle	88	90	-2	4	88	85	3	9
Almeria Middle	87	59	28	784	87	63	24	576
Alta Loma Middle	14.5	3	11.5	132.25	14.5	1	13.5	182.25
Apple Valley Middle	38	63.5	-25.5	650.25	38	58	-20	400
Arizona Intermediate	32	40	-8	64	32	41	-9	81
Auburndale Inter.	39	8.5	30.5	930.25	39	10	29	841
Badger Springs Mid.	92	61	31	961	92	56	36	1296
Barstow Middle	27	4	23	529	27	9	18	324
Big Bear Middle	24	39	-15	225	24	17	7	49
Blythe Middle	59	14	45	2025	59	16	43	1849
Brown (David A.) Mid	44	32	12	144	44	38	6	36
Cahuilla Desert Acad	91	72	19	361	91	59	32	1024
Canyon Hills Jr. H.	1	10	-9	81	1	13	-12	144
Central Middle	69.5	42.5	27	729	69.5	49	20.5	420.25
Chemawa Middle	53	33	20	400	53	37	16	256
Citrus Hills Inter.	29	31	-2	4	29	29	0	0
Clement Middle	14.5	36.5	-22	484	14.5	26	-11.5	132.25
Coffman (Nellie N.) M	62	84.5	-22.5	506.25	62	89	-27	729
Colton Middle	85	87	-2	4	85	84	1	1
Coombs (Susan B.) M	74.5	45	29.5	870.25	74.5	50	24.5	600.25
Cope Middle	16	18.5	-2.5	6.25	16	15	1	1
Corona Fund. Inter.	4	16	-12	144	4	14	-10	100
Cree (Raymond) Middle	58	93	-35	1225	58	86	-28	784
Cucamonga Middle	25	66	-41	1681	25	33	-8	64
Curtis Middle	95	81	14	196	95	78	17	289
Daggett Middle	56	94	-38	1444	56	87	-31	961
Dartmouth Middle	35	25	10	100	35	25	10	100
Day (James L.) Middle	8	29	-21	441	8	31	-23	529
Del Vallejo Middle	81	80	1	1	81	81	0	0
Desert Springs Middle	76	47	29	841	76	46	30	900
Earhart (Amelia) Mid.	21.5	2	19.5	380.25	21.5	2	19.5	380.25
Etiwanda Intermediate	13	38	-25	625	13	27	-14	196
Fontana Middle	89	63.5	25.5	650.25	89	68	21	441
Frisbie Middle	82	86	-4	16	82	72	10	100
Gage (Mathew) Middle	34	7	27	729	34	11	23	529
Golden Valley Middle	69.5	60	9.5	90.25	69.5	52	17.5	306.25
Harris (Ruth O.) Mid.	64	70	-6	36	64	64	0	0
Hesperia Junior High	52	75	-23	529	52	69	-17	289
Indio Middle	68	23	45	2025	68	32	36	1296
Jefferson (Thomas) M.	96	71	25	625	96	77	19	361
Jurupa Middle	73	89	-16	256	73	93	-20	400
Kennedy Middle	63	58	5	25	63	66	-3	9
Kolb Middle	86	95	-9	81	86	62	24	576
Kucera (Ethel) Middle	61	91	-30	900	61	91	-30	900
La Quinta Middle	42.5	26	16.5	272.25	42.5	40	2.5	6.25
Landmark Middle	49	50	-1	1	49	44	5	25

Loma Vista Inter.	47	51	-4	16	47	67	-20	400
Lucerne Valley Middle	46	77	-31	961	46	95	-49	2401
Magnolia Junior High	28	24	4	16	28	21	7	49
Margarita Middle	7	35	-28	784	7	45	-38	1444
Mary P. Henck Inter.	17	28	-11	121	17	20	-3	9
Menifee Middle	19	1	18	324	19	3	16	256
Mesa Linda Middle	60	92	-32	1024	60	90	-30	900
Mira Loma Middle	55	49	6	36	55	55	0	0
Mission Middle	71	78	-7	49	71	80	-9	81
Mountain View Jr High	31	73	-42	1764	31	79	-48	2304
Mountain View Middle	78	65	13	169	78	70	8	64
Musser (Ruth) Middle	18	5	13	169	18	4	14	196
Nicolet Middle	77	67	10	100	77	76	1	1
Norco Intermediate	33	34	-1	1	33	36	-3	9
North Mountain Middle	72	15	57	3249	72	12	60	3600
Palm Desert Middle	20	6	14	196	20	8	12	144
Palm Middle	42.5	53	-10.5	110.25	42.5	39	3.5	12.25
Pinacate Middle	80	62	18	324	80	74	6	36
Pinon Mesa Middle	36	12	24	576	36	18	18	324
Pioneer Junior High	6	13	-7	49	6	6	0	0
Quail Valley Middle	23	22	1	1	23	24	-1	1
Ramona Junior High	57	57	0	0	57	61	-4	16
Ranchero Middle	45	74	-29	841	45	65	-20	400
Raney (Letha) Inter.	41	56	-15	225	41	60	-19	361
Rialto Middle	79	96	-17	289	79	96	-17	289
Riverview Middle	9	17	-8	64	9	28	-19	361
Sequoia Middle	66	82.5	-16.5	272.25	66	83	-17	289
Serrano Middle	67	76	-9	81	67	71	-4	16
Shandin Hills Middle	83	88	-5	25	83	92	-9	81
Sheppard(Harry R.) M.	94	79	15	225	94	88	6	36
Shivela Middle	5	11	-6	36	5	7	-2	4
Sierra Middle	50.5	27	23.5	552.25	50.5	42	8.5	72.25
Southridge Middle	50.5	30	20.5	420.25	50.5	35	15.5	240.25
Summit Intermediate	12	41	-29	841	12	30	-18	324
Sunnymead Middle	90	84.5	5.5	30.25	90	94	-4	16
Temecula Middle	2	20	-18	324	2	23	-21	441
Terrace Hills Middle	54	69	-15	225	54	75	-21	441
Thompson Middle	3	8.5	-5.5	30.25	3	5	-2	4
Townsend Jr. High	21.5	52	-30.5	930.25	21.5	47	-25.5	650.25
Truman Harry S. Mid.	74.5	82.5	-8	64	74.5	82	-7.5	56.25
Twentynine Palms Jr	37	44	-7	49	37	57	-20	400
Univ. Heights Mid.	65	68	-3	9	65	48	17	289
Vail Ranch Middle	11	18.5	-7.5	56.25	11	22	-11	121
Vineyard Jr. High	10	36.5	-26.5	702.25	10	34	-24	576
Vista Campana Middle	26	42.5	-16.5	272.25	26	43	-17	289
Vista Heights Middle	30	21	9	81	30	19	11	121
Wells Intermediate	84	48	36	1296	84	73	11	121
Wilson (Woodrow) Mid.	93	55	38	1444	93	53	40	1600

WOODCREST JUNIOR HIGH	40	54	-14	196	40	51	-11	121
WORKMAN (JAMES) MID.	48	46	2	4	48	54	-6	36
TOTALS				**42833**				**38496**
CORRELATION				**+0.71**				**+0.74**

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