THE EFFECTS OF HOME COMPUTER ACCESS AND SOCIAL CAPITAL

ON MATHEMATICS AND SCIENCE ACHIEVEMENT AMONG

ASIAN-AMERICAN HIGH SCHOOL STUDENTS

IN THE NELS:88 DATA SET

A dissertation submitted in partial fulfillment of the

requirements for the degree of

DOCTOR OF EDUCATION

to the faculty of the

School of Education and Human Services

Division of Administration and Instructional Leadership

St. John's University
New York

by

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The purpose of this researcher was to examine specific environmental, educational, and demographic factors and their influence on mathematics and science achievement. In particular, the researcher ascertained the interconnections of home computer access and social capital, with Asian American students and the effect on mathematics and science achievement. Coleman's theory on social capital and parental influence was used as a basis for the analysis of data.

Subjects for this study were the base year students from the National Education Longitudinal Study of 1988 (NELS:88) and the subsequent follow-up survey data in 1990. 1992, and 1994. The approximate sample size for this study is 640 ethnic Asians from the NELS:88 database. The analysis was a longitudinal study based on the Student and Parent Base Year responses and the Second Follow-up survey of 1992, when the subjects were in 12th grade. Achievement test results from the NELS:88 data were used to measure achievement in mathematics and science. The NELS:88 test battery was developed to measure both individual status and a student's growth in a number of achievement areas. The subject's responses were analyzed by principal components factor analysis, weights, effect sizes, hierarchial regression analysis, and PLSPath Analysis.

The results of this study were that prior ability in mathematics and science is a major influence in the student's educational achievement. Findings from the study support

the view that home computer access has a negative direct effect on mathematics and science achievement for both Asian American males and females. None of the social capital factors in the study had either a negative or positive direct effect on mathematics and science achievement although some indirect effects were found.

Suggestions were made toward increasing parental involvement in their children's academic endeavors. Computer access in the home should be considered related to television viewing and should be closely monitored by the parents to promote educational uses.

This dissertation is dedicated to my wife, Susan, my children, Andrew and Emily and my parents, Randell and Declan Quigley.

I am forever grateful for their encouragement, support, and love during this long educational process.

Acknowledgments

Many individuals assisted in the success and completion of this study. I wish to extend my sincere gratitude and appreciation to my friends and family for their support, dedication, and guidance.

Dr. James Reed Campbell, mentor, provided his professional insight, encouragement, and support throughout the entire process. Dr. Campbell imparted high standards and precision in research techniques. Working under his guidance has been a valuable learning experience.

My committee members. Dr. Gene Geisert, Dr. Ino Rossi, Dr. Barbara Signer, and Dr. John Tartar. contributed their educational expertise, provided constructive recommendations, and extended their time to assist in my endeavor.

Kathleen Miranda, a colleague, shared insight and expertise into the NELS:88 data set. Her input and support was greatly appreciated.

My mother Randell Quigley, my father, Declan, my sisters Jennings and Caimien, and my brother Kevin provided their love, encouragement, and support in my educational endeavors.

Finally, my wife Susan and my children Andrew and Emily provided their love, patience, and encouragement to complete this project.

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Chapter I

Introduction

For years, educators have debated which has greater influence over a student, the home or school environment. In the past, many parents believed the school was an extension of the family, reinforcing the family's values (Coleman, 1987). Recent researchers have shown that some schools do a poor job of educating children; therefore, parents should reconsider the role of the home in their children's education. However, due to the rise of single parent homes and the two income family, parents have less time and energy to focus on their children's education. In a recently completed study, the author showed that parents have become "seriously disengaged" or disconnected from their children's education. This is a disturbing trend among parents, especially when considering that the atmosphere established by the parents in the home is influential in creating self-perceptions and positive self-images (Purkey, 1970). Of the students surveyed in a broad cross sectional study of Caucasian, African American, Asian and Latino students, over half believed they could bring home grades of "C" or worse without upsetting their parents (Tabor, 1996).

Such findings would classify the parents and students as "deficient" or lacking in social capital. Social capital is defined by its function and is not a single entity. The different entities have two elements in common; they all consist of some aspect of social structures and they facilitate certain actions within that structure. The relations between parents and children within a family is one aspect of social capital (Coleman, 1988). There are three kinds of capital that Coleman studied. Physical capital is the observable material in the home. Human capital is the skills and knowledge acquired by the family structure. Social capital is present in the least recognizable form, as the relations and network of relations among persons within and without the family (Zhang, 1993). Since the family environment is one of the most important influences in the development of a child's cognitive abilities and orientations (Marjoribanks, 1979), developing social capital within a family is important. The relations among people that are fundamental to social capital can take the form of establishing expectations and obligations derived from trust, both in the family and in the community. These expectations and obligations allow the participants to take advantage of various resources that help them achieve the desired outcomes, including educational achievement. Many modern families lack a sufficient supply of social capital, despite the abundant presence of financial or human capital in the home. In Coleman's studies, which involved the analysis of these three kinds of capital, social capital was found to affect student achievement in a positive way (Coleman, 1987).

Besides social capital, families provide other forms of capital for their children. Wealth and the purchases made by a family is defined as financial capital. These purchases include technological resources and microcomputers. The computer has revolutionized teaching in the classroom (Geisert, 1991) and is an ever increasing presence in the home. In both cases, the computer has generally contributed to education. Through the use of Computer-Assisted Instruction (CAI), tutorials, and simulations, students have been able to pace their learning to their own level of achievement (Geisert, 1991).

In mathematics and science courses, the computer helps to reduce mathematics and science theories to manageable concepts for the masses (Papert, 1980). Considering the United State's professed goal to be first in the world in mathematics and science by the year 2000 (Goals 2000, 1990), the computer will become an important factor in attaining this goal. The computer has been in the classroom since the late 1970's, and by 1985, 82 percent of elementary schools and 93 percent of secondary schools offered computer instruction (Martinez & Mead, 1988). The last decade has seen an increase in the use of computers in the instructional programs. This trend has extended beyond the classroom to include the home use of computers for educational purposes. A recent development in educational computing is to have students use computers for instructional purposes outside the classroom in conjunction with their school courses (Miller & McInerney, 1995).

However, economics restrict the use of computers for many families at home and in school. Many of the computers in schools today are older models, and upgrading the computers to use the latest hardware and educational software is hampered by the cost of the technology. Although schools have many computers, their use may be limited because of repairs or outdated software. Economically depressed school districts are unable to maintain and repair their computers. In the end, economically deprived students, some of whom with limited English proficiency, have the least access to computer use in the schools (DeVillers, 1994). In one Asian study, the single most important deterrent to computers in the school system was the hardware cost of computers (Talisayon, 1989). Some school systems attempted to address this problem through two special programs.

Studies of the Apple Classroom of Tomorrow program and the Buddy System program found increases in student motivation, self esteem, and parental involvement when computers were placed in the homes of each student in the program (Miller & McInerney, 1995). Although the results on achievement were inconclusive, parents took a more active role in their children's education.

Statement of the Problem

The focus of this researcher is to discover the relationship among computer access at home, parental involvement, social capital, and of mathematics and science achievement among Asian American families.

Asian American and native-born Asian groups believe that effort is most critical to the success of children in school (Campbell, 1994). Among Asian Americans, families that supply a low level of help, pressure, and monitoring, together with high levels of psychological support have been found to produce higher levels of mathematics achievement (Campbell, 1994). The success of many first generation Asian children in American schools depends upon strong families highly oriented to success. Schools are more effective for children from strong family backgrounds (Coleman, 1987).

Among Asian Americans, these strong family influences were observed by researchers that examined the differences between Caucasian and Chinese American parents (Hess, Chih-Mei, and McDevitt, 1987). In this study, the authors found that Chinese American mothers viewed poor home training and the child's lack of effort as major causes of poor performance. Caucasian mothers placed more emphasis on the natural ability of children for any achievement. Asian mothers believed that success in mathematics was achieved through hard work and supplemented by strong family discipline and encouragement. Chinese Americans were found to value hard work more than the Caucasians and to view the home as more responsible for the child's success. Through strong family discipline and encouragement, the social capital factor within the Asian American family appears high.

Coleman found that a network emerges when parents know the parents of their child's friends and this awareness creates an "intergenerational closure" among the parents and children. He hypothesized that these networks provide a foundation on which social norms become mutually understood and enforced (Coleman, 1988). This aspect of the social capital definition by Coleman needs to be explored among Asian American families. Within Asian immigrant communities, interactions among the neighbors are common and forms a strong community bond through language and common heritage.

One factor that seems to increase the interaction of parents and schools is technology in the home. Miller & McInerney (1995) found that when a computer is provided in the school and also in the home, parents become more active in the educational process of their children and more active in the school.

Purpose of the Researcher

The purpose of this researcher is to examine specific environmental, educational, and demographic factors and their influence on mathematics and science achievement. In particular, this investigator will ascertain the interconnections of home computer access and social capital with Asian American students and its effects on mathematics and science achievement.

<u>Research Questions</u>

1. Is there a significant relationship between social capital and mathematics achievement?

2. Is there a significant relationship between social capital and science achievement?

3. Is there a significant relationship between student use of computers in the home and mathematics achievement?

4. Is there a significant relationship between student use of computers in the home and science achievement?

5. Is there a significant relationship between student use of computers in the home and their math self-concepts?

6. Is there a significant relationship between student use of computers in the home and their science self-concepts?

The dependent and independent variables to be investigated are as follows:

1. Dependent Variables
   (a) Student's Science Achievement Score
   (b) Student's Mathematics Achievement Score
2. Independent Variables
   (a) Socio-Economic Status
      1. Father's Education
      2. Mother's Education
      3. Father's Occupation
      4. Mother's Occupation
      5. Family Income

(b) Student's Math Self-Concept

(c) Student's Science Self Concept

(d) Prior Ability

1. Student's Mathematics Proficiency

2. Student's Science Proficiency

(e) Student Home Computer Access

(f) Parent Social Capital

(g) Student Social Capital

(h) Community Social Capital

Definition of Terms

Asian American is a variable from the NELS:88 database and is an Asian or Pacific Islander. This group includes Chinese, Filipino, Japanese, Korean, Southeast Asian, and Pacific Islander.

Computer is a device that operates on data at high speeds, can store data, and needs to be programmed. The term "computer" is most frequently used to denote a digital device.

Mathematics Achievement will be measured by the Mathematics Standardized Score from the NELS:88 database. The mathematics test consisted of 40 questions. Test items included word problems, graphs, equations, quantitative comparisons, and geometric figures. Some questions could be answered by simple application of skills or knowledge, others required the student to demonstrate a more advanced level of comprehension and/or problem solving.

Math Self-Concept is one's confidence in one's ability to understand mathematics (Shavelson, 1976). For the purpose of this researcher, math self-concept will come from four questions in the NELS:88 database. The questions are numbers 22A, 22B, 22C, and 22D from the Student Second Year Follow-Up questionnaire.

Science Achievement will be measured by the Science Standardized Score from the NELS:88 database. The science test contained questions drawn from the subjects of life science. earth science, and physical science/chemistry. Emphasis was placed on understanding of underlying concepts rather than retention of isolated facts.

Science Self-Concept is one's confidence in one's ability to understand science. Science self-concept will be based on a factor analysis of four questions from the NELS:88 database. The questions are numbers 18A, 18B, 18C, and 18D from the Student Second Follow-Up questionnaire.

Social Capital is the relationship between the parents and the student in the study as defined by Coleman in his studies.

Socio-Economic Status is a variable composite score from the NELS:88 database that is based on a parent questionnaire. It includes the father's education level, mother's education level, father's occupation, mother's occupation, and family income from the Base Year data.

Student Computer Access means this factor will be analyzed from questions in the NELS:88 database. The first question was on the Base Year survey of students, "Which of the following does your family have in the home (A Computer)?" The other question is from the Base Year survey of parents, "Do you have a computer in your home that your child uses for educational purposes?" Responses to these questions will be analyzed for the purpose of this researcher.

Subjects, Materials, and Procedures

Subjects for this study will be the base year students from the National Education Longitudinal Study of 1988 (NELS:88) and the subsequent follow-up survey data in 1990, 1992, and 1994. The NELS:88 data surveys were monitored by the Longitudinal and Household Studies Branch (LHSB) of the National Center for the Education Statistics (NCES). Beginning in 1988 with a cohort of 25,000 eighth graders attending 1,000 public and private schools across the nation, NELS:88 was designed to provide longitudinal data about critical transitions experienced by students as they leave eighth grade school settings, progress through high school (or drop out), enter and leave postsecondary institutions, and enter the work force. The NELS:88 database integrates student and parent surveys and allows the examination of change in young people's lives and the role of parents and community in that process.

The approximate sample size for this study is 640 ethnic Asians from the NELS:88 database. The analysis is a longitudinal study based on the Student and Parent Base Year responses and the Second Follow-up survey of 1992, when the subjects were in 12th grade. Achievement test results from the NELS:88 data were used to measure achievement in mathematics and science. The NELS:88 test battery was developed to measure both individual status and a student's growth in a number of achievement areas.

Assumptions of the Study

It is assumed that the NELS:88 data contains a representative sample of the student population in the United States and that linear combinations of variables reported in NELS:88 are also normally distributed. It is assumed that linearity exists between the independent variables and the dependent variables, and that the dependent variables do not have statistically different standard deviations. Finally, it is assumed that all error is independent.

It is assumed that the subjects' responses are honest and complete (Kerlinger, 1986), and that the subjects' responses will not change significantly during the length of the study (Cook and Campbell, 1979).

Limitations of the Study

As a path analysis (soft modeling) study, it is not possible to distinguish exact causes and effects (Falk & Miller, 1992). Although this study is based on a large, cross-section of United States high school students, there are several caveats that should be presented.

This researcher used a secondary source, the NELS:88 database, for analysis. Use of secondary data poses both internal and external threats to validity (Gay, 1992). In particular, users of secondary source data should be wary of the accuracy and the consistency of the data.

Furthermore, many of the variables used in this study are obtained from self-reported surveys and should be generalized with caution.

Significance of the Problem

Many factors influence a student's academic achievement at the 12th grade level. Students' academic achievement will be analyzed in the interconnections among student home computer access, social capital, and the students' self-concepts in mathematics and science. This writer will analyze the importance of social capital in academic achievement (Coleman, 1987). This investigator also examined whether student computer access in the home has a positive effect on academic achievement as well (Miller & McInerney, 1995). In previous studies, student's self-concept in mathematics and science was found to be related to their performance in these subjects (Purkey, 1970).

In a recent study of Math Olympians in the United States, students with a high degree of computer literacy had lower grades. The most computer literate Olympians spent considerable amounts of time working on computers to pursue their own interests (Campbell, 1997). As access to outside resources and e-mail on the computer grow, will access to a home computer lower achievement in mathematics and science?

Socio-economic status is an unalterable variable that has been found to have conflicting effects on mathematics and science achievement (Jacobs & Eccles 1985; Eccles & Jacobs 1986; Coleman, 1988; German, 1994; Catsambis, 1995). This variable also has been found to effect parent's socialization practices (Blake, 1989; Campbell, 1994). The socialization process used by parents has been shown to be associated with gender differences in mathematics and science achievement (Majoribanks, 1981). Gender roles often hinder the advancement of females in mathematics and science subjects. This occurrence is prevalent among Greek Americans and Caucasian families more so than Asian Americans (Campbell, 1994).

Therefore, this study will add to the body of knowledge that presently exists and is designed to help educators, school administrators, and parents locate the most significant factors that influence academic achievement.

Chapter II

Review of Related Literature

Achievement in mathematics and science has been identified as an important goal for American schools. In 1989, an education summit was held by the president and governors of each state. The outcome of this meeting was the creation of a framework for National Education Goals. Among the major goals of this framework was that U.S. students would be first in the world in science and mathematics achievement by the year 2000 (Gronlund, 1993). As part of these goals and to provide some guidance, comparisons were made with other international educational systems.

Among the international comparisons reported was the lower parental expectations of American students compared with the educational expectations among Japanese and Twainese parents (Gronlund, 1993). Stevenson, Lee, and Stigler (1986) found more mathematics instruction, more mathematics homework, and higher demands are exerted on elementary age students in Asian countries than on American students. Yet, regardless of race/ethnicity, all students exhibit similar interests and positive attitudes toward science and mathematics-related careers at early ages (Peng, 1995). Parents play an important role in student learning in science and mathematics. Many of the activities related to student learning require the commitment of parents to support their child (Peng, 1995).

Computers in the home is one method parents use to support their children. Kulik (1987) has shown that computers in school positively affect achievement. Does the presence of computers in the home increase parental involvement in their children's academic development in mathematics and science?

This review of literature took into consideration both conceptions. The chapter is divided into the following topics: the growth and utilization of computer technology in schools; the effects of home environment and parental involvement on achievement; the relationship between home environment and social capital; academic achievement among Asians and Asian-Americans; and the use of the NELS:88 database.

The Growth and Utilization of Computer Technology in School

The effect of computer technology on education has been well documented (Chamberlin, 1988; Tolman, 1991; Goodson, 1991; Brosnan, 1995). Through the use of computer technology, students can assume more responsibility for their own learning (Evans-Andris, 1996). Early use of computers in education was primarily found in mathematics, science, and engineering as a mathematical problem-solving tool, replacing the slide rule and thus permitting students to deal more directly with problems of a type and size from the real world (Molnar, 1997).

The earliest applications of computer-assisted learning was in mathematics and reading at Stanford University by Patrick Suppes and Richard Atkinson. The self-paced programs allowed the student to take an active role in the learning process. Mastery was obtained through drill and practice. Programming languages such as BASIC and LOGO were developed primarily as teaching tools for students to learn mathematical concepts (Papert, 1980; Molnar, 1997).

In the seventies, the emphasis in computers shifted from large time-shared mainframe computers to low-cost microcomputers, starting the personal computer revolution. By the early eighties, personal computers were an integral part of American society. The number of computers in American schools has increased dramatically from the early 1980's to the present. The computer usage rate of students at school increased from 27 percent in 1984, to 43 percent in 1989, to 59 percent in October 1993 (Digest of Education Statistics, 1995). Although many schools acquired computers over the last decade, the focus appears to be on acquisition as opposed to effective implementation (Evans-Andris, 1996).

James Kulik of the University of Michigan performed a meta-analysis on several hundred research studies on the effect of computers on learning in a wide variety of subjects. He found that computer-based education can increase scores from 10 to 20 percentile points and reduce the time necessary to achieve these goals by one-third. He found that computers improved class performance by about one-half a standard deviation (Kulik, 1991; Molnar, 1997).

Computer use in the appropriate setting can lead to increased achievement in mathematics and science. Mathematics and science teachers find two major purposes for using a computer in class: motivating student interest in the subject and helping the students to master basic facts and skills. However, limited budgets dampen the speed at which computer technology can be acquired in schools (Brosnan, 1995). For those teachers with a large number of computers in the classroom, applying mathematical and scientific theories is the most important function (Becker, 1991). Computers in the classroom can provide students with the necessary tools and experience to practice the investigative skills used by scientists and mathematicians (Barman, 1993).

Research on students' learning in interactive computer environments has shown a positive correlation between the computer software and cognition. The presence of a computer can provide students with opportunities to achieve topical cohesion, clarify the meaning of ambiguous terms, and focus each other's attention to pertinent aspects of the displayed data (Roth, 1996).

Computers are used in a variety of educational settings. Computer tutorials operate as a teacher or textbook, explaining information or concepts to the learner. Drill and practice programs provide repeated practice and feedback on or about a designated objective. Computer simulations can replicate certain educational activities that are too expensive or dangerous to perform in an inexpensive and safe manner. The computer is used as a tool to solve problems that have traditionally been solved without a computer (Vockell, 1992). These computer-assisted instructional (CAI) techniques are the most common use of a computer in the classroom. In this setting, students interact with the computer on an individual basis and gain feedback from the computer, as the computer controls the sequencing of the material. Computer-assisted instruction can assist learners in attaining specified instructional objectives. A substantial savings in time (20% to 40%) can be achieved in learning as compared with conventional instruction. Retention following CAI compares well with retention following conventional instruction, and instructors react positively to well-designed CAI programs (Gleason, 1981). Kulik (1987) found that 81% of students involved in CAI outperformed traditional instruction. In another meta-analysis, Niemiec & Blackwell (1986) evaluated the effectiveness of CAI and tutoring. After looking at 29 previous studies on computer- assisted instruction, they found CAI to be the most cost effective method for improving instruction. In the majority of studies on computer-assisted instruction, researchers found that there was academic improvement when CAI was employed. There were no studies in which researchers showed that computer-assisted instruction had a negative effect. Microcomputers were slightly more effective than mainframes at the college level, whereas at the elementary level, microcomputers were more effective. Overall, computer-assisted instruction had a positive effect on students (Kulik & Kulik, 1987; Niemiec & Walberg, 1987).

Tsai and Phol (1977) found when student achievement was measured by a mathematics quiz or final exam score, significant differences resulted, indicating that CAI was more effective as an instructional technique than traditional instruction. Curriculum supplemented by CAI leads, at least in some subject areas, to improved student achievement. Burns and Bozeman (1981) performed a meta-analysis of CAI in mathematics, as a supplement to classroom instruction, showing a significant enhancement of learning in instructional environments supplemented by the computer. Difficult mathematical concepts are made easier to understand through the use of computer simulations.

Secondary school students were taught geometry concepts with the computer program LOGO. Significant differences were found in the achievement level of the experimental group which used computers and those instructed strictly by lecture (Yusuf, 1991). In another study using LOGO, Clarke (1986) looked at problem solving and mathematical concepts. She found a positive effect on the general mathematical ability and attitudes toward mathematics. Students expressed interest in learning about mathematics among the experimental group using the computer program compared with the control group. Other projects and studies have similar results in science curriculum.

In a study of attitudes toward science in a physical science course (chemistry and physics) at a Delaware high school, students were split into two groups. One group of students received computer-managed self-paced instruction whereas the other group received more traditional teacher-managed group-paced instruction. The computer group had significantly more positive attitudes toward the study of science topics than the traditional group (Knight & Dunkkleberger, 1977). In Nevada, the state developed a high school science curricula based on technology and student-centered learning which guides students in researching and designing multimedia projects. Despite the lack of technology and computer experience, students using this curricula scored higher in creativity. Furthermore, the students' interest increased, and their performance and work habits improved (Ebert & Strudler, 1996). Lu (1997) studied the use of a computer package covering biology concepts for an entire year. At the end of the academic term, the effects of the CAI program on learning was evaluated against other biology classes that did not use the computer package. Overall, the findings support a positive effect on the attitudes and achievement of the students using the computer compared with other biology students .

The Operation Whole Numbers project, a computer-assisted instructional approach to arithmetic operations, had test results showing that significant improvements were made by students using computers compared with those using a traditional approach. The Computer-Assisted Remediation and Evaluation (CARE) project looked at mathematics instruction in grades 7 to10. Post test results were that students using computers improved significantly more than the control group. Also, the University of Oregon's Center for Advanced Technology in Education found students can learn mathematics skills more quickly and effectively with instruction supplemented by the use of microcomputers than with traditional instruction (Tolman, 1991).

The use of computer-assisted instruction has been found to reduce mathematics anxiety. In a study by Wood (1992), an intermediate college algebra class was divided into similar achievement groups. The experimental group used computer tutorials for lab instruction whereas the control group received standard lecture lab instruction. The experimental group showed a decrease in mathematics anxiety and higher grades than the control group. Another researcher explored the use of computer tutorials on homework among students majoring in education. The experimental group was given computer tutorials as homework and the control group was given textbook exercises as homework assignments. The mathematics achievement of the students receiving computer tutorials as homework assignments was significantly higher than those students receiving textbook assignments (Sasser, 1991).

The introduction of computer graphics to mathematics equations has been found to improve achievement. The goal of the researcher was to find if performance on algebra word problems could be improved through the use of computer graphics among college undergraduates. When computer graphics accompanied the word problems, performance improved (Reed, 1985). Another development in educational computing is to have students use computers for instructional purposes outside the classroom in conjunction with their school courses. This approach includes the home use of computers for educational purposes. The growth of on-line services and improvements in educational software have created an interactive learning environment in the home.

Miller and McInerney (1995) looked at programs such as the Apple Classroom of Tomorrow and the Buddy System Project that placed computer systems in the homes of students. Studies of the home computer programs were found to influence achievement (Kitabchi, 1987; Herman, 1988). In another study, Bell Atlantic provided inner-city school children with access to technology both at home and school. They provided the basic software and hardware so that students and teachers could communicate, research on-line, and collaborate in the learning process. The home-school connection helped the students improve academically, in reading, writing, and mathematics (Drennan, 1996). Although other studys' findings on home computer programs and achievement are contrary (Ross, Smith, Morrison, & O'Dell, 1989; Baker, Gearhart, & Herman, 1990), improvement has been found in students' attitudes toward school and self-esteem. Additionally, parental involvement increased among those students participating in the program. Increasingly, educators are trying to use technology to expand involvement of parents in their children's education.

Landerholm et al. (1991) used educational activities, especially computer sessions, at convenient times and for a short duration of time to increase the number of parents involved in their children's education. Results showed higher achievement for the students. They also found that the parent's motivation improved as well. McMahon and Duffy (1993) found the Buddy System Project helped parents become more comfortable with computer technology. Although there was no change in the parents' level of involvement in homework, the newness of the technology and the child's expertise attracted the parents to the activity. Lauer (1995) found that a parent/child computer lab increased parental involvement. Parents and children created books and projects together and bought them home. Fullerton (1995) found that the Partners in Learning Take Home Computer Program that began in 1989 has shown a 90% rise in parents contacting their child's school. This home computer program has resulted in higher parental involvement in schoolwork and increases in reading and mathematics scores. As shown in other research, greater parental involvement can lead to higher academic achievement.

Although not all computer-assisted instructional efforts are successful, most researchers reveal positive effects on the factors considered and have concluded that educational programs supplemented with CAI are frequently more effective than programs that use traditional methods (Tolman, 1991).

The Effects of Home Environment and Parental Involvement on Achievement

The home environment has been found to be a significant factor in the cognitive development of a student (Bloom,1986). Thompson (1988) and Stiller and Ryan (1992) found that home environment directly affects children's achievement. Keith (1986) and Song and Hattie (1984) found an indirect effect of home environment on achievement. In the study on home educational environment, Dolan (1983) demonstrated a strong positive relationship with students' academic achievement. Iverson and Walberg (1982) synthesized 18 studies on home environment and concluded that academic ability and achievement were more closely linked to the measures of the sociopsychological environment. They also found that the intellectual stimulation in the home was more important than socioeconomic status. Campbell and Wu (1994) investigated selected family processes and found varying effects on children's academic achievement. Excessive pressure and help were found to be dysfunctional for mathematics achievement, whereas support and the level of intellectual resources were found to have direct positive effects on mathematics achievement.

The degree to which the parents are actively involved in the child's education is one of the most important factors in a child's success in school (Schneider, 1993). Schneider hypothesized that parental involvement can counteract the negative effects of low socioeconomic background and significantly improve students' performance. Parental involvement takes into account numerous family processes which in turn create opportunities for learning. A child's success in school may depend upon the amount of parental involvement (Muller & Kerbow, 1993). Fehrmann, Keith, and Reimers (1987) found that parental involvement had a direct effect on grades and homework. Results from a 1984 survey of the MacArthur Fellows recipients were that their parents were extraordinarily supportive during their early schooling (Cox, Daniel & Boston, 1985). Campbell and Mandel (1990) found that a multivariate mix of parental processes affects achievement. Providing low levels of help, pressure, and monitoring while incorporating high levels of psychological support enhances achievement. This researcher showed that this combination of processes had significant direct effects on mathematics achievement for boys and girls.

The Relationship Between Home Environment and Social Capital

The effects of the home environment on educational achievement is well documented. James S. Coleman, a sociologist at the University of Chicago, hypothesized that the positive effects of the home environment could be conceptualized as social capital. The term "social capital" was first used by Loury (1977), who defined it as the resources that are involved in family relations and in communities which are useful for the cognitive or social development of a child.

Coleman first explored this concept when he compared achievement levels of public school children with private and Catholic school children (Coleman, Hoffer, Kilgore, 1982). They found higher achievement in private and Catholic schools. The differences in test scores were more apparent among the minority students. Based on these findings, Coleman and his colleagues retested the same students two years later.

Besides showing the same difference in test scores, the researchers also found a higher drop-out rate among public school children compared with private and Catholic school children. Coleman expanded his focus to the inter-relationship between the parents, school, and student. He found the community surrounding Catholic schools was a contributing factor in the higher retention rate of students in religious schools. Religious organizations are among the few remaining organizations in our society, beyond the family unit, that cross several generations. Thus, the social capital developed in these communities is available to children through their interactions in the home and at school. Other parents from the school can enforce the norms of the society. Coleman refers to the networks that develop between parents who know other parents as "intergenerational closure." This is an important aspect of religious communities. However, social capital outside the family unit is only effective when social capital exists in the home (Coleman et al. 1982).

Changes in societal norms, parental attitudes, and increased autonomy for adolescent students has lead to an increasingly wider range of socialization activities delegated to the school (Coleman & Hoffer, 1987). Public schools can only provide a certain level of input into the socialization process that includes opportunities, demands, and rewards. Schools are more effective for children from strong family backgrounds. A child's attitudes, effort, and conception of self are hypothesized to originate from the social environment of the household (Coleman et al. 1987).

The function of any capital is to be used as a resource by individuals for further development and achievement. Families are an important source of capital in various forms. Physical capital is the wealth and tools provided by a family, including books and computers. Human capital comes from the skills and capabilities bought to the relationship by the participants within the family, especially parents and grandparents. Children are influenced by the belongings or human capital possessed by their parents. But this human capital may be irrelevant to the educational outcomes of children if parents are not an important part of their children's lives. If their human capital is employed exclusively at work or elsewhere outside the home, the effects on social capital will be diminished. Such children will lack the guidance and influence of social capital.

Social capital is different from human capital, which represents the personal resources of individuals, i.e., their talents, personality, education, and experience (Convey, 1987). Social capital refers to the norms, social networks, and the relationships between adults and children. Social capital is a productive entity, making possible the achievement of certain ends that in the absence of social capital would not be possible (Coleman, 1988).

Coleman and Hoffer contend that these relationships contribute more to the growth of children than do the human capital of the parents and the physical resources of the family. Because social capital consists of the relationships between persons, other persons may experience extensive losses by the severance of those relations. For example, when a family moves or a father or mother join the workforce, they are unable to maintain the social contacts outside the family and must establish new relationships outside the home. The loss of these long established relationships in the neighborhood and the associated focus by the parents on their new environment affects the parent/child relationship. Parents are unable to attend school functions as regularly as they did before the change (Coleman et al., 1987). Another part of these losses is the weakening of norms and sanctions that aid the school in its task of educating children.

As Coleman (1988) points out, social capital has one additional feature that sets it apart from other forms of capital: its public good quality. The benefits of social capital go to other members in the relational structure rather than those who bring it about. As opposed to physical capital and human capital, which ordinarily are private goods and benefits those who invest in it, the social structures that produce social capital do not directly benefit the person who brings it about, but benefits all those who are part of the relational structure. Because of the public good quality of social capital, the benefits of social capital are largely experienced by persons other than the actors. Most forms of social capital are created or destroyed as by-products of other activities. Social capital and its effects on the educational achievement of children is supported by the findings of other researchers on the home environment (Iverson & Wahlberg, 1982; Bloom, 1986; Bradley, 1988; Thompson, 1988; Shoffner, 1990; Stiller & Ryan, 1992; Campbell & Wu, 1994).

Academic Achievement Among Asians and Asian-Americans

Since the educational achievement of Asian American youth is strongly tied to family structural relations which produce social capital that benefit the next generation's education, an analysis of how Asian American family functions are needed to specify the forms of social capital an Asian family possesses.

Compared with American values that stress independence and individualism, Asian values encourage all to seek out competition, to compete and to win. The Confucian value system places emphasis on interdependence, stresses a functional interconnectiveness among individuals, with a strong, family-based orientation to achievement. The family structure of Confucian values reflects this value of interdependence. The Confucian family is well known for its traditional extended structure: family ties have been so strong that members of three or even four generations live under one roof. Yet with the rapid growth of urbanization and industrialization, in most Asian countries of the Confucian tradition, modern family structure has gone through a dramatic change. The orthodox extended family structure is being replaced by more intimate nuclear families. Interconnectiveness among kin is being substituted by independence (Zen Yi, 1986). Family functions, especially in the creation of human capital, are being replaced by other social institutions. The family's importance to the Asian is diminishing as the level of development grows and the mode of production changes.

Asian immigrants, especially those who received substantial education in their home countries, understand that a child's educational achievement can be positively influenced by both parents' encouragement and concern. Maintaining an intact family structure is, therefore, important in Asian families. In American society, where the divorce rate is high and single parent families are common, Asian immigrants in the United States make substantial sacrifices to maintain an intact family structure resulting in a lower divorce rate than other ethnic groups (Zhang, 1993).

Harold W. Stevenson (1992), in his cross national studies of children's home and school experience as related to academic success, suggests a link exists between the level of satisfaction with children's school and their academic achievement. He shows that far fewer Asian mothers, specifically Chinese and Japanese relative to American parents, said that they were very satisfied with their children's school or their achievement.

So while urging children to do well in school for the honor and pride of the family, Asian American parents help children to build self-confidence by telling them they have the ability to do well, an American value. They encourage children to look at things in a positive and optimistic way and reward good performance (an American norm), but they do stress shame if achievement falls below expectations (an Asian norm).

Attitudes about success in mathematics and acquiring an education stem from the family environment. Researchers have compared Asian and American learning environments. People who share a common cultural background will also share to a certain extent common patterns of intellectual abilities, thinking styles, and interests (Lesser, 1976). National differences may reflect culturally transmitted values, beliefs, and behaviors (Hess, 1987).

Education ranks first in Asian homes. It is viewed as a once in a lifetime opportunity and is a highly prized commodity in their culture (Stevenson, 1983). Asians are group-oriented and will sacrifice personal gains for the good of the group (Campbell & Connolly, 1984). They are more competitive than Americans, as honor and prestige are integral parts of their character (Campbell & Connolly, 1984, 1987). Chinese Americans retain the beliefs, attitudes, and values of their former countries (Campbell &

Connolly, 1987; Huntsinger & Jose , 1993). Dornbusch et al. (1987) examined Asian Americans across different generations and found that first-generation Asian American students exerted more effort than third-generation students. Hsia (1985) explained the high achievement of Asian American students as a product of traditional Asian discipline.

The Asian parents are very supportive of their children's dedication and inner drive. These parents have equal expectations for sons and for daughters and encourage both to enter technical fields (Campbell & Connolly, 1987) and pursue higher education (Youn, 1994). This attitude in turn leads males to having fewer stereotyping ideas of females.

The parental processes used by Chinese American and Caucasian American parents differ (Huntsinger, 1992). Campbell and Connolly (1984, 1987) showed that Asian American parents took an active role in creating a supportive atmosphere, supervising homework and providing tutors. Asian American children spend more time on homework than any other ethnic group (Muller & Kerbow, 1993). Other American children spend much less time on homework and receive less help from parents (Stevenson et al., 1986). Japanese American and Chinese American parents purchase supplemental mathematics and science materials to help their children with school work. The intellectual resources at home were found by Campbell and Wu (1994) to be connected positively with students' achievement among Chinese families. Chinese American fathers give more help in mathematics, and mothers assist in other subject areas (Stevenson, 1983). These parents provide specific instructions and give positive reinforcement to sons (Huntsinger & Jose , 1993). Chinese American parents use pressure as a motivational device to excel. Comparisons between neighboring children are more evident in Chinese American homes than in other American homes (Campbell, 1994).

Asian Americans in the NELS:88 Database

Researchers in some NELS:88 studies have explored achievement and parental involvement among Asian Americans. Muller and Kerbow (1993) examined the relationship between Asian American students and their parents. Although the Asian American students demonstrated higher achievement levels than other ethnic groups, parental involvement was mixed. Asian American parents spent less time speaking to their children about current school experiences, contacting the school about academic matters, or planning their high school program than other parents in the study. In this same study, Asian American parents had the least contact of any ethnic group with other parents from their children's school.

However, Asian American parents spent more time than other ethnic groups checking their children's homework, enrolling their children in computer courses outside the school, and spending money on education more often than other ethnic groups. Asian American students had the highest achievement scores and grades of any ethnic group in the study (Schneider, 1993; Muller, 1993). Asians are more likely to be enrolled in senior level mathematics and science courses, including advanced placement courses (Hoffer & Moore, 1996).

Chapter III

Methods, Subjects, Statistical Analyses

The present study is a correlational research study. This type of research was considered to be the most suitable for answering the proposed questions. The research questions, the design of the study, the selection of instruments, and population were established in accordance with guidelines based on the correlational research.

Because of the complicated nature of the NELS:88 data set, the research problem, and the inclusion of many variables, it is necessary to use statistical methods that are appropriate for the study. PLSPath analysis together with factor analysis were used to explain the interrelations among the variables of the study.

Methods

The survey research method selected for this study involved questionnaires and attitude rating scales. Instrument development was guided by the research objectives of NELS:88. Questionnaires were designed to meet the longitudinal goals of the study; items were chosen based on their utility in predicting or explaining future outcomes as measured in later survey waves. All of the questionnaires employed in the base-year, first follow-up, and second follow-up surveys were framed to provide continuity and consistency with earlier education longitudinal studies, such as the National Longitudinal Study of 1972, the High School and Beyond study, and the National Assessment of

Education Progress study, as well as to address new areas of policy concern and to reflect recent advantages in theory (Owings, 1994).

Data Set

The National Education Longitudinal Study of 1988 (NELS:88) provides longitudinal data that spans all four high school years. A national random sample of 24,599 eighth graders attending 1,000 public and private schools and their parents, teachers, and school administrators provides an important database of information on parent involvement (Rock, 1995). Conducted by the National Center for Education Statistics (NCES), NELS:88 is the third in a series of national longitudinal studies of American students that began in 1972. NELS:88 differs from other longitudinal studies in that the first data collection phase occurred when the students were in eighth grade. A substantial subsample of the NELS:88 students were resurveyed in 1990 as sophomores and in 1992 when they were high school seniors. The two previous NCES studies, in 1972 and 1980, began when the students were in secondary school and followed them through post secondary school into adulthood (Schneider, 1993).

Substantively, NELS:88 was designed to examine student achievement over time and to focus on family, community, school, and classroom factors that may promote or inhibit educational success. NELS:88 provides state-of-the-art information in mathematics, science, reading, and history for its respondents. Detailed information about the respondents' families, schools, and other experiences is available as well. Specific issues addressed by NELS:88 which were consistent with this researcher's interests include: the relationship between the parents and their children, parents' investments in out-of-school educational activities such as computer lessons, parents' investment in computers in the home, and parents' knowledge of their child's activities.

The NELS:88 base year study collected data from students, parents, teachers, and school administrators. Questionnaires and tests represented the principal modes of data collection. The student questionnaire solicited information on basic demographic areas and on a range of other topics, including schoolwork, aspirations, and social relationships. Students also completed a series of curriculum-based cognitive tests. One parent of each student was asked to respond to a parent survey to gauge family willingness to commit resources to their children's education, home environment rules, and other family characteristics related to achievement (Schneider, 1993).

The base year survey employed a two-stage, stratified sample design. The first stage of the sample involved the schools, and the second stage focused on the students within the selected schools. To ensure a balanced sample, schools were first stratified by region, urbanicity, and by the percentage of minorities prior to sampling. The school sample consisted of eighth graders enrolled in public and private schools (including independent, Catholic, and other types of religious schools). Schools considered ineligible were those that served special student populations, such as the Bureau of Indian Affairs schools, special education schools for the handicapped, and schools for dependents of U.S. personnel overseas. From a national population of eighth-grade students enrolled in 39,000 schools, a total of 1,057 schools participated in the study.

Within each school, approximately 26 students were randomly selected. Two additional Hispanic and Asian/Pacific Islander students were also included (over sampled). Hispanics and Asians were selected at a higher than normal rate in the base year and have been disproportionately retained in the study (Owings, 1994). The over-sample of Hispanics and Asian Americans makes the NELS:88 study particularly valuable for examining the racial and ethnic differences of parental resources (Schneider, 1993).

By design, the basic unit of analysis for most of NELS:88 analyses is the student. There were three test administrations (springs of 1988, 1990, and 1992), when students were added or deleted from the sample. Because of the sample freshening, NELS:88 constitutes a nationally representative sample of spring term 1990 sophomores and spring term 1992 seniors, as well as 1988 eighth graders (Owings, 1994).

Subjects

The subjects for this study were limited to include only those students in the NELS:88 study who were in the 12th grade in 1992 and who had participated in the first three waves of the study. This sub-sample was chosen in order to be able to measure achievement in mathematics and science (proficiency scores). For the purpose of this investigator, 640 ethnic Asian students were analyzed.

Test Scores

NELS:88 administered four achievement tests: reading (21 questions, 21 minutes), mathematics (40 questions, 30 minutes), science (25 questions, 20 minutes), and history (30 questions, 14 minutes). The NELS:88 tests were designed to measure achievement growth. In the base year, all students received the same tests. For the first follow-up in reading and mathematics, NELS:88 used multiple test forms targeted to students' performance on their base year test. Respondents with higher performance on the base year test were given a more difficult test to provide a higher ceiling. The same procedure was repeated for the second follow-up. NELS:88 used two forms in reading and three in mathematics. Tailoring the follow-up tests to respondents' likely achievement levels should increase the accuracy of the tests. In science, NELS:88 did not use multiple test forms tailored to respondents' base year performance because of the cost and complexity. Everyone took the same test with more difficult items added to the test.

The NELS:88 collected basic information on the skills that teachers and other experts think are important. NELS:88 selected items representing a range of possible topics within the most important content and skill areas.

Theta Scores

The IRT Theta "T" score has a mean of 50 and a standard deviation of 10 where the standardization was carried out on the weighted panel sample, i.e., on people who had all three data points. Every individual has a score in this metric, and all the usual statistical operations that are typically used with gain scores are appropriate. The Item Response Theory model allows one to put all the scores on the same vertical scale so that scores, regardless of the grade, can be interpreted in the same way. All the normal statistical operations that apply to any cognitive test score can be legitimately applied to the IRT Theta score.

Weighting the Data

The general purpose of weighting survey data is to compensate for unequal probabilities of selection and to adjust for the effects of nonresponse. Weights are often calculated in two main steps. In the first step, unadjusted weights are calculated as the inverse of the probabilities of selection, taking into account all stages of the sample selection process. In the second step, these initial weights are adjusted to compensate for nonresponse; such nonresponse adjustments are typically carried out separately within multiple weighting cells. This procedure was used for NELS:88 data (Owings et al., 1994).

The F2PNLWT is a longitudinal weight that applies to sample members who completed a questionnaire in 1988, 1990, and 1992 (all three rounds of NELS:88). This weight can be used to make projections to the population of 1988 eighth graders. This weight was used to calculate the relative weight and the design weight of the sample in the study.

Statistical Analyses

A series of outlier and assumption testing was made. Outliers were detected by calculating standardized residuals and Mahalanobis distances for the predictor variables. The removal of outliers from the data set was performed according to the suggestions made by Tabachnick and Fidell (1989). Following the removal of outliers from the data set, testing for violations of the assumptions of heteroscedasticity, normality, and linearity was conducted. To test for heteroscedasticity, scatterplots of the residuals for each dependent variable were plotted against predicted values. The multivatiate normality assumption was determined by residual plots. The multivariate linearity assumption was tested by plotting the residuals of the predicted variable against the residuals of the dependent variable.

Hierarchical Regression analyses were performed as a preliminary step for the path analyses. Regression analyses are a set of statistical techniques that allow one to assess the relationship between one dependent variable (DV) and several independent variables (IVs) (Tabachnick & Fidell, 1989).

Multiple regression is an extenuation of bivariate regression in which several independent variables (IV's) instead of just one are combined to predict a value on a dependent variables (DV) for each subject. The preselected factors entered the equation in an order specified by the researcher. That order has to be based in theory, logic, and past research (Keith, 1988). Each independent variable is assessed in terms of what it adds to the equation at its own point of entry (Tabachnick & Fidell, 1989). Regression analysis was used to compare the results with the path analysis. The disadvantage of the regression analysis is that it can detect only the direct effects between variables, whereas PLSPath can detect direct and indirect effects (Asher, 1983; Wolfle, 1982).

In path analysis, the sample size is sensitive to the number of predictor variables that are used in the regression equations (n/k ratio: n=number of subjects, k=number of predictors). If the ratios are too low, the results of these analyses can be inaccurate by capitalizing in chance (Campbell, 1994). Stevens (1986) recommended a fifteen to one ratio, whereas Falk and Miller (1992) suggested a five to one ratio.

Sellin's Partial Least Squares (PLSPath) program (1983) was used to determine the structural elements of the models that were analyzed. This version of PLSPath includes Jackknife procedures that omits one case at a time (blindfold) and re-estimates the model parameters on the remaining cases. The output includes Jackknife path coefficients (direct and indirect effects), Jackknife standard errors, and R^2 values. Taylor (1991) showed that Jackknifing reduces the danger of samples being overly specific.

In path analysis, like in hierarchical regression analysis, variables to be tested enter the equation in the same specific order. The significance of the path coefficients was determined by a formula provided by Keeves (1996) and is the value that is greater than one divided by the square root of the number of subjects multiplied by two.

Chapter IV

Results and Findings

This researcher investigated the relationship among, and the extent to which socio-economic status, family structure, computer access in the home, social capital, subject matter self-concepts, and prior achievement affected students' mathematics and science achievement.

Information was collected via questionnaires from the National Education Longitudinal Study: 1988-94 (NELS:88). The Statistical Package for the Social Sciences (SPSS)(SPSS Users's Guide, 1998) and the Partial Least Square Path Analysis (PLSPath Analysis) (Sellin, 1983) computer programs were used to analyze the data.

The questions selected for the social capital variables were from the Second Follow-up Student Questionnaire and the Second Follow-up Parent questionnaire. The questions were selected based on Coleman's theory of social capital (Coleman, 1982, 1987, 1990) and represent three social capital variables; Student's Perception of Interactions with Parents, Parents' Perception of Interactions with Student, and Parents' Interactions with Other Parents. Table 1, 2 and 3 list the questions used for each variable.

Another variable included is the availability of computers in the home. The HomePC variable is comprised of two questions: one from the Student Base Year questionnaire and one from the Base Year Parent questionnaire. Table 4 lists these questions.

The subject matter self-concept variables for mathematics and science are comprised of questions from the Student Second Follow-up questionnaire and are listed in Table 5. The SES variable and family structure variable (two parents, 2P) are separate variables from the Base Year Parent questionnaire. The information used to represent prior achievement (Pach) is the Mathematics and Science IRT Theta scores from the Base Year Student questionnaire. The dependent variable, achievement, is represented by the Mathematics and Science IRT Theta scores in the Second Follow-up Student questionnaire.

The original sample of 27,394 students was divided by ethnic background, and all the Asians in the study were separated. This method created a data set of 1527 students. From this data set, only the respondents to all three waves of the study in 1988, 1990, 1992 were kept in the data set. This criteria left the data set with 965 Asian students. Finally, only those students who participated in all three mathematics and science examinations and who had complete parental questionnaires were left in the data set. The final data set for the study was 640 students, 307 Asian American males and 329 Asian American females. Four of the subjects did not answer

Table 1

Student's Perception of Interactions with Parents

99. In the first semester or term of this school year, how often did you discuss the following with either or both of your parents or guardians?

1. Never
2. Sometimes
3. Often

F2S99A	Discussed School Courses with Parent
F2S99B	Discussed School Activities with Parent
F2S99C	Discuss Things Studied in Class with Parent
F2S99D	How Often Discussed Grades with Parents
F2S99E	Discussed Prep for the ACT/SAT Test
F2S99F	Discussed Going to College with Parents
F2S99H	Discussed Current Events with Parents
F2S99I	Discussed Troubling Things with Parents

Table 2

<u>Parent's Perception of Interactions with Student</u>

49. How frequently during the past two years have you and/or your spouse/partner talked about the following with your teenager?

1. Never
2. Sometimes
3. Often

F2P49A	Discuss with Teen Selecting Courses
F2P49B	Discuss with Teen School Activities
F2P49C	Discuss with Teen Things Teen has Studied
F2P49D	Discuss with Teen Teen's Grades
F2P49E	Discuss with Teen Plans to Take SAT/ACT
F2P49F	Discuss with Teen Applying to Colleges
F2P49G	Discuss with Teen Jobs Teen Might Apply
F2P49H	Discuss with Teen Community/National/World Events
F2P49I	Discuss with Teen Things Troubling Teen
F2P49J	Discuss with Teen Teen's Interests/Hobbies

Table 3

Parent's Interactions with Other Parents

55. How many parents do you talk to from time to time who have teenagers who attend the same school as your teenager (If you know both the father and mother in one family, please consider them together as one parent?

1. None
2. One or Two
3. Three to Five
4. Six to 10
5. Eleven to 20
6. More than 20
7. Not Applicable

56. How often do you talk to the parents of your teenager's friends about each of the following topics?

1. Seldom or Never
2. Once-Twice/Month
3. Once-Twice/Week
4. Almost Daily
5. Does Not Apply

F2P55	Number of Parents Respondent Talks to with Teens at Same School
F2P56A	Discuss Things at Teen's School with Other Parents
F2P56B	Discuss Teen's Education Plans with Other Parents
F2P56C	Discuss Teen's Career Plans with Other Parents

Table 4

Home Computer Access

35. Which of the following does your family have in your home?

1. Have
2. Do Not Have

BYS35H	Respondent's Family Has a Computer

70. Do you have a computer in your home that your child uses for educational purposes?

1. Yes
2. No

BYP70	Computer in Home Used for Educational Purposes

Table 5

Subject Self Concept

18C. Please rate these reasons in terms of how important they were to you in deciding to take the science course you are taking this term, from "not at all important" (0) to "very important" (5).?

F2S18CA	Respondent Interested in Science
F2S18CB	Respondent Does Well in Science

18D. Do any of the following sentences describe why you are not taking a science class this term?

1. Yes
2. No

F2S18DC	Respondent Not Interested in Science
F2S18DD	Respondent Doesn't Do Well in Science

22C. Please rate these reasons in terms of how important they were to you in deciding to take the mathematics course you are taking this term, from "not at all important" (0) to "very important" (5).?

F2S22CA	Respondent is Interested in Math
F2S22CB	Respondent Does Well in Math

22D. Do any of the following sentences describe why you are not taking a mathematics class this term?

1. Yes
2. No

F2S22DC	Respondent Not Interested in Math
F2S22DD	Respondent Doesn't Do Well in Math

Statistical Analysis

The initial step in the analysis of the data was to factor analyze the weighted data. The method used to extract maximum variance from the data set was principal components factor analysis. Criteria for stability of the factor analysis extraction depends on a large sample, numerous variables, and similar communality estimates (Tabachnick & Fidell, 1989). Factor analysis concentrates on variables with high communality. An estimate of factors was also determined by the size of the eigenvalues. The principal component extraction procedure isolated 12 factors with eigenvalues greater than 1.0. The scree test (Cattell, 1966) of eigenvalues plotted against factors was examined. Gorsuch (1983) reports the results of the scree test are more obvious and reliable when the sample size is large, communality values are high, and each factor has several variables with high loadings. This study's findings are in agreement with these requirements. The scree plot suggested six salient factors.

From the data, the first extracted factor with a substantial eigenvalue of 7.385 accounted for 23% of the variance among the 32 variables. The second extracted factor had an eigenvalue of 4.928, which explained 15% of the variance. The third extracted factor had an eigenvalue of 2.892, which explained 9% of the variance. The fourth extracted factor had an eigenvalue of 2.209, which explained 7 % of the variance. The fifth extracted factor had an eigenvalue of 1.932, which explained 6% of the variance. Finally, the last extracted factor had an eigenvalue of 1.504, which explained 5% of the variance. The six factor solution had a cumulative variance of approximately 65%.

A rotated factor matrix was generated yielding weighted factor scores. A factor analysis using a varimax rotation on six factors found strong loadings on all the variables for the study. A varimax rotation procedure maximized the variance of the loadings within factors and across variables, thereby creating a set of interpretable scales.

Variables with loadings of .30 and above provide for meaningful correlation and are interpretable (Tabachnick & Fidell, 1989). Comrey (1973) suggests that loadings in excess of .71 (50% overlapping variance) are considered excellent, .63 (40% overlapping variance) very good, .55 (30% overlapping variance) good, .45 (20% overlapping variance) fair, and .32 (10% overlapping variance) low. Choice of the cutoff for the size of factor loadings to be interpreted is a matter of researcher preference as expressed by Tabachnick and Fidell (1989). In this study, the cutoff selected was .30.

The factors for the study were named:

Social Capital 1 (SC1): Student's Perception of Interactions with Parents (see Table 6)

Social Capital 2 (SC2): Parent's Perception of Interactions with Student (see Table 7)

Social Capital 3 (SC3): Parent's Interactions with Other Parents (see Table 8)

Science Self Concept (SSC): Student Self-Concept in Science (see Table 9)

Math Self Concept (MSC): Student Self-Concept in Math (see Table 10)

Home Computer (HOMEPC): Home Computer Access (see Table 11)

The strongest factor was the Social Capital 1 (SC1) factor of student's responses to questions about their interactions with their parents. The other two social capital factors, parent's perceptions of interactions with students (SC2) and parent's interactions

Table 6

Principal Components Factor Analysis Loadings for the Factor Entitled:

Student's Perception of Interactions with Parents (SC1)

Variable	Loading
F2S99A	.773
F2S99C	.753
F2S99B	.730
F2S99I	.709
F2S99E	.669
F2S99H	.663
F2S99D	.636
F2S99F	.613
Eigenvalues: 4.928	

Table 7

Principal Components Factor Analysis Loadings for the Factor Entitled:

Parent's Perception of Interactions with Student (SC2)

Variable	Loading
F2P49A	.818
F2P49J	.768
F2P49C	.736
F2P49F	.734
F2P49B	.723
F2P49I	.706
F2P49E	.681
F2P49G	.632
F2P49H	.610
F2P49D	.591
Eigenvalues: 7.385	

Table 8

Principal Components Factor Analysis Loadings for the Factor Entitled:

Parent's Interactions with Other Parents (SC3)

	Variable	Loading
	F2P56B	.878
	F2P56C	.856
	F2P56A	.798
	F2P55	.565
Eigenvalues:	1.932	

Table 9

Principal Components Factor Analysis Loadings for the Factor Entitled:

Science Self-Concept (SSC)

Variable	Loading
F2S18DC	.918
F2S18DD	.907
F2S18CB	.882
F2S18CA	.876
Eigenvalues: 2.892	

Table 10

Principal Components Factor Analysis Loadings for the Factor Entitled:

Math Self-Concept (MSC)

Variable	Loading
F2S22CA	.919
F2S22CB	.911
F2S22DC	.845
F2S22DD	.845
Eigenvalues: 2.209	

Table 11

Principal Components Factor Analysis Loadings for the Factor Entitled:

Home Computer Access (HOMEPC)

Variable	Loading
BYS35H	.889
BYP70	.866
Eigenvalues: 1.504	

with other parents (SC3) were also strong factors. The self concept factors and the home computer access factors were the final components from the analysis. Each of the factors is independent of each other and revealed strong intercorrelations among the variables of each factor. The loadings for all the factors are considered excellent by Comrey (1973).

Multiple Regression Analyses

Regression analyses are a set of statistical techniques that allow one to assess the relationship between one dependent variable (DV) and several independent variables (IV) (Tabachnick & Fidell, 1989). Multiple regression is an extension of bivariate regression. It is a method for studying the magnitude of the effects of more than one continuous or dichotomous IV on DV (Kerlinger, 1986).

For this study, the researcher specified the order of IV entry into the regression equation, employing a hierarchical multiple regression technique. The entry of variables was determined according to logic, theory, and past research. The amount of variance added to R^2 by each IV is assessed at its own point of entry (Tabachnick & Fidell, 1989). It is desirable to have a high R^2, for it implies a more complete explanation of the phenomenon under study (Lewis-Beck, 1980).

In conjunction with the hierarchical regression, a series of outlier analyses and assumption testings were performed. Outliers were detected by calculating studentized residuals and Mahalanobis distances for the predictor variables. Tests for assumptions of linearity, multivariate normality, and homoscedascity were performed. Studentized residual histograms and normal probability plots tested for the assumption of normality.

Standardized scatterplots tested for linearity and homoscedascity. These testing procedures substantiated that the above assumptions were met.

As a result of these calculations, the total number of cases entered in further analyses was 307 Asian American males and 329 Asian American females. Table 12 lists the means and standard deviations for all measures in this analysis. Because the NELS:88 sample design involved stratification, disproportionate sampling of certain strata, and clustered probability sampling, the resulting statistics are more variable than they would have been had they been based on data from a simple random sample of the same size (Ingels, et al. 1993). One analytic strategy for accommodating complex survey designs is to use the mean design effect to adjust for the effective sample size resulting from the design. For Asians in the NELS:88 study, the mean design effect was calculated by the researchers at the National Center for Educational Statistics to be 2.556. The mean design effect was used to calculate the relative weight and the design weight of the sample. The formula is DESIGN WEIGHT = ((1/2.556) * (F2PNLWT/(ΣF2PNLWT/N))). This formula was applied to the data before the hierarchical regression analyses.

Hierarchical multiple regression was used to analyze the eight factors (SES, P2, SC1, SC2 SC3, HOMEPC, MSC or SSC, and PACH). Mathematics and science achievement was used as the dependent variable. There were four analyses:

1. Mathematics Achievement for Asian American Males (see Table 13)
2. Mathematics Achievement for Asian American Females (see Table 14)

Table 12

Means and Standard Deviations of the Study's Predictor Variables

for Asian American Male and Females

Variable	Mean	Standard Deviation
SES	.2983	.7360
P2	2.10	.42
SC1	1.93	.67
SC2	2.43	.64
SC3	1.85	.85
HOMEPC	1.52	.50
MSC	2.15	1.19
SSC	1.97	1.23
PACHMATH	49.100	8.32
PACHSCI	47.605	8.37

Table 13

Hierarchial Regression Equation for the Study's 8 Predictor Variables

Variables: Mathematics Achievement and Males

Variables	R^2	R^2Ch	FCh	SigCh
SES, P2	.140	.140	6.469	.002**
SC1, SC2, SC3	.762	.622	6.834	.000**
HOMEPC	.776	.014	1.673	.197
MSC	.799	.024	1.513	.212
PACH	.918	.118	72.376	.000**

Table 14

Hierarchial Regression Equation for the Study's 8 Predictor Variables

Variables: Mathematics Achievement and Females

Variables	R^2	R^2Ch	FCh	SigCh
SES, P2	.040	.040	1.827	.167
SC1, SC2, SC3	.436	.396	2.059	.013**
HOMEPC	.453	.017	.958	.389
MSC	.536	.083	2.618	.044*
PACH	.894	.358	193.47	.000**

Table 15

Hierarchial Regression Equation for the Study's 8 Predictor Variables

Variables: Science Achievement and Males

Variables	R^2	R^2Ch	FCh	SigCh
SES, P2	.143	.143	6.429	.003**
SC1, SC2, SC3	.640	.496	3.438	.000**
HOMEPC	.683	.044	3.655	.033*
SSC	.726	.042	1.889	.127
PACH	.826	.101	27.821	.000**

Table 16

Hierarchial Regression Equation for the Study's 8 Predictor Variables

Variables: Science Achievement and Females

Variables	R^2	R^2Ch	FCh	SigCh
SES, P2	.076	.076	3.486	.035**
SC1, SC2, SC3	.550	.474	3.005	.000**
HOMEPC	.558	.008	.517	.599
SSC	.602	.044	1.546	.201
PACH	.582	.130	26.990	.000**

3. Science Achievement for Asian American Males (see Table 15)

4. Science Achievement for Asian American Females (see Table 16)

The order of entry for the mathematics achievement for both male and female was as follows:

1. Socio-economic Status (SES), Marital Status (P2)

2. Social Capital 1 (SC1), Social Capital 2 (SC2), Social Capital 3 (SC3)

3. Home Computer Access (HOMEPC)

4. Math Self-Concept (MSC)

5. Prior Mathematics Achievement (PACH)

Using mathematics achievement as the dependent variable, the males' multiple regression analysis revealed three significant entries (Table 13). The SES and P2 variables accounted for 14% of the variance. The social capital variables of SC1, SC2, and SC3 accounted for 62.2% of the variance. Home computer access and math self-concept had little impact on the study's dependent variable. Prior mathematics achievement accounted for an additional 11.8% of the variance. Overall, these predictor variables accounted for 91.8% of the variance in the dependent variable.

The female analysis used the same order of variables and revealed two entries as being significant at the .01 level of significance (Table 14). The social capital variables accounted for the most variance with 39.6%. Prior mathematics achievement accounted for 35.8% of the variance. The math self-concept was significant at the .05 level and accounted for 8.3% of the variance. Home computer access, SES, and marital status had the least effect on the dependent variable. Overall, these predictor variables accounted for 89.4% of the variance.

Hierarchical regression was performed on the study's predictor variables using science achievement as the dependent variable for male and female subjects. The same order of entry for the factors was used as in the previous analysis.

1. Socio-economic Status (SES), Marital Status (P2)
2. Social Capital 1 (SC1), Social Capital 2 (SC2), Social Capital 3 (SC3)
3. Home Computer Access (HOMEPC)
4. Science Self-Concept (SSC)
5. Prior Science Achievement (PACH)

The results of the male analysis for science achievement revealed three factors significant at the .01 level of significance (Table 15). SES and marital status accounted for 14.3% of the variance. The social capital predictor variables accounted for 49.6% of the variance. Finally, prior achievement in science accounted for 27.8% of the variance. Home computer access was found to be significant at the .05 level of significance and accounted for 4.4% of the variance. Overall, the predictor factors accounted for 82.6% of the variance in male achievement.

The female regression analysis for science achievement revealed two factors significant at the .01 level of significance (Table 16). The social capital factors accounted for 47.4% of the variance and prior achievement in science accounted for 27% of the variance in the dependent variable. At the .05 level of significance, SES and marital status accounted for 7.6% of the variance. Home computer access (0.8%) and science self-concept (4.4%) accounted for little or no variance in the dependent variable. Once again, the predictor factors accounted for 73.2% overall of the model variance.

PLSPath Analysis

The final step in this analysis was a series of Partial Least Square Path Analyses (PLSPath) to analyze the direct and indirect interconnections among the eight factors for the dependent variables mathematics and science achievement. Path analysis is an outgrowth of regression analysis. The PLSPath program was developed by Sellin (1983), and each Path model contains specific interconnections among variables. Campbell (1996) recommends three criteria to consider in determining the ordering and direction of variables. The first consideration is chronology or time. The second criteria concerns a logical order of the variables. The third criteria involves previous research which provides information about the direction and position of the variables in the Path model.

For this study, the exogenous variables are Socio-economic status (SES) and marital status (P2). The endogenous variables are the social capital variables SC1, SC2, and SC3, home computer access (HOMEPC), math or science self-concept (MSC or SSC), and prior achievement in mathematics or science (PACH). Sellin (1989) recommends the data be standardized before entry into the program. For the purpose of attaching the design weight dictated by the NELS:88 database, the data were converted to z-scores for the analysis by PLSPath, thus standardizing the data for the path analysis.

The significance of the path coefficients was determined by the formula developed by Keeves (1988). The level of significance for the path coefficients was computed by dividing one by the square root of the sample size multiplied by two. Due to the design weights dictated by the NELS:88 database, the sample sizes for this study were N=124 for males and N=126 for females. However, each of these subjects stands for 121 Asian American students in the population (Owings, 1994). When used in Keeves' formula, the values for determining the statistical significance of each path coefficient was .1796 for males and .1782 for females.

The order of entry of the variables into the PLSPath models was as follows: SES, P2, SC1, SC2, SC3, HOMEPC, MSC or SSC, and PACH. There were four analyses:

1. Mathematics Achievement and Asian American Males (see Table 17)
2. Mathematics Achievement and Asian American Females (see Table 18)
3. Science Achievement and Asian American Males (see Table 19)
4. Science Achievement and Asian American Females (see Table 20)

Only the significant path coefficients are illustrated in the path diagrams(Figures 1 through Figures 4). Table 17 summarizes the males' Jackknife path coefficients using mathematics achievement as the dependent variable and Table 18 summarizes the females' results.

Results of the model on mathematics achievement for Asian American males were that prior achievement in mathematics was the best predictor of mathematics achievement (.7569). Access to home computer had a negative direct effect on mathematics achievement among males in the sample (-.1961). Home computer (-.2930) and social capital 3 (-.2143) had negative direct effects on prior mathematics achievement whereas math self-concept (.2858) had a strong positive direct effect on prior

Table 17

Male JackKnife Path Coefficients and Correlations - Mathematics Achievement - N=124

Dependent Variable	Predictor Variables	Direct Effects	Total Effects	Indirect Effects	r with Math Achievement
Math Achievement	SES	-.1143	-.1999*	-.0856	-.0184
	P2	.1494	.2464*	.0969	.0992
	SC3	-.0529	-.2463*	-.1934*	-.1805
	SC2	.0630	.3470*	.2840*	.2358
	SC1	.0245	.1483	.1238	.1308
	HOMEPC	-.1961*	-.4179*	-.2218*	-.4511
	MSC	.0279	.2442*	.2163*	.3637
	PACH	.7569*	.7569*		.8673

* $p<.05$ $R^2=.800$

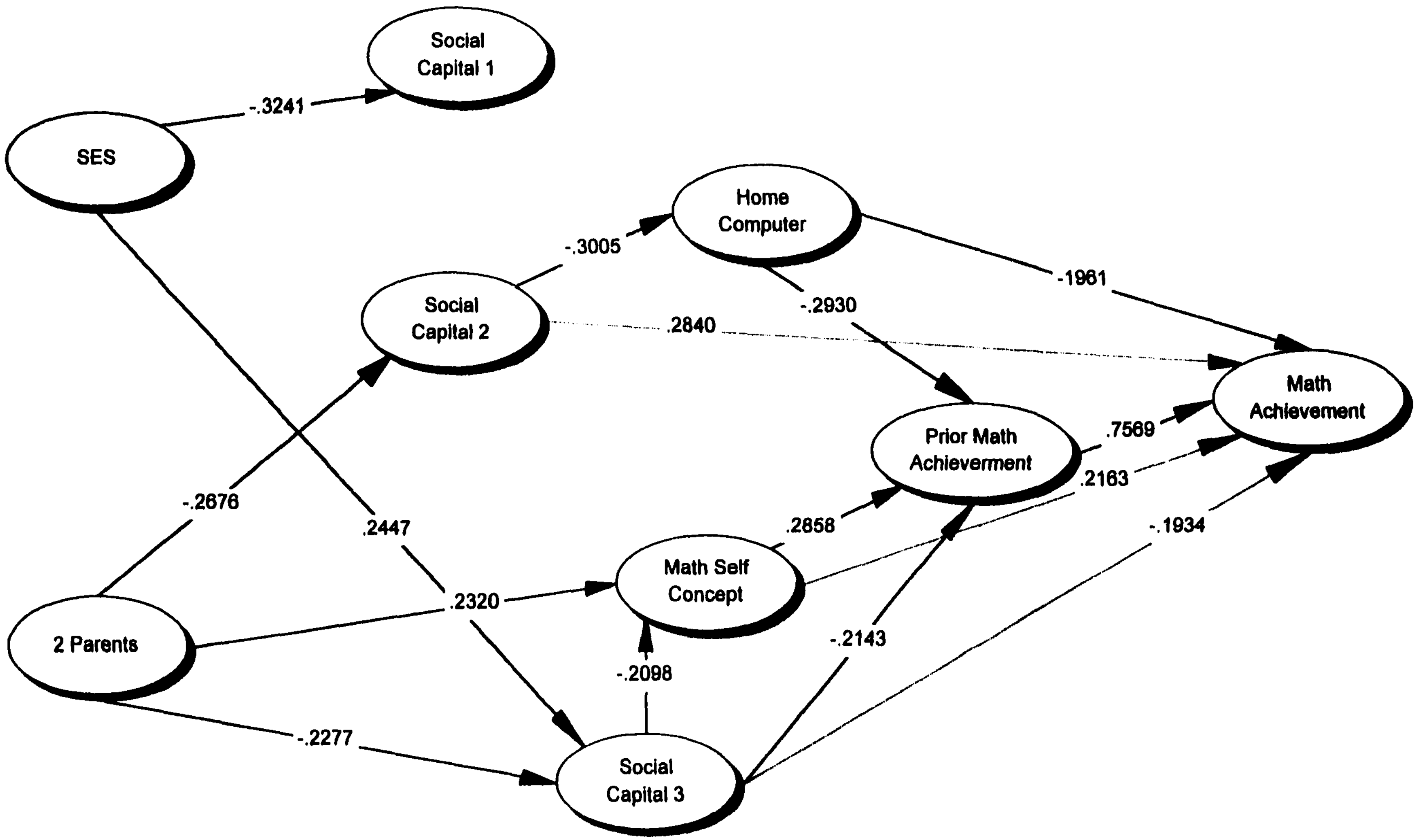

Figure 1 Path Analysis: Male Mathematics Achievement (Significant Paths)

Table 18

Female JackKnife Path Coefficients and Correlations - Mathematics Achievement - N=126

Dependent Variable	Predictor Variables	Direct Effects	Total Effects	Indirect Effects	r with Math Achievement
Math Achievement	SES	-.0814	-.0513	.0300	.0061
	P2	-.0008	.0796	.0804	.0425
	SC3	.0289	.0206	-.0084	.0911
	SC2	.0729	.2265*	.1535	.1969
	SC1	.0280	.2353*	.2073*	.2423
	HOMEPC	-.1039	-.2463*	-.1424	-.2828
	MSC	.1707	.2972*	.1265	.3504
	PACH	.7321*	.7321*		.7898

* $p<.05$ R^2=.691

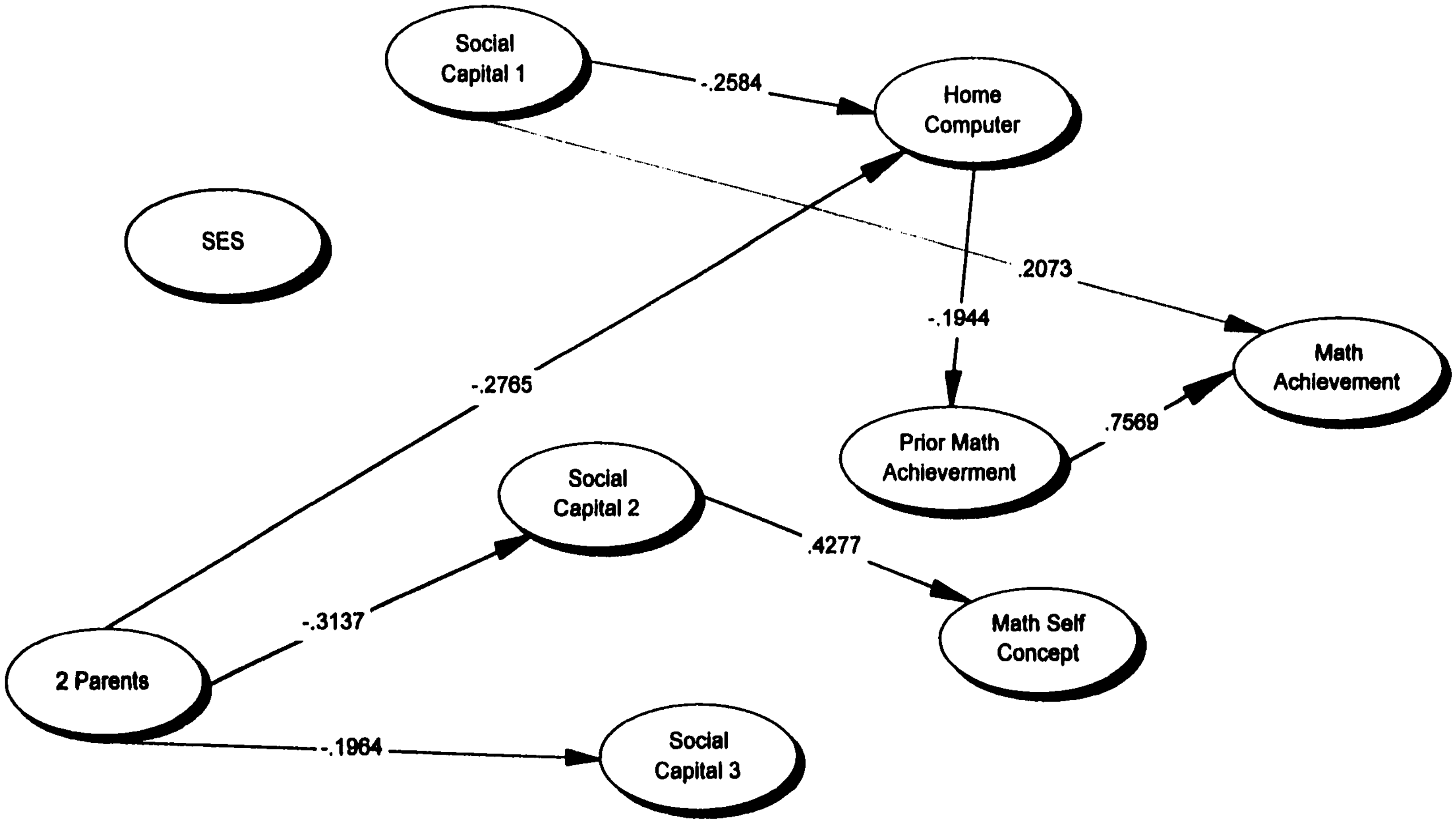

Figure 2 Path Analysis: Female Mathematics Achievement (Significant Paths)

mathematics achievement. The social capital 3 variable had a negative direct effect on math self-concept (-.2098) whereas the 2 parents variable had a positive direct effect on math self-concept (.2320). The social capital 2 variable had a negative direct effect on home computer access (-.3005). The 2 parents variable had negative direct effects on social capital 2 (-.2676) and social capital 3 (-.2277). Finally, SES had a positive direct effect on social capital 3 (.2447) and a negative effect on social capital 1 (-.3241).

The model revealed some substantial indirect effects on mathematics achievement. Math self-concept (.2163) and social capital 2 (.2840) had a positive indirect effect on mathematics achievement. Social capital 3 had a negative indirect effect on mathematics achievement (-.1934).

The results of the path model for Asian American females revealed one direct effect on mathematics achievement. Prior mathematics achievement (.7569) was the strongest statistically significant direct effect on mathematics achievement among females. Home computer (-.1944) was a significant negative direct effect on prior mathematics achievement. Social capital 1 was a negative direct effect on home computer as well (-.2584). The social capital 2 variable had a positive direct effect on math self-concept (.4277). The 2 parent variable had a negative direct effect on home computer (-.2765), social capital 2 (-.3137), and social capital 3 (-.1964).

Only one indirect effect was found in the path model. Social capital 1 had a positive indirect effect on mathematics achievement (.2073).

Table 19

Male JackKnife Path Coefficients and Correlations - Science Achievement - N=124

Dependent Variable	Predictor Variables	Direct Effects	Total Effects	Indirect Effects	r with Math Achievement
Science Achievement	SES	-.1221	-.1262	-.0041	-.0578
	P2	.0734	.0929	.0195	.0000
	SC3	-.0429	-.0320	.0109	-.0023
	SC2	.0042	.2201*	.2160*	.1900
	SC1	-.1010	.1371	.2381*	.1172
	HOMEPC	-.2966*	-.4393*	-.1426	-.4683
	SSC	.2929*	.4094*	.1165	.4302
	PACH	.4389*	.4389*		.6229

* $p<.05$ R^2=.534

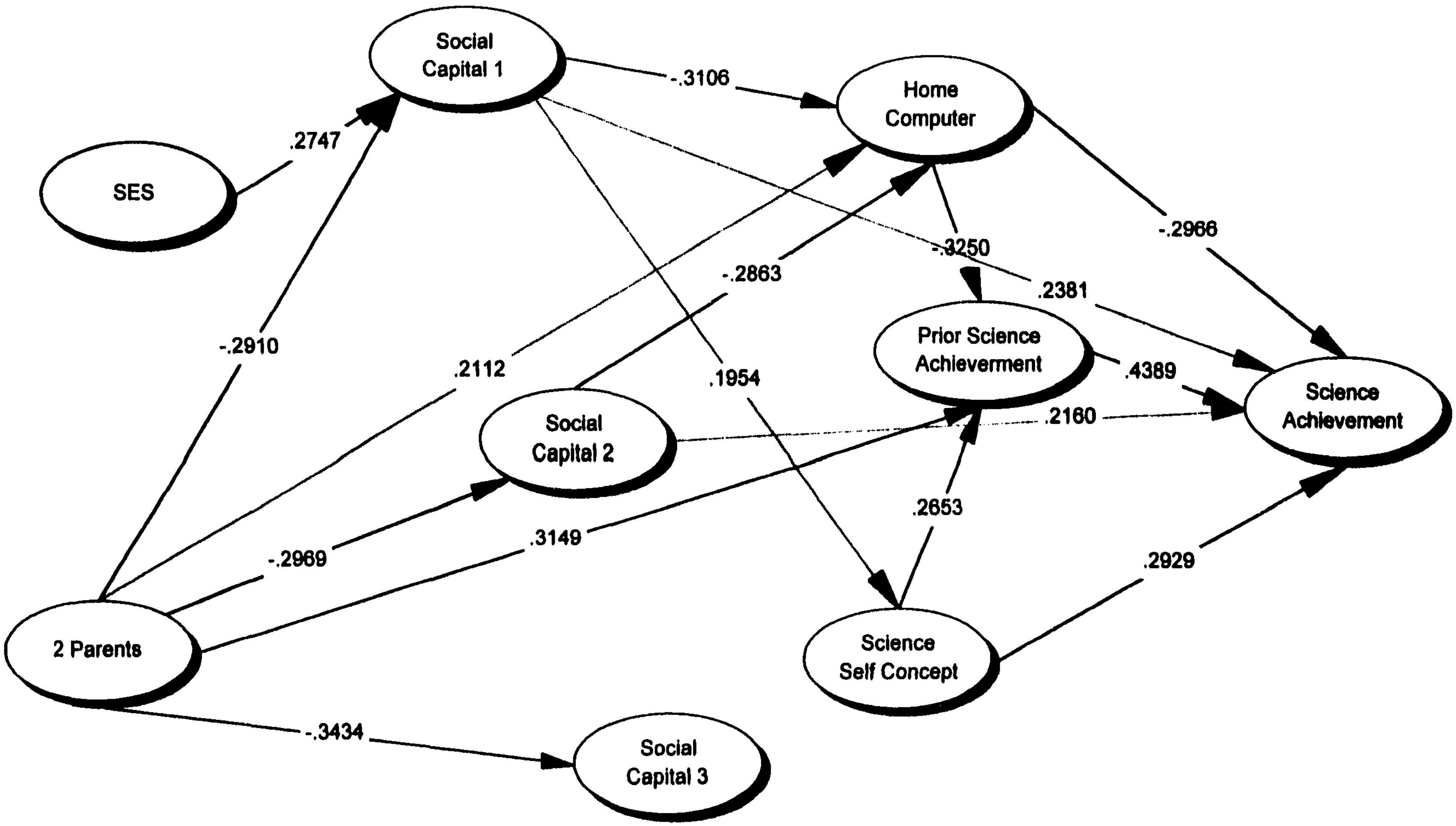

Figure 3 Path Analysis: Male Science Achievement (Significant Paths)

Table 20

Female JackKnife Path Coefficients and Correlations - Science Achievement - N=126

Dependent Variable	Predictor Variables	Direct Effects	Total Effects	Indirect Effects	r with Math Achievement
Science Achievement	SES	.0801	.0432	-.0369	.1251
	P2	.0916	.1134	.0219	.1446
	SC3	.0338	.0829	.0491	.0681
	SC2	-.0182	.1215	.1397	.0612
	SC1	-.0735	-.0485	.0251	-.0199
	HOMEPC	-.0859	-.2291*	-.1431	-.2919
	SSC	.2068*	.3118*	.1050	.2833
	PACH	.3791*	.3791*		.4850

* $p<.05$ $R^2=.293$

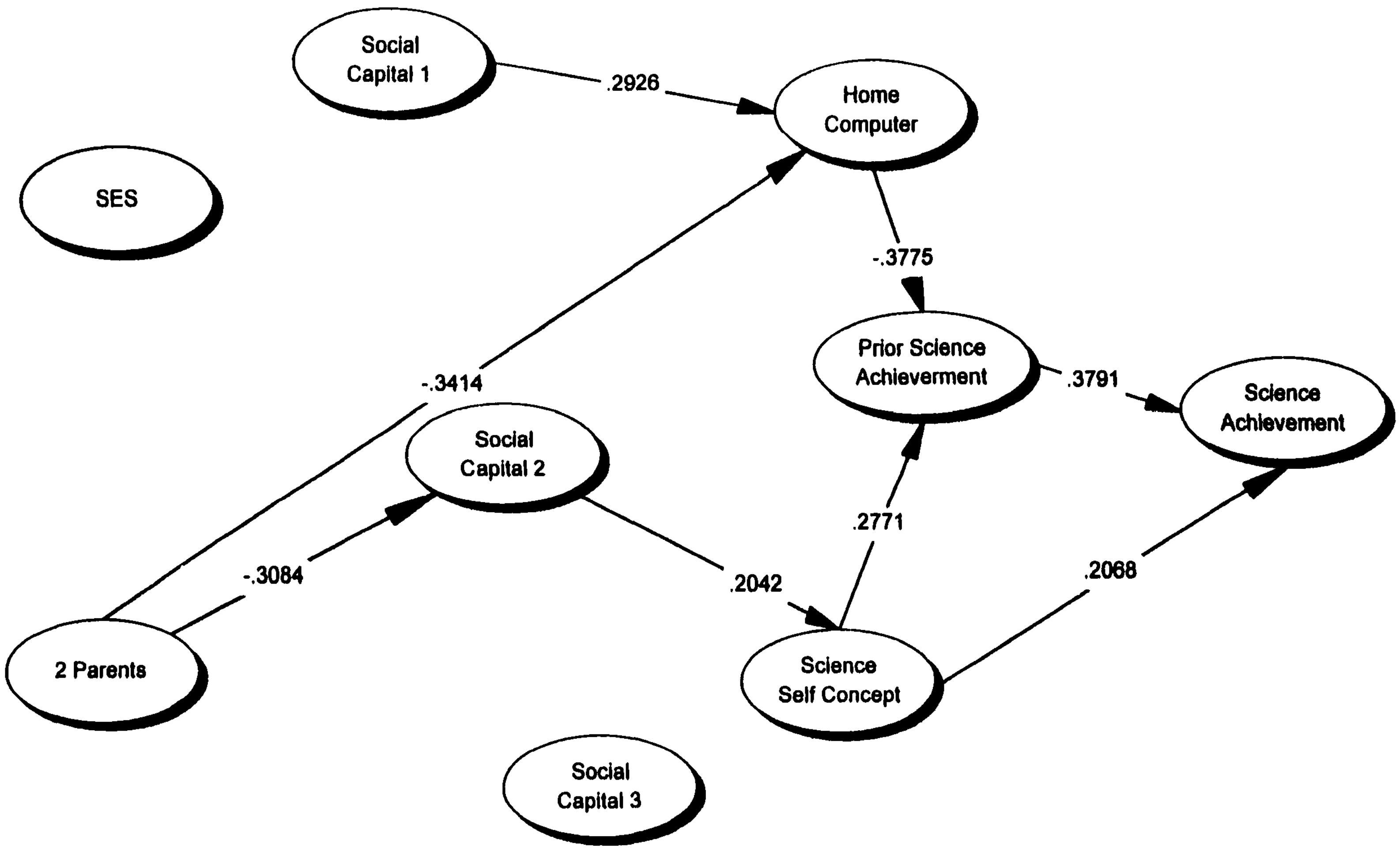

Figure 4 Path Analysis: Female Science Achievement (Significant Paths)

Table 19 summarizes the Asian American males' Jackknife path coefficients using science achievement as the dependent variable and Table 20 summarizes the Asian American females' results.

The results of this model revealed that the best predictor of males' science achievement was prior science achievement (.4389). As with the male mathematics achievement model, home computer had a significant negative direct effect on science achievement among males (-.2966). Science self-concept (.2929) had a significant positive direct effect on science achievement. Home computer had a negative direct effect on prior science achievement (-.3250) whereas science self-concept had a positive direct effect on prior science achievement (.2653). Social capital 1 (-.3106) and social capital 2 (-.2863) had negative direct effects on home computer. The 2 parents variable had negative direct effects on social capital 1 (-.2910), social capital 2 (-.2969), and social capital 3 (-.3434) among males. However, 2 parents did have a positive direct effect on prior science achievement (.3149). Finally, SES (.2747) had a positive direct effect on social capital 1 among males.

This model revealed some substantial indirect effects among Asian American males and science achievement. Both the social capital 1 (.2381) and social capital 2 (.2160) factors had significant positive indirect effects on science achievement. Social capital 1 had a positive indirect effect on science self-concept (.1954). The 2 parents factor (.2112) had a positive indirect effect on home computer among males.

The results of the path model for Asian American females revealed two direct effects on science achievement. Prior science achievement (.3791) and science self-concept (.2068) had significant positive direct effects on science achievement. Science self-concept had positive direct effects on prior science achievement (.2771). Home computer had a significant negative direct effect on prior science achievement (-.3775). The social capital 1 factor had a positive direct effect on home computer (.2926), and the social capital 2 factor had a positive direct effect on science self-concept (.2042). Finally, the 2 parents had negative direct effects on home computer (-.3414) and social capital 2 (-.3084). There were no significant indirect effects for females and science achievement.

Chapter V

Summary, Discussion, Conclusions, Recommendations

Summary

The purpose of this investigator was to examine the structural relationships among specific environmental, educational, and demographic factors and their effect on the students' mathematics and science achievement. The intervening factors included in this study were home computer access and social capital factors about the relationship of the students with their parents. Educational factors included prior achievement in mathematics or science and the self-concept of each student in these subject areas. The demographic factors included a composite of factors for socio-economic status and the family structure (one/two parent families). Salient direct and indirect effects of these factors were examined by gender for each of the two dependent variables.

Subjects for this study were the base year students from the National Education Longitudinal Study of 1988 (NELS:88) and the subsequent follow-up survey data in 1992.

The approximate sample size for this study is 640 ethnic Asians from the NELS:88 database. The analysis was a longitudinal study based on the Student and Parent Base Year responses and the Second Follow-up survey of 1992, when the subjects were in 12th grade. Total participants in this study included 307 Asian American males and 329 Asian American females and their parents. After calculating for design weights, the final sample size was 124 Asian American males and 126 Asian American females.

This study used the survey research of the NELS:88 study. The NELS:88 data surveys were monitored by the Longitudinal and Household Studies Branch (LHSB) of the National Center for the Education Statistics (NCES). NELS:88 was designed to provide longitudinal data about critical transitions experienced by students as they leave eighth grade school settings, progress through high school (or drop out), enter and leave postsecondary institutions, and enter the work force. The NELS:88 database integrates student and parent surveys and allows the examination of change in young people's lives and the role of parents and community in that process. NELS:88 was designed as a representation of each ethnic group on a national basis. Using the Asian Americans from this database represents a national sample of that ethnic group. The factors of this study were taken from questions in the survey, including achievement test scores from the base year of the study and the second follow-up survey.

The Statistical Package for Social Sciences (SPSS) was used to analyze the data collected from the database. A principal components factor analysis was used to extract the salient factors. The extraction procedure isolated six factors for the study, three social capital factors, two subject based self-concept factors, and a home computer factor. The specific factors were named:

1. Social Capital 1 (SC1): Student's Perception of Interactions with Parents
2. Social Capital 2 (SC2): Parent's Perception of Interactions with Student
3. Social Capital 3 (SC3): Parent's Interactions with Other Parents
4. Home Computer (HOMEPC): Home Computer Access
5. Math Self-Concept (MSC): Student Self-Concept in Mathematics

6. Science Self-Concept (SSC): Student Self-Concept in Science

After the factor analysis isolated the scales, each scale underwent item analysis, which produced item means, variances, and inter-item correlation. These data were used to detect variables that did not contribute to the reliability of each scale.

Hierarchical regression analysis was used to study the effects and magnitude of the effects of the study's predictor variables on the two dependent variables. The results indicated that among Asian American males and Asian American females, the social capital factors were good predictors for mathematics and science achievement. Prior achievement in mathematics and science were excellent predictors among Asian American males and Asian American females too. Although SES and P2 (two parent homes) were good predictors among Asian American males for mathematics and science achievement, it was only a moderate predictor for Asian American females in predicting science achievement. The only self-concept factor that had moderate success as a predictor was math self-concept for Asian American females. The students' access to a home computer had no effect on the study's dependent variables among Asian American males and Asian American females.

The final step in the study was a PLSPath analyses of each dependent variable by gender. The data were standardized before entry. This version of PLSPath includes a Jackknife procedure that omits one case at a time (blindfold) and re-estimates the model's parameters on the remaining cases. The direction and ordering of the factors were specified by the researcher following previously established guidelines of chronology, logical order, and past research (Campbell, 1996).

Results of the mathematics achievement for Asian American males and Asian American females were that prior achievement in mathematics was the best predictor for both Asian American males and Asian American females. This result is consistent with those of previous empirical researchers that found prior achievement in a subject is the best predictor of success in that subject area (Campbell, 1994, Koutsoulis, 1995, Verna, 1996).

Home computer access exhibited a negative direct effect on mathematics achievement among Asian American males in the sample. The home computer factor exhibited a negative direct effect on prior achievement in mathematics for Asian American females and Asian American males in the sample as well. This result could be related to the similarities between television viewing and computers in the home. Walberg's productivity model found nine causal influences on student learning, of which television had a negative effect on achievement (Walberg, 1984). The computer, instead of being used for educational purposes, is providing another distraction in the home and reducing the amount of time children spend studying.

For Asian American females, math self-concept demonstrated a positive direct effect on prior achievement in mathematics and an positive indirect effect on mathematics achievement.

The social capital 3 factor (Parent's Interactions with other Parents) exhibited negative direct effects on prior achievement in mathematics and math self-concept as well as an indirect negative effect on mathematics achievement for Asian American males. This factor could be related to Asian parents speaking to other parents primarily about their children's problems in school and looking for guidance. Parents discussing their children's problems academically with other parents is common among Asian Americans (Peng, 1998). This form of behavior leads to increased pressure felt by the Asian American children to succeed academically (Campbell, 1994).

Two parent homes demonstrated positive direct effects on math self-concept among Asian American males and negative direct effects on both the social capital 2 (Parent's Perception of Interactions with Student) and social capital 3 factors. Both parents may work in this case, decreasing the opportunities for the parents to interact with their children and other parents from the school. The SES factor had a positive effect on the social capital 3 factor and a negative direct effect on the social capital 1 (Student's Perception of Interactions with Parents) factor. The parents with a higher SES factor may interact more with other parents but less with their own children.

Among the Asian American females for mathematics achievement, the two parent factor had negative direct effects on home computer access, social capital 2, and social capital 3. These factors may show that Asian American females have less access to a computer in the home and their parents' perceptions of their interactions with their daughters are less frequent in a two parent home. This result was found among the Asian American males and mathematics achievement as well. Asian American females had a positive indirect effect on mathematics achievement from the social capital 1 factor, which was the students' perceptions of the frequency of interactions with their parents.

The results for science achievement for Asian American males and Asian American females showed a strong positive direct effect for prior science achievement and for the science self-concept. Once again, the home computer access had a negative direct effect on science achievement for Asian American males. Home computer access also had negative direct effects on prior achievement in science for both Asian American males and Asian American females in this sample, suggesting a negative relationship between achievement and home computer access for both genders. Instead of using computers to complete homework assignments or perform research, heavy computer use may mean the students are using the computer more for video games, surfing the internet, or talking to other teenagers in on-line chat groups.

Among Asian American males and science achievement, two parent homes had negative direct effects on social capital 1, social capital 2 and social capital 3 factors. One may infer from this result that among Asian American males, limited interactions take place in two parent homes and parents have limited interactions with other parents as well. However, in a two parent home, Asian American males have a positive indirect effect on home computer access, suggesting that parents are more likely to supply the male with a computer. However, both the parents' perception of interactions with the student (SC2) and the student's perception of interactions with the parents (SC3) have a negative direct effect on home computer access in the home for Asian American males. This result leads to the assumption that a computer in the home reduces the opportunities for parents and their sons to discuss daily events and academics because the children may be spending time on the computer instead of interacting with their parents.

Among Asian American females in the sample, there was a positive direct effect between science self-concept and prior achievement in science but a negative direct effect between home computer access and prior science achievement. As with the mathematics results, there is a negative direct effect in two parent homes to home computer access and parental perceptions of interactions with students (SC2) for Asian American females. This result could be because in a one parent home, the parent is working and has less time for their daughters but buys a computer in an attempt to provide an educational resource for the children to access when they study and the parent is not at home.

Discussion

This study sought answers to the following research questions:

1. Is there a significant relationship between social capital and mathematics achievement?
2. Is there a significant relationship between social capital and science achievement?
3. Is there a significant relationship between student use of computers in the home and mathematics achievement?
4. Is there a significant relationship between student use of computers in the home and science achievement?
5. Is there a significant relationship between student use of computers in the home and their math self-concepts?
6. Is there a significant relationship between student use of computers in the home and their science self-concepts?

One may infer from the results of this study that the social capital factor of student perceptions of their interactions with parents (SC1) has a positive indirect effect on male science achievement and female mathematics achievement. Also, parents' perceptions of their interactions with student (SC2) has a positive indirect effect on science and mathematics achievement among Asian American males. There was no direct effect of any of the social capital factors on male and female achievement. The reason for a lack of positive direct effects on achievement by these factors could be attributed to the erosion of social capital in the family. As human capital has increased as measured by increased educational attainment, social capital has decreased, as measured by the presence of adults in the home and the range of exchange between parents and children about academic, social, economic, and personal matters (Coleman, 1987).

The results of Asian American males and mathematics achievement showed one social capital factor, parent interactions with other parents as a negative indirect effect on mathematics achievement. This result could be explained by the greater erosion of social capital in the Asian American community in the United States. The usual effective norms of social control, adult-sponsored youth organizations, and informal relations between children and adults have declined even more than the families, eroding the social capital of the community by an even greater margin (Coleman, 1987). Although the existence of two parent families should increase the opportunities for interactions between parents, there were numerous negative direct effects of two parent families on each of the social capital factors for male and female achievement. Among Asian American families, it is common for all members of the family to work, including both parents (Campbell, 1994). Social capital depends on the physical presence of the parents in the home. The nuclear family, with one or both of the parents working outside the home can be seen as structurally deficient, especially with the decrease of grandparents, aunts, and uncles in the immediate household (Coleman, 1988).

The presence of a computer in the home resulted in negative direct effects for both male and female subjects in mathematics and science achievement and prior achievement in mathematics and science. This result is consistent with another study on Math Olympians in the United states that showed that subjects with higher computer literacy had lower achievement levels than other Math Olympians (Campbell, 1997). Although other researchers have shown the benefits of having a computer in the home and achievement (Kitachi, 1987; Herman, 1988; Sasser, 1991; Lauer, 1995; Miller et al, 1995), the subjects of the studies used the computer for specific homework assignments from the school. This researcher only looked at the presence of a computer in the home and not how it was being used by the student. There were no questions in the NELS:88 study that specifically asked the students about their computer use in the home. Future surveys need to focus on how the computer is used by students in the home and, more importantly, how the internet is affecting computer use in the home.

The results suggested that the subject related self-concepts were directly affected by the social capital factors. Specifically, female math and science self-concepts were positively affected by the parents' perception of interactions with their daughters (SC2). This positive result demonstrates the influence that Asian American parents have on the self-concept of their daughters, who react more favorably to parental interactions than Asian American males. The results of the direct effect of parents' interaction with other parents suggest the negative impact of some social capital and self-concept among Asian

American males. Asian American parents tend to compare their children's academic success to other Asian American children. This practice creates a fierce competition among the children, which undermines the confidence of some children (Campbell, 1994). There was one positive indirect effect for Asian American males between science self-concept and student's perception of interactions with parents (SC1).

Conclusions

The conclusions drawn from these analyses are that prior mathematics and science achievement are the best predictors of mathematics and science achievement. This finding supports the view of other researchers on achievement. The negative effect of access to a home computer was not unexpected when considering other factors. A lack of supervision and expertise by parents contributes to the use of a computer in the home less as an educational tool and more of a substitute for television. Since it has been shown that television has a negative effect on achievement (Walberg, 1984), it is reasonable to assume that home computer use has the same negative effect on achievement.

The effects of the social capital factors on self-concept show the importance of family interactions on achievement. Other researchers (Marjoribanks, 1981; Blake,1989) have demonstrated the effects of family support and achievement. The positive direct and indirect effects of this study support the conclusions of previous researchers.

Future Recommendations

This researcher attempted to explore the growing influence of computers in the home and the changing demographics of the family. Future investigators may want to explore the computer programs and applications of the computer in the home among this nation's students and among different ethnic groups.

As social capital continues to decrease in the home due to changes in the family and an increased use of technology, there is a tendency to replace social interactions with more school-like resources (Coleman, 1987). Replacing the informal interactions of the family with this type of structured activity may not increase achievement or social growth. In an alternative study, an investigator may want to research the increase in structured family activities outside of school through scheduled playtime with other children and after school programs offered by private profit driven organizations and the effects on achievement these activities may develop or hinder.

The influence of the family and home computers on other ethnic groups such as African Americans, Latinos, and Caucasions should be researched in future studies.

Increasingly, our society is more dependent on technology, and the introduction of new technology into every aspect of our lives threatens traditional views on family and education. Exploring the effects these changes have on our lives will better equip the family of this century to deal with the changes that will occur in the next century.

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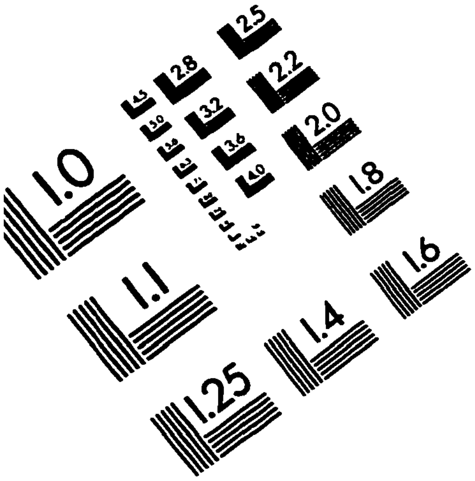
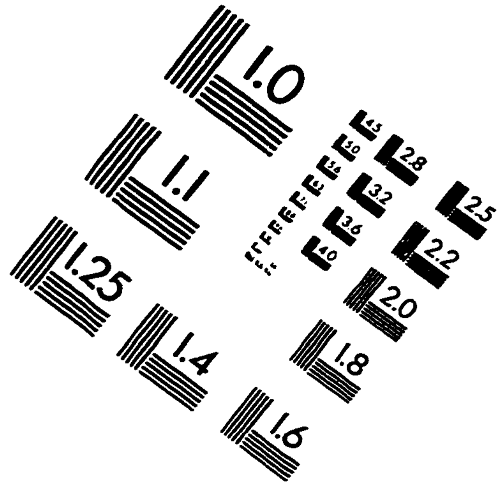
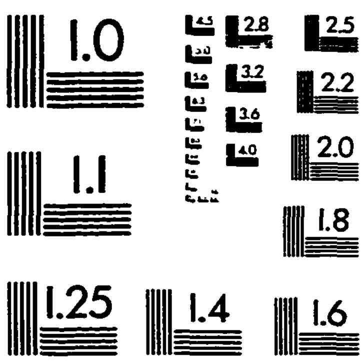
IMAGE EVALUATION TEST TARGET (QA-3)







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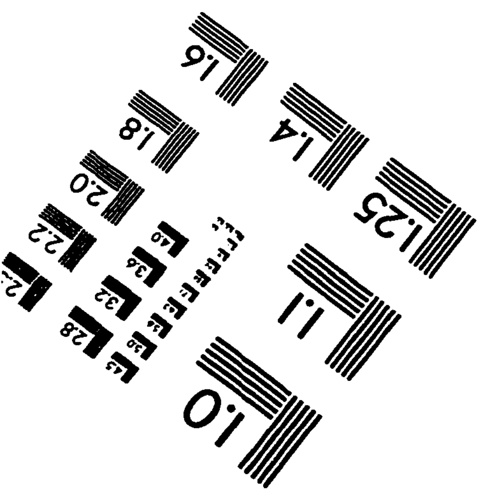

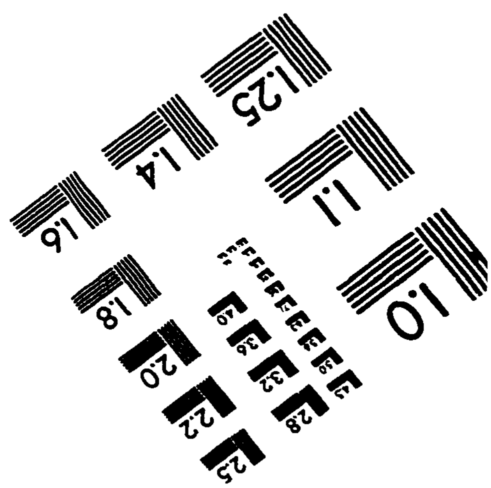

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