THE RELATIONSHIPS AMONG SCHOOL FACILITY CHARACTERISTICS, STUDENT ACHIEVEMENT, AND JOB SATISFACTION LEVELS AMONG TEACHERS

by

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(Under Direction the of C. KENNETH TANNER)

ABSTRACT

This study examined the relationships between the physical characteristics of the school, student achievement and behavior, and job satisfaction levels among teachers. The purpose of the study was to determine if correlations existed between schools with certain physical characteristics and high levels of student achievement, good behavior, or teacher satisfaction.

Specifically, 13 measures of the school facility such as the presence of natural light, carpet, acoustic tile, ventilation, noise, mold, consistent temperature control, and general maintenance were compared to 10 measures of student behavior and four measures of teacher satisfaction. Controlling for socio-economic status, teacher experience levels, and teacher education levels, these measures were compared to levels of student achievement on the Georgia High School Graduation Test, the SAT, and ACT.

The population of the study was 164 teachers from 28 high schools in Central and North Georgia. Each teacher provided a rating on a scale of 1 to 10 for each of the 27 measures. The data were correlated utilizing a series of Pearson product moment coefficients as an indication of the level of statistical relationship between measures. At least three responses were obtained from each of the 28 schools.

The results of these analyses indicated that among the schools participating in this study, no significant correlations existed between the physical characteristics of the school and student achievement. Moderate correlations existed between the quality of the physical environment, teacher satisfaction, and student behavior. The most significant correlation was revealed between teacher satisfaction and student behavior with 18% of the variance in teacher satisfaction ratings attributable to student behavior.

A variety of characteristics revealed significant correlations to health measures for both students and teachers. In general, teachers who worked in cleaner schools with better ventilation reported using fewer sick days and rated students higher for motivation; they reported less student lethargy and absenteeism as well.

From these findings it may be concluded that relationships do exist between the physical characteristics of the school, the level of teacher satisfaction, student behavior, and the health of teachers and students.

INDEX WORDS: School Facilities, Student Achievement, Student Behavior, Job Satisfaction Among Teachers, Ventilation, Acoustic Quality, Temperature Control, Natural Light, Carpet, Noise, Mold, Teacher Burnout, Student Health, Socio-economic Status

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DEDICATION

This document is dedicated to my family, who have supported me throughout my pursuit of higher education. My wife, my mother and father, and my four wonderful new children have provided me with the inspiration and the support I have needed throughout this process.

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CHAPTER 1

INTRODUCTION

The physical characteristics of the school have a variety of effects on teachers, students, and the learning process. Poor lighting, noise, high levels of carbon dioxide in classrooms, and inconsistent temperatures make teaching and learning difficult. Poor maintenance and ineffective ventilation systems lead to poor health among students as well as teachers, which leads to poor performance and higher absentee rates (Andrews & Neuroth, 1988; Burton, 1999; Crandell & Smaldino, 2000; Davis, 2001; Edwards, 1991; Frazier, 2002; Hathaway, 1995; Johnson, 2001; Lackney, 1999; Lyons, 2001; McGuffey, 1982; Nicklas & Bailey, 1997; Ostendorf, 2001). These factors can adversely affect student behavior and lead to higher levels of frustration among teachers, and lower job satisfaction. All these factors interact to hinder the learning process and perpetuate the shortage of teachers (Brouwers & Tomic, 1999; Borg & Riding, 1991; Byrne, 1991a; Ingersoll, 2001).

The problem stems in part from the trend toward more energy-efficient buildings. Since the energy crisis of the 1970's in the United States, school buildings have been built tighter, with more insulation, fewer windows, and relaxed ventilation standards in order to conserve energy. This has created a serious health hazard in some school systems where dust, mold spores, chemical fumes, and other allergens can be detected indoors at levels several times that of the outdoors (Sterling & Paquette, 1998).

> Impacts on health, well-being and performance may be hard to recognize. But indoor pollution levels may be 2-5 times, and occasionally 100 times, higher than outdoor levels, according to the U.S. Environmental Protection Agency (EPA). Studies indicate most Americans spend about 90 percent of their time indoors. Children are especially vulnerable because of the amount of time they spend indoors during the school day. (Ostendorf , 2001, para. 2)

The physical characteristics of aging or poorly designed schools can also inhibit learning with poor lighting, plumbing, and temperature control systems. The decision to build educational facilities with fewer windows in favor of fluorescent lighting may have reduced the amount of heat loss, but may also have created a more serious risk to health and performance. According to Lackney (2000), natural light and artificial full-spectrum lighting has been found to minimize mental fatigue as well as reduce hyperactivity in children, while students tend to react more positively to classrooms that have windows. Further, it has been found that fluorescent lighting may be related to greater amounts of hyperactivity in learners. Thermal comfort is also an important issue in relation to school facilities. Lackney (2000) states that classroom temperatures affect task performance and students' attention spans.

Leaky plumbing systems in poorly ventilated schools contribute to the growth of mold on bathroom surfaces (Davis, 2001). The affects of mold in the environment can be as minor as simple irritation of the sinuses or much more serious depending on the duration of the exposure and the susceptibility of those suffering from the effects. Some people experience temporary effects which disappear when they vacate the premises, while others may experience long-term effects (Davis, 2001).

> Certain health effects, such as those related to allergic reactions like irritation of the eyes, nose, and throat, dermatitis, exacerbation of asthma, and respiratory distress, have been proven to be associated with mold exposure. Other reported effects such as fever, flu-like symptoms, fatigue, respiratory dysfunction (including coughing up blood), excessive and regular nose bleeds, dizziness,

> headaches, diarrhea, vomiting, liver damage, and impaired or altered immune function have been identified in persons who have been exposed to mold via inhalation. (Davis, 2001, p.4)

These maintenance and design issues can have a serious negative effect on the learning environment for students and the working environment for teachers; it is a health hazard for all who spend significant amounts of time in the building. These effects: poor student behavior, lethargy, and apathy are some of the most consistently identified stressors for teachers (Abel & Sewell, 1999; Blasé, 1986; Dewe, 1986; Stenlund, 1995).

Beyond the direct effects that poor facilities have on students' ability to learn, the combination of poor facilities, which create an uncomfortable and uninviting workplace for teachers, combined with frustrating behavior by students including poor concentration and hyperactivity, lethargy, or apathy, creates a stressful set of working conditions for teachers. Because stress and job dissatisfaction are common pre-cursors to lowered teacher enthusiasm and attrition (Friedman, 1995; Rosenholtz & Simpson, 1990; Shann, 1998), it is possible that the aforementioned characteristics of school facilities have an effect upon the shortage of teachers.

What is lacking in the body of research related to the effects of school facilities upon student achievement and the performance of teachers is analysis of key characteristics such as lighting, ventilation, acoustics and temperature control in relation to measures of both student performance and teacher satisfaction. According to Schneider (2002), most studies have focused on single environmental media, neglecting the critical issue of interaction effects between daylighting, air quality, noise, thermal comfort, or other factors (p. 4). It is possible that relationships exist between all three areas of the

school environment: the quality of the school facility, behavior of students, and teacher satisfaction.

Certainly, more research is needed in this area. In fact, the federal government may act as a catalyst for such research. Section 5414 of the No Child Left Behind Act of 2001 calls for more research into the health and learning impacts of environmentally unhealthy public school buildings on students and teachers (U.S. Congress 2002).

Just as changes in the design of school buildings constructed during the energy crisis were driven by budget concerns created from rising energy costs, any future changes in school design trends are likely to be affected by the cost to taxpayers. Logic suggests the need for research into the specific effects of certain characteristics of school design for which tax monies will be spent before these changes will be realized.

There is considerable debate as to the relationship of funding to academic achievment. According to Schneider (2002), and Hanushek (1989), there is little correlation between capital expenditures and academic achievement. Conversely, Hedges, Laine, and Greenwald (1994), and Lockwood and McLean (1993), state that a correlation between spending and academic achievement does exist.

An analysis by Hanushek (1989) of 37 research articles on the direct effects of spending on achievement stated that “detailed research spanning two decades and observing performance in many educational settings provides strong and consistent evidence that expenditures are not systematically related to student achievement” (p. 49). However, Hedges, Laine, and Greenwald (1994) re-analyzed data from the same 37 articles and found that there was strong evidence to support a systematic positive relationship between resource input and school output.

Lockwood and McLean (1993) proposed that when the basic requirements of the educational process have been adequately funded, additional monies do improve the educational process. Their study concluded that once a base level of funding has been provided, the result of judicious spending on the instructional program should be evidenced in improved achievement (Lockwood & McLean, 1997). However, a study in Great Britian by Pricewaterhouse-Coopers (as cited in Schneider, 2002) analyzed the effects of capital investment on academic achievement, teacher motivation, school leadership, and other issues and found that relationships were weak. Stricherz (2000) noted that student achievement suffers in inadequate school buildings, but there is no hard evidence to prove that achievement rises when facilities improve beyond the norm.

Schneider (2002) summarized the debate, stating that existing studies on school building quality generally point to improved student behavior and better teaching in higher-quality facilities; however, "what is needed is more firm policy advice about the types of capital investments that would be most conducive to learning and to good teaching" (p. 9).

The lack of consensus is evidence of a need for further research of the specific effects of school building maintenance and design issues, not only on the student, but also the teacher and his or her job satisfaction, enthusiasm, and commitment to the profession. Should the study of these factors yield significant correlations to student achievement and overall levels of job satisfaction among teachers, it would provide justification to the allotment of monies for the renovation of existing facilities and the design of new facilities to include natural lighting, optimum acoustic and air quality in the classroom, and better temperature control, as well as proper maintenance.

Purpose of the Study

Previous studies have investigated the relationship of poor school building maintenance, including problems with ventilation, poor lighting, mold and mildew, and inconsistent temperatures in the classroom with student health problems, student behavior, and student achievement (Andrews & Neuroth, 1988; Crandell & Smaldino, 2000; Davis, 2001; Hathaway, 1995; Johnson, 2001; Lackney, 1999; Lyons, 2001; Moore, 2002; Sterling & Paquette, 1998; Stricherz, 2000; Tanner, 2000). Other studies have investigated the effects of student behavior on teacher satisfaction levels, having identified low job satisfaction as a precursor to burnout and the decision to leave the profession (Abel & Sewell, 1999; Blase, 1986; Borg & Riding, 1988; Brouwers & Tomic, 1999; Byrne, 1991; Coutanch, 1984); Dewe, 1986; Ingersoll, 200; Kyriacou & Sutcliffe, 1978; Stenlund, 1995).

The purpose of this study was to investigate the possible relationships of specific facility characteristics: light, acoustics, thermal control, and general maintenance, to student achievement, student behavior, and teacher satisfaction. In short, this study sought to investigate a very complicated and pervasive question. How much do design and maintenance issues in our schools affect the well-being and performance of teachers and students?

Research Hypothesis

The research hypothesis was: there is a positive correlation between building maintenance and design, job satisfaction levels among teachers, and student achievement on the Scholastic Aptitude Test (SAT), the (ACT) test developed by the American College Testing Program, Inc., and the Georgia High School Graduation Test (GHSGT).

Implications

Should this study yield a strong correlation between teacher satisfaction levels and the existence of poor climate and maintenance conditions in the school building, it would imply that these conditions affect not only the effectiveness with which teachers perform, and therefore the quality of instruction experienced by students, but also the rate of attrition among teachers. Whether teachers decide to leave the profession directly or indirectly because of the state of the building in which they work is likely to be hard to identify, but a strong correlation between low job satisfaction and a perception of poor facilities and student behaviors symptomatic of SBS would imply a relationship. It is entirely possible that the frustrations teachers experience from poor student behavior and achievement are related to the characteristics of the school facility.

Strong correlations would also imply that a greater devotion to building maintenance and climate control is needed in order to ensure optimum teacher and student performance. This researcher hoped to draw significant conclusions as to the validity of this argument by comparing levels of performance on the SAT, ACT, and the GHSGT of students with poor facilities as indicated on teacher questionnaires to levels of performance in schools where teachers describe the facility as adequate or excellent in this regard.

In the past, studies in this area have been limited to the affects of unhealthy buildings on student performance, and the degree to which student behavior affects teachers' job satisfaction. The unique aspect of this study was that it considered these charachteristics both in relation to individual characteristics and in relation to a series of grouped characteristics.

Assumptions

1. The sample of teachers who volunteered to participate was representative of teachers in high schools in the Central and North Georgia area.
2. The SAT, ACT, and GHSGT are valid measures of student achievement.
3. Teacher questionnaires provide a valid measure of building conditions and student behavior.
4. The percentage of students receiving free or reduced lunch was a valid measure of socio-economic status (SES).

Limitations of the Study

The study was limited to the following factors:

1. The schools in the study were limited to public high schools.
2. The schools in the study were limited to Central and North Georgia.
3. The teachers who participated in the study were all volunteers.
4. Student behavior and characteristics of each building were rated solely by the perceptions of teachers.
5. Student achievement was rated solely by published scores on the SAT, ACT and GHSGT for the individual schools.

Definition of Terms

1. Sick Building Syndrome: Situations in which building occupants experience acute health and comfort effects that appear to be linked to time spent in a building.

2. HVAC: Heating, Ventilating, and Air Conditioning, related processes designed to control conditions within buildings for comfort or for industrial purposes.
3. Ventilation: A system that circulates fresh air throughout a building, replacing stagnant air or noxious fumes with clean air.
4. Full-spectrum lighting: The use of light fixtures to illuminate the rooms of a building, which simulate natural light from the sun.
5. Mold: A type of fungi which grows in damp, poorly lit environments and can cause allergic reactions, breathing difficulties, and other health problems.
6. SAT: Scholastic Aptitude Test, a test of math, science, and reading skills used to measure a student's potential to succeed in college.
7. GHSGT: The Georgia High School Graduation Test, a series of tests to measure student achievement levels in English Language Arts, Math, Science, Social Studies, and Writing skills among Georgia students.
8. ACT: A set of tests used nationally as a criteria for determining student achievement and eligibility for admission to college, which was developed by the American College Testing Program, Inc.
9. Acoustics: The way in which sound travels throughout a building or room, and how it is absorbed or reflected by surfaces such as walls or floors.
10. Thermal environment: The characteristics of the climate control system of a building and the resulting characteristics of air temperature.

11. Building maintenance: The overall cleanliness and working condition of equipment and systems of a building, the state of repair of a building and the equipment within the building.
12. Circadian Rhythm: Circadian rhythms cue daily behavior patterns even in the absence of external cues such as sunrise or sunset, evidence that such patterns depend on internal timers. However, when living things are deprived of normal cues, they display a characteristic "free-running" period of not quite 24 hours and drift slowly out of phase with the natural world. Light, particularly bright light, is believed to be the most powerful synchronizer of circadian rhythms.
13. High School: For this study, the term high school will refer to public schools including grades 9 through 12.
14. Mean Individual Characteristic Scores: The mean rating for each school for a particular characteristic averaged from teacher responses.
15. Composite Scores: The mean rating for each school for a group of characteristics averaged from teacher responses (eg. Student Behavior, Teacher Satisfaction, Physical Environment).

Organization

Chapter one of the study consists of a description of the problem, purpose of the study, research hypothesis, implications of the study, assumptions, limitations, definitions of terms used, and the procedures used. Chapter two consists of a review of the literature relating to building maintenance and design, air quality and ventilation, thermal conditions, and their effect on student achievement and health as well as their effect on

teacher satisfaction and health. In addition, literature describing the effects of teacher enthusiasm and satisfaction on student achievement was considered, as well as the effect of teacher satisfaction on student achievement. Chapter three describes the methodology of the study, the criteria used to select the sample population, a description of the sample population, the instrument used in the study, and a description of how the data were collected and analyzed. Chapter four reports the findings of the study based on analysis of correlations between variables. Chapter five summarizes the findings, presents interpretations and implications, and presents recommendations to consider for future research.

CHAPTER 2

REVIEW OF RELATED LITERATURE

Perhaps the best way to analyze the body of knowledge relating to the study of school facilities, student behavior and achievement, and levels of job satisfaction among teachers, and the relationships thereof, is to first realize that the primary goal of educational research is almost always either directly or indirectly related to student achievement. The issue of teacher satisfaction is related and important, essentially in its relationship to student achievement. However, the present and pervading shortage of teachers nationwide makes possible links between SBS, school facility design, and teacher attrition rates an important topic of study. With this in mind, we must begin by examining the body of research that attempts to construct a variety of explanations of the factors that influence student achievement.

It is widely accepted that socioeconomic status (SES) is the primary determiner of student achievement. In its annual report to Congress on the condition and progress of education in the United States, The National Center For Educational Statistics (2002) states that student achievement outcomes are closely related to SES. The nationwide study of achievement levels among students in grades 4, 8, and 12, yielded results in both mathematics and science that indicated a high correlation between SES and student achievement (National Center for Educational Statistics [NCES], 2002).

> The level of poverty in the school was associated with student achievement. In all three grades, average scale scores decreased as the percentage of students in the school eligible for a free or reduced-price lunch increased. (NCES, 2002, p. 57)

International comparisons of reading literacy among 15-year-olds in 31 participating countries yielded similar results. “The socioeconomic status of students’ parents was positively associated with performance in reading literacy in the United States” (NCES, 2002, p. 56).

Associations between SES and student achievement among Georgia high school students are consistent with national statistics. For example, students who live and attend schools in affluent districts tend to perform better on standardized tests such as the SAT, ACT, and the GHSGT. Schools in the affluent East Cobb area north of Atlanta and the high-income regions of Gwinnett and Fulton Counties typically score in the top ten in Georgia on standardized tests. Although these schools all have over 2000 students, it is not uncommon for almost every student taking the GHSGT to pass on the first attempt, whereas the state average for the English Language Arts, Math, Social Studies and Science sections of the test is a combined 69% and a pass rate of 87% on the writing section of the test (Georgia Department of Education, 2003).

The 2001-2002 Georgia Public Education Report Card reports results consistent with this trend. The top ten schools in SAT total scores are primarily from affluent districts of Cobb, Fulton, and Gwinnett counties, seven of which have an average free and reduced lunch count of less than 7 percent. It is important to note that Woody Gap High/Elementary School was omitted from this comparison since it has only 100 students K-12, and only one student took the SAT in 2002.

The statistics are similar for each section (Math, Science, Social Studies, and English Language Arts) of the GHSGT. The highest performing schools typically have the lowest percentage of students eligible for free and reduced lunch, while the poorest

performing schools in the state are typically found to have the highest percentage of students eligible for free and reduced lunch (Georgia Department of Education, 2003).

One theory as to why this correlation exists is that low socio-economic school districts with limited resources fail to keep school facilities in good condition. A recent study in North Carolina (Burton, 1999) indicates that districts which yield undesirable test scores also suffer from inadequate facilities. Burton points out that districts in North Carolina with limited funds have poorer school facilities.

> Lacking adequate financial resources, districts are often unable to meet their capital needs. Delaying infrastructural repairs, improvements, or construction often leads to inadequate facilities. Eventually, it is widely believed, students pay the costs for this neglect. These costs manifest themselves through overcrowding; discomfort caused by poor ventilation, heating, and air conditioning; electrical wiring that does not lend itself to advanced technology; and building deterioration, that is, peeling paint, leaking roofs, and inoperable commodes. (Burton, 1999, para.10)

Interestingly, these outcomes do not follow racial lines in Burton's study. "Poor children, controlling for race, disproportionately attend schools with more deteriorated buildings than their better off peers" (Burton, 1999, para. 8). However, she pointed out that "black children, controlling for poverty, disproportionately attend schools with better buildings than Whites." This provided evidence that the problem is one of socio-economic status, not race.

In a recent report by Lyons (2001) for The Council of Educational Facility Planners International (CEFPI) the author stated that there is a significant correlation between student achievement and the state of the school facility. "Four recent studies that evaluated the relationship between school buildings and student achievement found higher test scores for students learning in better buildings and lower scores for students learning in substandard buildings" (Lyons, 2001, para. 43). He stated that a difference of

5 to 17 percentile points existed in test scores, which was a stronger effect on student achievement than the combined effects of family background, socioeconomic status, school attendance, and behavior (Lyons, 2001).

Lyons (2001) names a variety of problems that distinguish a good school facility from a poor one, including age, lighting, ventilation, temperature, and noise. In fact, many of these buildings cannot meet the Americans with Disabilities Act accessibility requirements. More than 75% of our schools were built before 1970 – three decades ago. By age 40, most buildings start deteriorating rapidly, even if all original equipment is replaced. Typical market forces suggest retiring our 42-year-old schools. But their service continues, perpetuating crowded classrooms, outmoded designs, poor communications systems, limited technology, and inadequate security (Lyons, 2001).

Air Quality and Temperature

According to Lyons (2001), ventilation and maintenance problems can trigger asthma, lethargy, an inability to concentrate, and drowsiness in students because allergens are not effectively removed from the atmosphere in the classroom, and high temperatures or inconsistent temperatures make students drowsy and sick or irritable. These problems are partially the result of building tighter buildings to counteract the loss of heat and to save energy during the 1970's. It was common practice during the 1970's to reduce ventilation rates from 15 cubic feet per person per minute to 5 cubic feet per person per minute. As a result, the Environmental Protection Agency (EPA) claims that indoor levels of pollutants may be two to five times higher than outdoor levels, and sometimes as high as 100 times as high (Lyons, 2001).

The EPA identifies some such conditions as Sick Building Syndrome (SBS). First employed in the 1970s, SBS describes a situation in which reported symptoms among a population of building occupants can be temporarily associated with their presence in that building (EPA, 1994).

Students and teachers with asthma or allergies suffer the most when exposed to mold and mildew, but even those with no apparent sensitivity to these conditions suffer from lethargy from the build up of carbon dioxide due to poor ventilation, and all suffer when the temperature is inconsistent between classes, or when classrooms are consistently too warm or too cold (Davis, 2001; EPA, 1994; EPA, 2000; Lyons, 2001).

Lackney (1999) asserts that these factors may affect not only the performance but also the overall health of children. "Children in 'sick buildings' have been found to exhibit clear signs of sensory irritation, skin rashes, and mental fatigue – all factors with the potential of decreasing the ability of students to perform" (Lackney, 2000, p. 27). "Poor indoor air quality has been linked to headaches, sore throats, sleepiness, lethargy, dizziness and asthma. Incidents of acute asthma attacks among children have doubled in the past 10 years and asthma is currently the number one reason American children are hospitalized" (Ostendorf, 2001, para. 3).

> According to a separate report by the EPA, "Children do not perform as well when they are sick or absent from school. Indoor air quality problems can result in absences because of respiratory infections, allergic diseases from biological contaminants, or irritant reactions to chemicals used in virtually every part of the school. Some conditions in the school environment are closely associated with the incidence of sick building syndrome and asthma symptoms, and asthma-related illness is one of the leading causes of school absenteeism, accounting for over 10 million missed school days per year. In addition, persons with asthma or other sensitivities may have reduced performance in the presence of environmental factors that trigger their asthma. All of these building-related illnesses result from the lack of effective indoor environmental quality management." (EPA, 2000, para. 6)

Lackney suggests that strategies for improving indoor air quality, such as increasing levels of fresh-air intake and increased ventilation rates in buildings, can help ensure that students can remain focused on the tasks of learning. According to Ostendorf (2001), prevention and problem solving usually necessitates managing pollution sources and using ventilation to control pollutants. A proactive approach costs less than resolving problems after they develop. It also saves money that would be better spent on educating students (Ostendorf, 2001).

Research by Andrews and Neuroth (1988) concurred, indicating the quality of air inside public school facilities may significantly affect students' ability to concentrate. The evidence suggests that youth, especially those under ten years of age, are more vulnerable than adults to contaminants found in some schools such as asbestos, radon, and formaldehyde (Andrews & Neuroth, 1988).

Another significant health risk related to poor ventilation is the presence of mold spores in the atmosphere and on surfaces. Molds can cause a variety of health problems such as minor allergic reactions, exacerbation of asthma, and even brain damage. In the school setting, mold can grow on wood, paper, paint, fabric, carpet, or even glass and bare concrete, while the spores can travel throughout the school in the atmosphere. Davis stated that floods, leaking pipes, leaking windows, and leaking roofs are all potential sources of moisture which can lead to mold infestation. "Increased ambient humidity as a result of inadequate ventilation or improper drying of flooded areas can also lead to mold growth" (Davis, 2001, p. 2). According to her report, the increased air tightness of newly constructed buildings can allow moisture to become trapped in exterior walls, creating an environment conducive to mold growth. Also, centralized heating and air-conditioning

systems can pick up contaminants and re-circulate them throughout the building thus potentially spreading the infestation.

> Consequences of poor indoor air quality in schools include: increasing risk of long and short-term health problems in teachers and students; a negative impact on students' ability to learn due to physical symptoms; reduced productivity of teachers; destruction of school equipment, including text books; and negative publicity for the school resulting in strained relationships among teachers, parents, and administrators. (Davis, 2001, p. 7)

Thermal comfort has been linked to academic achievement in several studies. Thermal conditions below optimum levels affect dexterity, while higher than optimal temperatures decrease general alertness and increase physiological stress (Lackney, 2000). McGuffey (1982) set the threshold of thermal comfort at 80 degrees F. Temperatures above 80 degrees F tend to produce harmful physiological effects that decrease work efficiency and output. (McGuffey, 1982).

According to Harner (1974), both math and reading skills are affected by temperature. He found a significant reduction in reading comprehension and reading speed occurred between 73.4 degrees F and 80.6 degrees F, while mathematical operations such as multiplication, addition and factoring were significantly reduced by air temperatures above 77 degrees F (Harner, 1974). A report by the Environmental Protection Agency agrees. It stated that temperature can affect the ability to perform everyday activities effectively.

> In addition to indoor pollution and ventilation, studies confirm that various human activities such as typing or driving a vehicle are diminished when people are demonstrably too cold or too hot. Temperature is also implicated in studies of sick building syndrome. Maintaining temperature at the high end of the comfort zone tends to increase symptoms, while temperatures at the low end of the comfort zone tend to reduce symptoms. (EPA, 2000, para. 7)

The same report indicates that fluctuations in temperature need not be drastic to adversely affect student learning. “There is also good evidence that moderate changes in room temperature, even within the comfort zone, affect children's abilities to perform mental tasks requiring concentration, such as addition, multiplication, and sentence comprehension” (EPA, 2000, para. 8).

Acoustics

Good acoustics are a key to learning, but noise from the outdoors, mechanical noise, and noise generated from within the classroom because of the hard concrete block walls and concrete floor, make it difficult for students to learn. According to Lyons (2001), “students require a higher level of acoustic quality than adults, and to attain the good speech recognition necessary for optimal comprehension and learning, classrooms must limit background noise, carefully manage reverberation of sounds, and keep outdoor noise to a minimum” (para. 18). When acoustic quality in the classroom is poor, students may not be able to completely understand instructions from the teacher, causing frustration, and poor performance (Johnson, 2001).

> Poor acoustics interferes with speech intelligibility, the ability of a student to hear and correctly interpret instruction of discussion. When a classroom sounds ‘echoey,’ or when outside traffic or noise from the gym class next door interrupts a student’s concentration, it’s likely that students will miss or misinterpret part of the teacher’s lesson. If this happens too often, a student may tune out because it’s too much of an effort to listen. As a result, learning suffers.
> (Johnson, 2001, para. 4)

Johnson (2001) added that students with learning disabilities are at a greater risk of suffering the affects of poor acoustics in the classroom, but that teachers are also affected. “They may have to speak loudly to overcome background noise and may be less inclined to repeat information” (Johnson, 2001, para. 6).

The acoustic environment of a classroom is determined primarily by two factors: background noise and reverberation time. Background noise refers to any undesired auditory stimuli that interfere with what a child can hear in the classroom. Common sources of background noise include airplane noise, construction, automobiles, playgrounds, gymnasiums, cafeterias, busy hallways, and noise from inside the room from talking or movement (Crandell & Smaldino, 2000). Traffic noise in particular has been linked to deficits in mental concentration. Students make more errors on difficult tasks when traffic noise can be heard in the classroom, and a greater likelihood exists of giving up on tasks before the time allocated has expired (Lackney, 1999).

Background noise in a classroom can inhibit the child's ability to perceive speech by masking the acoustic and linguistic cues available in the teacher's spoken message. In general, the spectral energy of consonants is less intense than vowel energy; therefore, background noise in the classroom predominantly reduces consonant perception (Crandell et al., 2000). Reverberation refers to the persistence or prolongation of sound as sound waves reflect off of hard surfaces, such as walls or floors. Reverberant speech energy reaches the listener after the direct sound, and overlaps with that direct signal, resulting in a 'smearing' or masking of speech. Like noise, reverberation tends to affect consonant perception adversely (Crandell et al.). The combined affects of background noise and reverberation are more serious than either factor alone. "The interaction of noise and reverberation adversely affects speech perception to a greater extent than the sum of both effects taken independently" (Crandell et al., p.365). In fact, their combined effects on speech perception can equate to a 40% to 50% reduction in speech perception (Crandell et al.).

The effects of classroom noise are not limited to students. Teachers also have been found to suffer ill effects from both background noise and reverberation (Ko, 1979). In a study of the effects of classroom noise on 1,200 teachers, results indicated that noise related to classroom activities and traffic or airplane noise were correlated with teacher fatigue, increased tension and discomfort, and an interference with teaching and speech recognition (Ko, 1979). In addition, Crandell (2000) reported that teachers have been found to exhibit a significantly higher incidence of vocal problems than do the general population. "It is reasonable to assume that these vocal difficulties are caused, at least in part, by having to increase vocal output to overcome the effects of classroom noise during the school day" (Crandell et al, p.365).

For teachers, sustained exposure to traffic noise in the workplace can lead to an increase in blood pressure. A review of a series of studies in the United States between 1980 and 1986 concluded that significant increases in blood pressure were associated with schools being near noisy urban streets (Evans, Kliewer & Martin, 1991).

These conditions can be controlled, however, with the use of acoustic tile on walls, carpeted floors, and proper location of schools away from airports, industry, or busy streets and highways whenever possible.

> HVAC blowers and breakout noise, caused by air vibrating in metal ductwork, are common sources of background noise. A simple solution to both problems is to install acoustic liners inside the ductwork. Melamine foam is especially suitable for this. It resists fungus and microbial growth, and does not contribute to airborne contaminants. High-density vinyl barriers within walls can help stop noise from spilling into adjoining rooms. (Johnson, 2001, para. 10)

Classrooms with suspended ceilings can be fitted with vinyl barriers behind the ceiling panels to reduce noise, and acoustic tile can be installed on the surface of walls to reduce reverberation within the classroom as well as the use of carpeted floors.

Proper maintenance is necessary, however, when using these materials. Although carpet absorbs noise, it must be vacuumed regularly to avoid an increase in dust and mold, and wet carpet must be allowed to properly dry to avoid growth of mold. Acoustic tile on the walls is useful in lessening noise, but one coat of paint on this tile ruins its effectiveness. The location of the school away from busy streets is often impossible, but proper insulation for new schools and adding insulation to older buildings whenever possible is advised.

Lighting

Natural light has been found to profoundly influence the body and mind by affecting our circadian rhythm, according to Lyons (2001). “It can alter our mood and is a major source of Vitamin D, required for strong bones and healthy teeth” (Lyons, 2001, para. 21).

Heschong (1999) supported this claim in a study of 21,000 students in Colorado, California, and Washington state. Students exposed to maximum daylight were found to have learned much faster. A study by Hathaway (1995) indicated that both attendance and achievement were better in schools with full-spectrum light or full-spectrum with UV enhancement. Nicklas and Bailey compared test scores for over 1,200 students in three schools with natural lighting in North Carolina to scores in the county school system as a whole and other new schools within the county without natural lighting. The study showed that students who attended schools with natural lighting outperformed the students in schools without natural lighting by 5%-14% (1997).

A study by Plympton, Conway, and Epstein (2000) revealed that an increase in the use of natural light was not found to increase costs:

> Schools found that increasing the amount of daylighting in school design did not necessarily represent an increase in school construction and operation costs. Incorporating design components such as light sensors, and optimizing mechanical and electrical systems due to reduced cooling and lighting loads, can actually reduce the initial capital cost because of the reduced size and cost of HVAC equipment. Furthermore, the operations and maintenance costs are reduced due to a smaller electrical load and a smaller number of lighting fixtures to maintain. (Plympton, Conway, & Epstein, 2000, para. 6)

Lighting has been linked to student behavior as well as performance. Ott (1976) found that using full-spectrum fluorescent tubes which more closely replicate natural light than the traditional cool-white fluorescent tubes can show dramatic improvement in some children's behavior in the classroom. Students in standard lighting were observed fidgeting, leaping from their seats, flailing their arms, and paying little attention to their teachers. Students in the full-spectrum lit classrooms settled down more quickly and paid more attention to their teachers (Ott, 1976).

General Maintenance

Some studies indicate that general maintenance affects student achievement by fostering the conditions that inhibit students' ability to perform well. Frazier (2002) stated that deferred maintenance can create an environment of peeling paint, crumbling plaster, nonfunctioning toilets, poor lighting, inadequate ventilation, and inoperative heating and cooling systems, which affects both the health and the morale of staff and students.

The Carnegie Foundation for the Advancement of Teaching found that in those schools which are under funded, morale is low, facilities are decaying, and the dropout rate remains high year after year (1988). This hypothesis was tested by the Washington D.C. school system. While controlling for socioeconomic status and other factors, Edwards (1991) found that as the school's condition improved from one category to the

next, for example, from poor to fair, student's standardized achievement scores increased an average of 5.45 points. With an improvement from poor to excellent, an increase of 10.9 percentage points was noted.

A recent study of New York City schools revealed that 40% of the 39 schools studied had filthy bathrooms with no soap nor toilet paper. Thirty-three percent had poor ventilation, and 24% had dirty cafeterias. Forty percent reported garbage lying around the school, and 30% had inadequate lighting. The author commented: "It is remarkable that at a time when children are being held to higher standards, there are few standards to protect their health from hazards at school, and that existing laws created to protect adult health and safety are being ignored" (Neglected Buildings, 1999, p. 2).

In addition to the need for adequate maintenance, some researchers propose the upgrade of school health programs to counteract threats to student health from inside and outside the school. A study by Symons, Cinelli, James, & Groff (1997), identified the health of the student as a primary determiner of the student's achievement. It stated that adolescents manifest difficulty learning when they are not in good health and suggested comprehensive health care services for students at school to lessen the effects of poor health. The authors admitted, however, that obstacles such as lack of administrative and governmental support as well as a lack of funding make this unlikely (Symons, Cinelli, James, & Groff, 1997).

Moore (2002) described four types of maintenance necessary in the school setting: emergency, routine, preventive, and predictive. She described emergency maintenance as that which takes place when a system fails; routine maintenance as corrective in nature and scheduled in advance, such as repairing systems or replacing

parts; and preventive maintenance as proactive in nature such as lubrication or cleaning. She asserted the need for a relatively new concept in maintenance called predictive maintenance to counteract poor conditions. She identified predictive maintenance as forecasting failures in plumbing, electrical, and ventilation systems and replacing them before they fail. The primary cause for the lack of such maintenance procedures is lack of funding.

"Reasons for the poor maintenance of our school facilities range from years of under-funding, to the sheer volume of tasks to be completed, to the natural preference to fund growth and development rather than maintenance" (Moore, 2002, para. 4). In addition, Moore identified problems with the quality of workmanship among school maintenance staff as part of the problem. A maintenance staff that is poorly trained or unmotivated can cause more harm than good.

Shideler (2001) also asserted the need for improved employee training in maintenance procedures. "Training employees in cleaning for health and safety empowers them to help produce cleaner, healthier facilities at less cost, enhances professionalism of a custodial department, raises morale and creates safer working conditions" (Shideler, 200, para. 1).

Discussion

The general body of research regarding the effects of SBS and related issues such as poor ventilation, lighting, acoustics, and cleanliness agrees that there is a significant relationship between these issues and student health and achievement in school (Andrews & Neuroth , 1988; Burton, 1999; Crandell & Smaldino, 2000; Davis, 2001; Edwards, 1991; Evans, Kliewer & Martin, 1991; Frazier, 2002; Harner, 1974; Heschong, 1999;

EPA, 2000; Johnson, 2001; Ko, 1979; Lackney, 1999; Lackney, 2000; Lyons, 2001; McGuffey, 1982; "Neglected Buildings," 1999; Nicklas & Bailey, 1997; Ostendorf, 2001; Ott, 1976; Plympton, Conway & Epstein, 2000; Symons, Cinelli, James & Groff, 1997). Teachers also suffer when the school facility is inadequate in this regard (Crandell & Smaldino, 2000; Evans, Kliewer & Martin, 1991; Johnson, 2001; Ko, 1979; Ostendorf, 2001). Researchers and industry professionals promote an increased emphasis on designing schools with better ventilation systems that move more air than is presently accepted, using full-spectrum lighting and/or natural light whenever possible, and the use of acoustic tile and carpet to lower noise levels in the classroom. Others promote improved training of custodial staff and higher standards of cleanliness.

Teacher Satisfaction

There are many studies investigating the different determiners of job satisfaction among teachers. Some of the variables identified are teacher autonomy, administrative support, relationships with parents, and feelings of efficacy, stress, and student behavior. Many of these issues were beyond the scope of this study, but the effect of the building itself on job satisfaction levels among teachers, whether directly or indirectly through its relationship to student behavior was relevant to this investigation. What is implied here is that poor conditions due to maintenance and design issues are adding to an already serious shortage of teachers and adversely affecting the commitment and enthusiasm they have for their profession, therefore affecting student achievement.

In a study by Richard M. Ingersoll (2001), the author analyzed data gathered by the National Center for Education Statistics through its Schools and Staffing Survey (SASS) and its supplement, the Teacher Follow-up Survey (TFS) involving 6,733

teachers. “The data show that, in particular, low salaries, inadequate support from school administration, student discipline problems, and limited faculty input into school decision-making, all contribute to higher rates of turnover, after controlling for characteristics of both teachers and schools” (Ingersoll, 2001).

The data in this study show that reasons for teachers leaving the profession are varied, but of particular interest to the facilities management issue are Ingersoll’s findings regarding student discipline and motivation. He reports: “For example, on a four unit scale, a one unit increase in reported student discipline problems in schools is associated with a 23 percent increase in the odds of a teacher departing” (Ingersoll, 2001).

Of the teachers polled, 18 percent cited student discipline problems as a reason to move to another school, and 30 percent cited student discipline problems as a reason to leave teaching altogether. In addition, 10 percent cited lack of student motivation as a reason to move to another school, while 38 percent cited lack of student motivation as a reason to leave the profession. Perhaps the most striking statistics are gathered from urban, high poverty schools. Among these schools, 29 percent cited student discipline problems as a reason to move to another school, and 27 percent cited student discipline problems as a reason to leave teaching, while 27 percent cited lack of student motivation as a reason to move to another school, and 50 percent cited lack of student motivation as a reason to leave the profession (Ingersoll, 2001). In light of the statistics, it seems no small coincidence that urban, poverty stricken schools tend to have poorer facilities overall. The findings of these studies provide evidence indicating that student discipline and motivation are two significant factors in determining the level of job satisfaction among teachers.

Much of the research available on the mental well being of teachers uses the term morale; however, a definition of morale is hard to pinpoint. Mendel (1987) described morale as a feeling, state of mind, mental attitude, or an emotional attitude. Washington and Watson (1976) defined morale as the feeling a worker has about his or her job in relation to where they are in the organization and the extent to which the organization meets their own needs and expectations. Bentley and Rempel (1980) called morale the professional interest and enthusiasm that a person displays towards the achievement of individual and group goals in a given job situation. Hoy and Miskel (1987) stated that morale is high when teachers feel a sense of accomplishment from their jobs. Although researchers do not agree on a specific definition of morale, evidence indicates that certain aspects of low morale lead to teacher attrition and poor performance in the classroom. Because the term morale is difficult to define and even harder to measure, this study focused specifically on the level of job satisfaction among teachers.

A study of the Texas public school system revealed that 44 percent of respondents (teachers) were seriously considering leaving the profession (Henderson & Henderson, 1996). Estes, Stansbury, and Long (1990) examined attrition rates, or "burnout," of teachers in the State of California and found that more than 50% of all newly hired teachers leave the profession in that state within 5 years. In a similar study, Colbert and Wolff (1992) discovered an identical rate of attrition.

Apparently the stresses of the workplace lead to lower job satisfaction and eventually the decision to choose another career usually within five years. Although each individual is affected by different aspects of the profession, researchers have tried to pinpoint the most common of these. Dewe identified inadequate resources, and feelings

of inadequacy or negative attitudes as sources of stress (1986). Pupil misbehavior and poor working conditions are two sources of stress among teachers identified by Borg and Riding (1981).

In a study by Byrne involving over 3000 subjects, the author identified student behaviors as primary sources of teacher stress. She cited no less than 16 articles of research in support of her claim. “In particular, student discipline problems, student apathy, low student achievement, and verbal and physical abuse by students have been shown to be primary sources of teacher stress” (Byrne, 1991a, p. 649).

The Environmental Protection Agency lists indoor air quality as one of the determiners of teacher morale. According to Ostendorf (2001), “Good indoor air quality can increase productivity, morale and a sense of comfort for teachers, administrators and all school occupants” (para. 3).

Effects of Low Satisfaction

As individuals, teachers are affected in different ways by stress. Dewe (1986) concluded that the psychological and emotional effects of stress include general uneasiness, depression, nervousness, anxiety, and a loss of confidence. Behavioral effects include procrastination, impatience with others, low productivity, absenteeism, and withdrawal from teaching (Dewe, 1986).

This researcher theorizes that the cycle of poor student attitudes and performance, poor conditions in the workplace, and low levels of satisfaction among teachers, repeats itself when teachers become so frustrated that their patience with low-achieving students and students with poor attitudes and behavior begins to wane, perpetuating the problem. Overall, educators who fall victim to burnout are likely to be less sympathetic toward

students, have a lower tolerance for classroom disruption, be less apt to prepare adequately for class, and feel less committed and dedicated to their work which ultimately leads to increased absenteeism and impetus to leave the profession (Farber & Miller, 1981).

The need to nurture high levels of satisfaction among teachers becomes apparent in light of studies relating to the effects of low teacher enthusiasm. According to Patrick, Hisley, and Kempler (2000), teacher enthusiasm leads to greater student achievement. In an analysis of two studies in this area they concluded: "The studies described herein provide strong, consistent evidence, from both the laboratory and the classroom, to suggest that when a teacher exhibits greater evidence of enthusiasm, students are more likely to be interested, energetic, curious, and excited about learning" (Patrick, Hisley, & Kempler, 2000, p. 233).

Stress can affect teachers' job satisfaction and their effectiveness with pupils (Blasé, 1986). Stress can also result in mental and physical illness and impair the working relationship between teachers and students as well as the overall quality of teaching (Kyriacou, 1987). Prolonged stress can result in burnout. The consequences of burnout include diminished job satisfaction, reduced teacher-pupil rapport and pupil motivation, and decreased teacher effectiveness in meeting educational goals (Kyriacou & Sutcliffe, 1978). According to Shann (1998), teacher satisfaction influences job performance, attrition, and ultimately, student performance. Teachers who are satisfied with their jobs indicate that the student-teacher relationships are most important. A study by Stenlund (1995) involving teachers from the U.S. and six other nations supported the importance of student-teacher relationships. Teachers questioned clearly identified students as the

primary determiner of both their professional enthusiasm and discouragement. Teachers indicated that they almost universally treasure student responsiveness and enthusiasm as a vital factor in their own enthusiasm, and conversely listed low motivation in students as a discourager (Stenlund, 1995).

Burnout

When faced with overwhelming stress and the feeling that what they are doing is no longer useful or effective, teachers often reach what many researchers have labeled "burnout" (Guglielmi & Tatrow, 1998; Ingersoll, 2002; Ingersoll, 2001; Blase, 1986; Borg, & Riding, 1991). "Burnout is a work-related syndrome that stems from an individual's perception of a significant discrepancy between effort (input) and reward (output)" (Friedman, 1995, p. 281). It occurs when teachers perceive they are unable to effectively fulfill the requirements of their profession. Friedman described burnout as a process, not an event, and is the result of unmediated stress over time.

Brouwers and Tomic (1999) identified disruptive student behavior as one of the most prevalent precursors to teacher burnout. "When teachers have little confidence in their ability to maintain classroom order, they will likely give up easily in the face of continuous disruptive student behavior. As a consequence, they feel themselves ineffective in their attempts to maintain classroom order" (Brouwers & Tomic, 1999, p.249). A report from the National Center for Education Statistics (1998) supported the importance of student behavior in relation to teacher job satisfaction, along with other factors such as administrative support, teacher autonomy, and parental support.

According to Coutanch (1984), job dissatisfaction leads to high rates of teacher absenteeism and turnover as well as increased student apathy, negativism, and

misbehavior. Jenkins and Calhoun (1991) concurred, stating that stress is a major factor in teachers' decision to leave teaching. They prescribed staff development for teachers in stress management techniques and in controlling the circumstances that cause stress. According to Byrne (1991b) teachers suffer serious emotional consequences as a result of burnout, which eventually effect student achievement.

> Teachers are purported to exhibit signs of emotional exhaustion when they perceive themselves as unable to give of themselves to students, as they did earlier in their careers; depersonalization, when teachers develop negative, cynical, and sometimes callous attitudes towards students, parents, and colleagues; and feelings of reduced personal accomplishment, when they perceive themselves as ineffective in helping students to learn, and in fulfilling other school responsibilities. (Byrne, 1991b, p. 198)

In addition to the adverse effects that stress and low job satisfaction have on the teachers themselves, the loss of good teachers adversely affects the quality of learning that students receive. Ingersoll (2001) stated that the decision to leave by teachers who do not share the goals and mission of the school is not a negative occurrence. It gives the administration an opportunity to replace them with teachers who do share in the mission, but he described a threshold at which the organization begins to lose experienced teachers who are beneficial to the level of learning available to students (Ingersoll, 2001). "After reaching a certain threshold level, however, turnover may become a source of group disintegration, rather than group integration. At such a point, the negative consequences of turnover for organization stability and coherence would begin to overshadow the positive consequences for the organization resulting from the elimination of dissension" (Ingersoll, 2001). He suggested that turnover rates of more than 25 percent are likely to have a negative impact on organizational performance.

Summary

Professionals in the field of school building design, educational researchers, and health care professionals have published an extensive body of literature based on the study of these interrelated issues. This literature yields evidence to support the hypothesis that student achievement, job satisfaction levels among teachers, and the health of both students and teachers can be affected significantly by lighting, acoustics, ventilation, and maintenance (Andrews & Neuroth , 1988; Burton, 1999; Crandell & Smaldino, 2000; Davis, 2001; Edwards, 1991; Evans, Kliewer & Martin, 1991; Frazier, 2002; Harner, 1974; Heschong, 1999; EPA, 2000; Johnson, 2001; Ko, 1979; Lackney, 1999; Lackney, 2000; Lyons, 2001; McGuffey, 1982; "Neglected Buildings," 1999; Nicklas & Bailey, 1997; Ostendorf, 2001; Ott, 1976; Plympton, Conway & Epstein, 2000; Symons, Cinelli, James & Groff, 1997).

The literature analyzed states that full-spectrum lighting and natural light positively effects student achievement, and that it can positively affect the mood of those exposed to it, while fluorescent light can be detrimental to students, especially those with Attention Deficit Disorder (ADD) or Attention Deficit-Hyperactivity Disorder (ADHD). The lack of natural light or full-spectrum light can lead to irritability, restlessness, and the inability to concentrate (Hathaway, 1995; Heschong, 1999; Lyons, 2001; Nicklas & Bailey, 1997; Ott, 1976).

Poor acoustics has been indicated as a detriment to learning in that it makes it difficult for students to differentiate between vocalized sounds. Poor acoustics in the classroom can also magnify street noise or construction noise, making it hard to concentrate, and making it difficult and frustrating to teach above the noise (Crandell &

Smaldino, 2000; Evans, Kliewer & Martin, 1991; Johnson, 2001; Lackney, 1999; Lyons, 2001).

Poor ventilation has been found to cause an increase in levels of carbon dioxide in the building, which can make students and teachers lethargic. It can also harbor dangerous toxins in the air such as chemical fumes, asbestos, or mold spores. These factors lead to poor student achievement and apparent empathy as a result of poor health or lethargy. This effect can be compounded, as teachers perceive their efforts in the classroom to be futile, and eventually lose enthusiasm for their task (Andrews & Neuroth, 1988; Davis, 2001; EPA, 1994; EPA, 2000; Lyons, 2001; Ostendorf, 2001).

And finally, studies have shown that poor maintenance can lead to poor health conditions. Filthy bathrooms, dusty and dirty classroom carpets and floors, and inconsistent temperatures with poorly serviced HVAC systems lead to a variety of health problems which lead to poor student achievement and poor health among teachers (Shideler, 2001; Symons, Cinelli, James & Groff, 1997).

CHAPTER 3

METHOD

This study was designed to identify relationships of both positive and negative aspects of school facility design, maintenance, indoor lighting and air quality, as well as student behaviors and teacher satisfaction, with student performance levels on the GHSGT, ACT, and SAT. Although causal relationships cannot be established with a correlational study of this type, the purpose of the study was to determine which aspects of the physical characteristics of the school could be identified as predictors of student achievement, student behavior, and teacher satisfaction.

Population

The population includes 164 teachers from 28 high schools in Central and North Georgia. In order to preserve the confidentiality of all participants, the names of participating schools will not be published; however, the approximate location of schools is indicated (see Figure 1). Twelve schools were rural schools; 15 were suburban, and one was located in the inner city of Atlanta.

Figure 1

Dots indicate location of participating schools.

Sample

The 164 subjects included in the study were randomly selected from 28 high schools in Central and North Georgia. Teachers were given the option to decline to participate at any time during the process. None of the subjects were paid for their participation or instructed as to the research hypothesis. Expectations with regard to findings were not discussed prior to their response.

Data Collection

School officials from 201 high schools in Georgia were contacted through electronic mail with a request for permission to recruit teachers to participate in the study. Forty five schools returned at least one questionnaire. To ensure a level of validity within the responses, only those returning at least three questionnaires were included in the database for analysis. Teachers were electronically mailed consent forms including a hyperlink to the questionnaire for online response and given the option to decline at any time during the process. Each questionnaire contained 30 questions with regard to the following information:

1. Personal information regarding the respondent's experience level, years of education, and number of sick days taken during the 2002-2003 school year.
2. Information on the teacher's perception of the school's lighting and the presence of windows in classrooms.
3. Information on the teacher's perception of the temperature of the classrooms.

4. Information on the teacher's perception of the overall cleanliness of the school.
5. Information on the teacher's perception of student behavior, motivation, illness, lethargy and absenteeism.
6. Teacher's plans to continue in the field of education or to change careers.
7. Information as to the noise levels in the school.

The questions were designed to measure the quality of the school's facility, the presence of certain characteristics such as natural light, carpet, and acoustic tile and their perceived effect on student health and teacher satisfaction. Data were then collected from the Georgia Department of Education's web site regarding the SAT, ACT, GHSGT, and free and reduced lunch percentages for each of the schools. Socio-economic status was estimated by comparing the percentage of free and reduced lunch participants at each school. All data were recorded by hand into spreadsheet form using SPSS 11.0 and separated by individual schools into 28 sections with responses to 30 questions by each of 164 respondents.

Data Analysis

The data were analyzed using SPSS 11.0 to perform a series of correlations for Pearson's r in order to determine what statistical relationships may or may not have existed between characteristics of the physical environment of the school and student achievement, student behavior, and teacher satisfaction levels. In order to produce the

most accurate and useful findings possible, the data were analyzed controlling for socio-economic status, teacher experience levels, and teacher education levels.

Socio-economic status was determined by the number of free and reduced lunches reported by the Georgia Department of Education for each school. The state of the facility was determined by the perceptions reported by teachers regarding specific variables such as quality of lighting, temperature, and cleanliness, on randomly distributed questionnaires. The reliability of the questionnaire was tested using Cronbach's Alpha.

The dependent variables were: student achievement, student behavior, and teacher satisfaction. Student achievement was determined by published reports of average SAT scores, ACT scores, and pass/fail rates for the GHSGT published by the Georgia Department of Education for each school represented. Student behavior and teacher satisfaction was reported by the subjects via questionnaire.

CHAPTER 4

FINDINGS

Principals of 201 high schools in Georgia were electronically mailed requests to participate in the study. Each was asked to forward the request to members of their staff. Teachers then submitted their responses using a hyperlink to the online questionnaire. Forty-five schools returned at least one response; however, to ensure the reliability of the data, only those who returned at least three questionnaires were used in the database. Twenty-nine schools returned three or more responses for a total of 169 questionnaires. One school was eliminated due to the fact that it was so new that there were no published test scores available for that school on the Georgia Department of Education website. Data from the remaining twenty-eight schools, including a total of 164 responses, were recorded and analyzed using SPSS 11.0.

A series of statistical analyses were performed in order to find the most comprehensive evidence available from the recorded data. First, the reliability of the questionnaire was analyzed using Cronbach's Alpha. The accuracy and validity of the data received from the Georgia Department of Education website regarding free and reduced lunch percentages and mean test scores on the GHSGT, SAT and ACT were assumed.

The questionnaire requested ratings from teachers in three areas: the physical character of the school building, behavioral characteristics of students, and their own level of job satisfaction (see Appendix A). All of these were based solely on the perceptions of teachers utilizing a Likert scale from 1 to 10 (1 indicating they "strongly

disagree;" 10 indicating they "strongly agree"). In some of the questions, 1 reflected a negative characteristic and 10 reflected a positive characteristic, while others reflected the opposite perception. All negatively oriented questions were re-coded to reflect a positive orientation, so that all responses on the final data set reflected 1 as negative and 10 as positive in order to make statistical analysis accurate.

Using the percentage of free and reduced lunch participants at each school, the relationship of socio-economic status to test scores was analyzed. Linear correlations for Pearson's product moment coefficient were performed for evidence of a relationship between test scores and free lunch. The r^2 value for each was analyzed to determine the amount of shared variance between factors.

Ratings from teachers were averaged to determine a mean score per school for each characteristic. The following characteristics of the facility were measured: cleanliness, working order of the school's equipment, temperature of the classroom, ventilation, windows, the presence of fumes in the classroom, noise levels, the presence of acoustic tile and carpet. The following student behaviors were also measured: lethargy, interest in school, illness, absenteeism, and behavior detrimental to the learning process. Teacher characteristics measured included lethargy, frustration, the number of sick days taken, and job satisfaction. All of the measures tested on the questionnaire were determined solely by teacher perceptions.

Also, a mean score was calculated per school for each of three groups of characteristics: Physical Environment, Student Behavior, and Teacher Satisfaction. Linear regressions were performed utilizing both the means for individual characteristics and the mean group scores in relation to mean test scores on the GHSGT, ACT, and SAT.

Control variables used to determine adjusted variables included free and reduced lunch percentages (socio-economic status), teacher experience levels, and teacher education levels.

Linear regressions were also performed to determine the relationship of adjusted test scores to mean student behavior ratings and mean teacher satisfaction ratings for each school. Finally, specific physical characteristics of the school relating to student and teacher health issues were analyzed for their relationship to student lethargy and motivation, student illness, teacher lethargy, and sick days taken by teachers. Health-related characteristics included cleanliness, temperature, ventilation, windows, the presence of fumes, and the presence of carpet.

Reliability

The reliability of the questionnaire was analyzed using Cronbach's Alpha, which is considered valid for determining the internal consistency of the questionnaire (see Appendix B). Cronbach's Alpha is a correlation between the test and all other possible tests containing the same number of items constructed from a hypothetical universe of items that measure the characteristic of interest (Huck, 2000). Table 1 reveals the three parts of the questionnaire and the alpha per section.

Table 1

Reliability of the Instrument *

Questionnaire Items	Section Construct	Standardized Alpha
1 to 13	Physical Characteristics	.7023
14 to 23	Student Behavior	.8752
24 to 27	Teacher Satisfaction	.6818

* See Appendix A for questionnaire items.

Control Variables

Data regarding the percentage of students receiving free or reduced lunch were recorded from the Georgia Department of Education website (Georgia Department of Education, 2003). Teacher education and experience levels were reported by teachers on the questionnaire. The purpose of including the percentage of free lunch in the analysis was to serve as an indicator of socio-economic status per school. The school was the unit of analysis. SAT scores, ACT scores, and percent passing the GHSGT were also recorded from the Georgia Department of Education website. These data were analyzed using SPSS 11.0 for significant statistical relationships (see Appendix C).

The first aspect of analysis required applying a multiple regression to adjust for socioeconomic status, teacher education, and teacher experience. This yielded 13 adjusted variables (see descriptive statistics in Table 2).

Table 2

Grand Means For Adjusted Variables

Descriptive Statistics

	Mean	Std. Deviation	N
GT WRITING	88.33	5.80	27
GT SCIENCE	74.78	11.38	27
GT SOCIAL STUDIES	83.41	9.78	27
GT MATH	92.11	5.22	27
GT ENGLISH	95.96	2.97	27
ACT SCIENCE	19.833	1.539	27
ACT READING	20.111	2.091	27
ACT MATH	19.659	1.615	27
ACT ENGLISH	19.100	2.049	27
ACT COMPOSITE	19.796	1.758	27
SAT MATH	495.37	33.80	27
SAT VERBAL	493.63	29.59	27
SAT TOTAL	989.00	62.57	27

Table 3

Multivariate Tests

Effect		Value	F	Hyp. df	Error df	Sig.	Eta Sq
Intercept	Pillai's Trace	.987	73.540	12.000	12.000	.000	.987
	Wilks' Lambda	.013	73.540	12.000	12.000	.000	.987
	Hotelling's Trace	73.540	73.540	12.000	12.000	.000	.987
	Roy's Largest Root	73.540	73.540	12.000	12.000	.000	.987
YRS. EXP	Pillai's Trace	.715	2.509	12.000	12.000	.062	.715
	Wilks' Lambda	.285	2.509	12.000	12.000	.062	.715
	Hotelling's Trace	2.509	2.509	12.000	12.000	.062	.715
	Roy's Largest Root	2.509	2.509	12.000	12.000	.062	.715
YRS.COL	Pillai's Trace	.608	1.549	12.000	12.000	.230	.608
	Wilks' Lambda	.392	1.549	12.000	12.000	.230	.608
	Hotelling's Trace	1.549	1.549	12.000	12.000	.230	.608
	Roy's Largest Root	1.549	1.549	12.000	12.000	.230	.608
FREE LUNCH	Pillai's Trace	.939	15.471	12.000	12.000	.000	.939
	Wilks' Lambda	.061	15.471	12.000	12.000	.000	.939
	Hotelling's Trace	15.471	15.471	12.000	12.000	.000	.939
	Roy's Largest Root	15.471	15.471	12.000	12.000	.000	.939

a Exact statistic

b Design: Intercept+YRS.EXP+YRS.COL+FREE.LUN

The analysis of the data to adjust the test scores is found in Table 3, where the significant levels range from 0.00 to 0.23. The measure of association, eta, is appropriate for the dependent variables (test scores) measured on an interval scale and the independent variables (years of experience, years of college, and free lunch). Eta is asymmetric and does not assume a linear relationship between the variables. Eta squared can be interpreted as the proportion of variance in the dependent variable explained by differences among groups. Appendix D reveals the tests between-subjects effects, where the eta squared ranges from .000 to .964 for the corrected model.

Physical Environment

Thirteen characteristics of the physical environment of the school were measured utilizing the opinions of teachers: cleanliness of the school, condition of the classroom equipment, temperature of the classroom (both warm and cold), quality of ventilation, presence of windows, cleanliness of bathrooms, presence of fumes in the classroom, noise, traffic noise, presence of acoustic tile, presence of carpet, and cleanliness of the cafeteria. The responses from each school were averaged to determine a mean score for each characteristic per school. A composite score for the total quality of each facility was determined by averaging the means for each of the individual characteristics. Both the individual characteristics of each school and the composite score for the total quality of the physical environment of each school were analyzed to determine the degree to which relationships existed between the physical environment and student achievement as measured on the SAT, ACT, and GHSGT.

Analysis of the individual school characteristics revealed no significant positive relationships with adjusted test scores on the SAT. In fact, the only significant

relationships revealed were negative correlations between the presence of windows and the SAT Total (r = -.436, p = .023), the SAT Math (r = -.427, p = .026), and the SAT Verbal (r = -.440, p = .022); as well as coldness of the classroom and SAT Total (r = -.405, p = .036), SAT Math (r = -.419, p = .030), and SAT Verbal (r = -.383, p = .049). This indicated that among our sample of schools, colder schools and schools with fewer windows were more successful on the SAT, controlling for SES, teacher experience, and teacher education levels. The other eleven measures of facility characteristics revealed no significant correlation with the SAT Total (see Table 4). Analysis of the composite physical environment scores revealed no significant correlation to SAT Total.

Table 4

Correlations: Adjusted SAT, Physical Environment

		Adj.MAT	Adj.VERB	Adj.TOT
CLEAN	Pearson Correlation	-.025	.008	-.010
	Sig. (2-tailed)	.901	.970	.960
	N	27	27	27
EQUIP	Pearson Correlation	.194	.166	.182
	Sig. (2-tailed)	.333	.408	.363
	N	27	27	27
WARM	Pearson Correlation	-.285	-.249	-.271
	Sig. (2-tailed)	.149	.210	.172
	N	27	27	27
COLD	Pearson Correlation	-.419	-.383	-.405
	Sig. (2-tailed)	.030	.049	.036
	N	27	27	27

(table continued)

Table 4 continued

		Adj.MAT	Adj.VERB	Adj.TOT
VENTILAT	Pearson Correlation	-.252	-.265	-.260
	Sig. (2-tailed)	.205	.182	.191
	N	27	27	27
WINDOW	Pearson Correlation	-.427	-.440	-.436
	Sig. (2-tailed)	.026	.022	.023
	N	27	27	27
BATHROOM	Pearson Correlation	.014	.068	.039
	Sig. (2-tailed)	.946	.735	.847
	N	27	27	27
CAFE	Pearson Correlation	.014	.048	.030
	Sig. (2-tailed)	.947	.812	.883
	N	27	27	27
FUMES	Pearson Correlation	-.025	-.057	-.040
	Sig. (2-tailed)	.901	.777	.842
	N	27	27	27
NOISE	Pearson Correlation	-.308	-.345	-.327
	Sig. (2-tailed)	.118	.078	.096
	N	27	27	27
TRAFFIC	Pearson Correlation	-.086	-.079	-.083
	Sig. (2-tailed)	.669	.695	.679
	N	27	27	27
AC.TILE	Pearson Correlation	.140	.128	.136
	Sig. (2-tailed)	.485	.524	.500
	N	27	27	27
CARPET	Pearson Correlation	.241	.276	.258
	Sig. (2-tailed)	.227	.164	.193
	N	27	27	27
MEANPE	Pearson Correlation	-.235	-.212	-.226
	Sig. (2-tailed)	.238	.288	.257
	N	27	27	27

Analysis of individual school characteristics with adjusted ACT scores revealed no positive correlations. The only significant relationships revealed were negative correlations between the presence of windows and the ACT Composite ($r = -.412$, $p = 033$), the ACT English ($r = -.424$, $p = .028$), the ACT Math ($r = -.417$, $p = .031$), the ACT Reading ($r = -.396$, $p = .041$), and the ACT Science test ($r = -.400$, $p = .039$). No relationship was detected between the composite physical environment scores and the five sections of the ACT (see Table 5).

Table 5

Correlations: Adjusted ACT, Physical Environment

		Pred COMP	Pred.ENG	Pred.MAT	PredREAD	Pred.SCI
CLEAN	Pearson's r	.043	.071	.011	.026	.048
	Sig. (2-tailed)	.830	.726	.958	.899	.814
	N	27	27	27	27	27
EQUIP	Pearson's r	.103	.119	.115	.083	.087
	Sig. (2-tailed)	.610	.553	.568	.680	.665
	N	27	27	27	27	27
WARM	Pearson's r	-.193	-.146	-.248	-.220	-.183
	Sig. (2-tailed)	.336	.467	.211	.271	.362
	N	27	27	27	27	27
COLD	Pearson's r	-.296	-.291	-.334	-.288	-.276
	Sig. (2-tailed)	.133	.141	.089	.145	.164
	N	27	27	27	27	27
VENTILAT	Pearson's r	-.273	-.239	-.297	-.296	-.274
	Sig. (2-tailed)	.168	.230	.133	.134	.167
	N	27	27	27	27	27
WINDOW	Pearson's r	-.412	-.424	-.417	-.396	-.400
	Sig. (2-tailed)	.033	.028	.031	.041	.039
	N	27	27	27	27	27
BATHROOM	Pearson's r	.128	.159	.084	.108	.136
	Sig. (2-tailed)	.525	.427	.677	.590	.500
	N	27	27	27	27	27
CAFE	Pearson's r	.098	.089	.086	.108	.107
	Sig. (2-tailed)	.628	.660	.668	.593	.596
	N	27	27	27	27	27
FUMES	Pearson's r	-.116	-.074	-.125	-.151	-.130
	Sig. (2-tailed)	.565	.713	.533	.451	.519
	N	27	27	27	27	27

(table continued)

Table 5 continued

		Pred COMP	Pred.ENG	Pred.MAT	PredREAD	Pred.SCI
NOISE	Pearson's r	-.366	-.367	-.359	-.362	-.365
	Sig. (2-tailed)	.061	.059	.066	.064	.061
	N	27	27	27	27	27
TRAFFIC	Pearson's r	-.067	-.054	-.081	-.075	-.065
	Sig. (2-tailed)	.740	.790	.687	.711	.748
	N	27	27	27	27	27
AC.TILE	Pearson's r	.101	.095	.116	.102	.095
	Sig. (2-tailed)	.617	.639	.564	.614	.639
	N	27	27	27	27	27
CARPET	Pearson's r	.292	.314	.273	.274	.290
	Sig. (2-tailed)	.139	.111	.169	.166	.142
	N	27	27	27	27	27
MEANPE	Pearson's r	-.174	-.140	-.215	-.195	-.167
	Sig. (2-tailed)	.384	.487	.282	.331	.404
	N	27	27	27	27	27

Analysis of individual school characteristics and composite physical environment scores with adjusted GHSGT scores revealed no positive correlations between adjusted test scores and the physical environment. The only significant correlations revealed were negative correlations between the presence of windows with the GHSGT Writing test (r = -.411, p = 033), Science test (r = - .417, p = .031), Social Studies test (r = -.420, p = .029), Math test (r = -.408, p = .035), and English test (r = -.395, p = .042). In addition, negative correlations were revealed between the coldness of the classroom and the GHSGT Social Studies test (r = -.407, p = .035), Math test (r = -.404, p = .037), and English test (r = -.397, p = .040). This indicates that schools from our sample with colder classrooms and fewer windows tended to score higher on the GHSGT (see Table 6).

Table 6

Correlations: Adjusted Georgia High School Graduation Test, Physical Environment

		Pred.ENG	Pred.MAT	Pred.SOC	Pred.SCI	Pred.WRI
CLEAN	Pearson's r	-.068	-.054	-.037	.012	-.014
	Sig. (2-tailed)	.738	.789	.854	.954	.945
	N	27	27	27	27	27
EQUIP	Pearson's r	.135	.151	.165	.115	.116
	Sig. (2-tailed)	.502	.451	.411	.569	.566
	N	27	27	27	27	27
WARM	Pearson's r	-.361	-.340	-.314	-.247	-.287
	Sig. (2-tailed)	.064	.083	.111	.215	.147
	N	27	27	27	27	27
COLD	Pearson's r	-.397	-.404	-.407	-.333	-.351
	Sig. (2-tailed)	.040	.037	.035	.090	.072
	N	27	27	27	27	27
VENTILAT	Pearson's r	-.329	-.310	-.290	-.296	-.314
	Sig. (2-tailed)	.094	.116	.142	.134	.110
	N	27	27	27	27	27
WINDOW	Pearson's r	-.395	-.408	-.420	-.417	-.411
	Sig. (2-tailed)	.042	.035	.029	.031	.033
	N	27	27	27	27	27
BATHROOM	Pearson's r	-.027	-.012	.007	.086	.051
	Sig. (2-tailed)	.894	.952	.972	.671	.799
	N	27	27	27	27	27
CAFE	Pearson's r	.053	.044	.037	.087	.082
	Sig. (2-tailed)	.794	.829	.854	.667	.686
	N	27	27	27	27	27
FUMES	Pearson's r	-.137	-.107	-.080	-.125	-.139
	Sig. (2-tailed)	.496	.594	.693	.535	.488
	N	27	27	27	27	27

(table continued)

Table 6 continued

		Pred.ENG	Pred.Mat	Pred.SOC	Pred.SCI	Pred.WRI
NOISE	Pearson's r	-.315	-.318	-.322	-.360	-.351
	Sig. (2-tailed)	.109	.106	.102	.065	.073
	N	27	27	27	27	27
TRAFFIC	Pearson's r	-.109	-.103	-.095	-.081	-.091
	Sig. (2-tailed)	.589	.610	.636	.688	.650
	N	27	27	27	27	27
AC.TILE	Pearson's r	.143	.143	.141	.116	.124
	Sig. (2-tailed)	.476	.478	.484	.565	.536
	N	27	27	27	27	27
CARPET	Pearson's r	.205	.219	.235	.274	.253
	Sig. (2-tailed)	.306	.273	.239	.167	.202
	N	27	27	27	27	27
MEANPE	Pearson's r	-.293	-.277	-.258	-.213	-.242
	Sig. (2-tailed)	.138	.162	.194	.285	.223
	N	27	27	27	27	27

Correlation of Composite Scores

In order to identify possible correlations between student behavior, the characteristics of the school, and the level of teacher satisfaction, mean ratings from teachers were divided into three categories: Student Behavior, Physical Environment, and Teacher Satisfaction. Statistically significant correlations were revealed for two of the three comparisons.

The mean for the Teacher Satisfaction group was 7.41, with a standard deviation of 1.24. The mean for Physical Environment was 6.62, with a standard deviation of .828. The mean for Student Behavior was 6.31, with a standard deviation of .894 (see Table 7).

Table 7

Descriptive Statistics

	Mean	Std. Dev.	N
Physical Environment	6.6171	.82824	28
Teacher Satisfaction	7.4089	1.23986	28
Student Behavior	6.3114	.89446	28

Analyses for the three groups revealed positive correlations between Student Behavior and Teacher Satisfaction ($r = .423$, $p = .025$), and between Teacher Satisfaction and Physical Environment ($r = .372$, $p = .051$). No significant relationship was revealed between Student Behavior and Physical Environment.

The coefficient of determination (r^2) is an indication of the amount of variability in one variable that is associated with (or explained by) variability in the other variable. It is calculated by squaring the correlation coefficient (Huck, 2000). These calculations indicated that 18% of the variance in Teacher Satisfaction was attributable to Student Behavior ($r^2 = .179$). The analysis of Teacher Satisfaction with the Physical Environment ($r^2 = .138$) indicated a shared variance of 14% (see p.57). These results indicate that schools from the sample which reported high ratings for Physical Environment also tended to report high ratings for Teacher Satisfaction, and those which reported high ratings for Student Behavior also tended to report high ratings for Teacher Satisfaction. Examination of corresponding scatterplots indicates a linear relationship, lending evidence of the validity of the findings of this analysis (see Appendix E).

Table 8

Correlations: Mean Composite Scores

		Phys.Env.	Stu.Beh.	Teach.Sat.
Physical Environment	Pearson's r	1	.237	.372
	Sig. (2-tailed)	.	.226	.051
	N	28	28	28
Student Behavior	Pearson's r	.237	1	.423
	Sig. (2-tailed)	.226	.	.025
	N	28	28	28
Teacher Satisfaction	Pearson's r	.372	.423	1
	Sig. (2-tailed)	.051	.025	.
	N	28	28	28

Correlation of Health Predictors

Another aim of this study was to investigate the possibility that relationships exist between such characteristics as temperature in the classroom, ventilation, fumes, windows, carpet, and illness or lethargy among students and teachers. The data were analyzed to determine the Pearson product moment coefficient for each of these factors with measures of student lethargy, illness, absenteeism, and motivation, as well as teacher lethargy, and sick days taken by teachers. Significant positive correlations were revealed between the following factors: cleanliness and student motivation ($r = .410$, $p = .030$, $r^2 = .168$), warmth of the classroom and student illness ($r = .431$, $p = .022$, $r^2 = .185$), ventilation and student motivation ($r = .430$, $p = .022$, $r^2 = .184$), cleanliness of the bathrooms and student absenteeism ($r = .497$, $p = .007$, $r^2 = .247$), cleanliness of the bathrooms and student motivation ($r = .376$, $p = .048$, $r^2 = .141$), cleanliness of the

cafeteria and student lethargy ($r = .390$, $p = .040$, $r^2 = .152$), noise in the classroom and student lethargy ($r = .383$, $p = .045$, $r^2 = .147$), noise in the classroom and student illness ($r = .440$, $p = .019$, $r^2 = .194$) (see Table 9).

The most significant relationships to student behaviors was detected through the correlation of cleanliness of the bathrooms with student absenteeism which indicated that 25% of the variance in student absenteeism was attributable to the cleanliness of the bathroom. Noise in the classroom accounted for 19% of the variance in student illness.

Significant negative relationships were revealed between fumes in the classroom and teacher sick days ($r = -.429$, $p = .023$, $r^2 = .184$) as well as ventilation and teacher sick days ($r = -.409$, $p = .031$, $r^2 = .167$). This indicates that 18% of the variance in sick days used was attributable to the variance in fumes, while 16.7% of the variance in sick days was attributable to the variance in ventilation. The negative relationships revealed involving teacher sick days reveal the same relationship as positive relationships involving all other factors because sick days were not re-coded on the data set to reflect a positive orientation. The relationship of noise in the classroom to teacher lethargy ($r = .382$, $p = .045$, $r^2 = .145$) indicated that 14% of the variance in teacher lethargy was attributable to noise.

According to these findings noise, ventilation, fumes, temperature, and cleanliness had significant correlations to measures of student and teacher health. Schools which reported high ratings for these characteristics also reported better student motivation, lower levels of student illness and absenteeism, and fewer sick days used by teachers (see Table 9). Scatterplots of these correlations reveal linear relationships lending evidence to the reliability of the test (see Appendix E).

Table 9

Correlations: Health measures, Physical environment

		S.LETH	S.SICK	S.ABS	S.MOT	T.LETH	T.SICK
CLEAN	Pearson's r	.219	.264	.293	.410*	.361	-.209
	Sig(2-tailed)	.263	.175	.130	.030	.059	.286
	N	28	28	28	28	28	28
	r^2	.048	.069	.086	.169	.130	.043
WARM	Pearson's r	.238	.431*	.370	.131	.326	-.271
	Sig(2-tailed)	.222	.022	.053	.507	.090	.163
	N	28	28	28	28	28	28
	r^2	.057	.185	.137	.017	.106	.073
VENTILAT	Pearson's r	.274	.156	.058	.430*	.286	-.409*
	Sig(2-tailed)	.159	.429	.769	.022	.140	.031
	N	28	28	28	28	28	28
	r^2	.061	.024	.003	.185	.082	.167
BATH	Pearson's r	.083	-.038	.497*	.376*	.167	-.061
ROOM	Sig(2-tailed)	.675	.849	.007	.048	.395	.759
	N	28	28	28	28	28	28
	r^2	.006	.001	.247	.141	.028	.004
CAFE	Pearson's r	.390*	.230	.264	.084	-.140	-.210
	Sig(2-tailed)	.040	.239	.175	.670	.478	.284
	N	28	28	28	28	28	28
	r^2	.152	.053	.070	.007	.020	.044
FUMES	Pearson's r	-.090	.075	.066	.363	.062	-.429*
	Sig(2-tailed)	.649	.705	.739	.058	.755	.023
	N	28	28	28	28	28	28
	r^2	.008	.006	.004	.132	.004	.184
NOISE	Pearson's r	.383*	.440*	.193	.135	.382*	-.304
	Sig(2-tailed)	.045	.019	.324	.492	.045	.116
	N	28	28	28	28	28	28
	r^2	.147	.193	.037	.018	.146	.092

* correlation is significant at the 0.05 level (2 tailed)

CHAPTER 5

CONCLUSIONS

Introduction

The purpose of the study was to investigate the relationships of the physical characteristics of the school environment to student achievement, job satisfaction levels among teachers, and student behavior and the possible interrelatedness of these factors. Teachers were recruited from high schools across northern and central Georgia and asked to give their perceptions of a variety of characteristics of their particular school pertaining to the school facility, student behaviors, and their own job satisfaction. The resulting data were matched with corresponding SAT, ACT, and GHSGT scores and free and reduced lunch percentages for their school as published in the Georgia Department of Education website. The result was an extensive data set viable for a variety of statistical tests using SPSS 11.0 for analysis. Controlling for socio-economic status, teacher experience levels, and teacher education levels, the data were analyzed for relationships across a variety of variables using a series of correlations for evidence of statistical relationship.

Findings

Only limited evidence could be found to support the existence of a relationship between the physical characteristics of the school and student achievement, regardless of controls for socio-economic status, teacher experience, and teacher education levels.

Analysis of composite scores for each of three categories: Teacher Satisfaction, Student Behavior, and Physical Environment, revealed moderate correlations. Teacher satisfaction tended to increase as the reported behavior of students improved. To a lesser

degree, teacher satisfaction improved as the quality of the physical environment improved (see Appendix F). The results of these analyses support the findings of previous studies regarding the relationship of student behavior and the quality of the physical environment of the school to teacher satisfaction (Brouwers & Tomic, 1999; Byrne, 1991a; Ingersoll, 2001; Kyriacou, 1987; Ostendorf, 2001; Stenlund, 1995).

Analysis of health-related characteristics to student lethargy and motivation, student illness, teacher lethargy, and sick days used by teachers revealed significant correlations for several characteristics. As warmth, cleanliness, ventilation and noise levels improved, measures of student heath and motivation as well as measures of teacher health also improved (see Appendix F). Consideration of these analyses supports the findings of previous studies in relation to the health benefits of clean and well-ventilated schools (Davis, 2001; EPA, 1994; EPA, 2000; Lyons, 2001; Shideler, 2001; Symons, Cinelli, James & Groff, 1997).

Concerns

Two factors that may be confounding influences in this study are the nature of teacher perceptions, and the reasons behind sick days taken by teachers. Teacher perceptions of student traits are subjective in nature. What a teacher perceives as lethargy or illness in students may actually be caused by other factors such as learning disabilities or personal problems originating in the home. Incorrect perceptions by teachers regarding the nature of student behavior could render the results invalid. Also, teacher perceptions are likely to be influenced by any number of personal factors which could not be controlled in this study. Likewise, teacher's perceptions of the school as a whole are

subject to their experiences in the classroom. The presence of noise or fumes, for example, in one classroom may not be typical of all of the classrooms.

The reasons for teacher sick days are varied. Many teachers are sick because of reasons that do not relate to the school environment. The number of sick days taken can be skewed by pregnancy, or extended illnesses that are unrelated, which would compromise the validity of the analysis. However, it would be very difficult to determine the number of sick days taken that were related entirely to school environment issues.

Recommendations

Further investigation is needed. A means of controlling for sick days taken by teachers related only to the school environment would lend greater evidence to the effects detected in apparent correlations. In addition, a better method of measuring student absenteeism and student lethargy would be an important improvement in the method of study. In addition, a better method of characterizing the school facility should be employed. Using a team of researchers to visit schools for the purpose of rating each of the characteristics might yield more consistent results and increase the validity of the data.

Summary

In brief, this study revealed a substantial amount of useful evidence to questions regarding the nature of student achievement and teacher satisfaction. Within the sample of schools participating in this study evidence was revealed that teachers who approve of the physical environment of the school, including both physical characteristics of the facility and student behavior, rated their job satisfaction higher than those who did not approve of the physical environment. Findings relating to student and teacher health were

more significant. Teachers who reported clean schools with good ventilation and temperature controls also reported higher student motivation and health, and fewer sick days taken during the year (see Appendix F).

A limited degree of evidence was revealed that there was any significant or practical correlation between the physical characteristics of the school facility and student achievement on the SAT, ACT, and GHSGT. This researcher believes the results of this study indicate that significant correlations exist between the physical characteristics of the school facility and teacher satisfaction, student behavior, and the health of both students and teachers; however, a variety of confounding factors made significant correlations between test scores and the physical characteristics of the school difficult to achieve. These correlations may exist, but a more precise method of measure must be employed to adequately identify them.

REFERENCES

Abel, M.H., & Sewell, J. (1999). Stress and burnout in rural and urban secondary school teachers. *The Journal of Educational Research,* 92(5), 287-293.

Andrews, J., & Neuroth, R (1988). Environmentally Related Health Hazards in the Schools. Paper presented at the Annual Meeting of the Association of School Business Officials International in Detroit, Michigan, ED 300 929

An Imperiled Generation: Saving Urban Schools. Carnegie Foundation for the Advancement of Teaching. Princeton, New Jersey: Author, 1988. ED 293 940

Bentley, R. & Rempel, A. (1980). Manual for the Purdue Teacher Opinionaire. West Lafayette, Indiana: The University Book Store.

Blase, J. J. (1986) A qualitative analysis of sources of teacher stress: Consequences for performance. *American Educational Research Journal, 23*(1), 13-40.

Borg, M. G., & Riding, R. J. (1991). Towards a model for the determinants of occupational stress among schoolteachers, *European Journal of Psychology of Education, 6,* 355-373.

Burton, R. L. (1999). A study of disparities among school facilities in North Carolina: effects of race and economic status, *Educational Policy*, Los Altos; 13(2), 280-295, ISSN: 08959048

Byrne, B. M. (1991) Burnout: testing for the validity, replication, and invariance of causal structure across elementary, intermediate, and secondary teachers. *American Educational Research Journal*, Fall, 31(3), 645-673

Carnegie Foundation for the Advancement of Teaching. (1988) *An imperiled generation: saving urban schools.* Princeton, New Jersey, ED 293 940, retrieved from http://ericae.net/edo/ED356564.htm

Colbert, J., & Wolff, D. (1992) Surviving in urban schools. *Journal of Teacher Education* (43), 193-199

Crandell, C., & Smaldino, J. (2000) Classroom acoustics for children with normal hearing and with hearing impairment. Language, Speech, and Hearing Services in Schools, Vol. 31 (362-370) American Speech-Language-Hearing Association

Davis, P. J. (2001, March). *Molds, Toxic Molds, and Indoor Air Quality*. Prepared at the request of assembly member Alan Lowenthal, California Research Bureau, California State Library. CRB Note. 8(01)

Dewe, P. (1986). Stress: Causes, consequences and coping strategies for teachers. Wellington, N.Z.: New Zealand Education Institute. (ERIC Document Reproduction Service No. ED280807)

Edwards, M. M. Building Conditions, Parental Involvement, and Student Achievement in the D.C. Public School System. Masters Thesis, Georgetown University, May 1991. ED 338 743

Environmental Protection Agency. (1994). *Indoor Air Pollution: An Introduction for Health Professionals* (Publication No. 1994-523-217/81322) Washington, DC: U.S. Government Printing Office. Retrieved from http://www.epa.gov/iaq/pubs/hpguide.html

Environmental Protection Agency, (2000, August). *Indoor Air Quality and Student Performance* (Publication No. 402-F-00-009). Washington, DC: U.S. Government Printing Office. Retrieved from http://www.epa.gov/iaq/schools/performance.html

Estes, G., Stansbury, K., & Long, C. (1990). Assessment component of the California New Teacher Project: First year report.

Evans, G.W., Kliewer, W., & Martin, J. (1991). The role of the physical environment in the health and well being of children. In H.E. Schroeder (Ed.), New Directions in Health Psychology Assessment (pp. 127-157). New York: Hemisphere.

Farber, B. A., & Miller, J. (1981). Teacher Burnout: A psychoeducational perspective. *Teachers College Record*, *83,* 235-245.

Friedman, I. (1995, May/June). Student behavior patterns contributing to teacher burnout. *The Journal of Educational Research.* 88 (05) 281-288.

Frazier, L. M. (2002). Deteriorating School Facilities and Student Learning. Eric Digest, Number 82. Retrieved from http://ericae.net/edo/ED356564.htm

Georgia Department of Education. (2003). *Georgia Public Education Report Card 2001-2002*. Retrieved March 1, 2003, from http://techservices.doe.k12.ga.us/reportcard/default.htm

Guglielmi, R. & Tatrow, K. (1998). Occupational stress, burnout, and health in teachers: a methodological and theoretical analysis. *Review of Educational Research*. 68(1), 61-99.

Hanushek, E.A. (1989). The impact of differential expenditures on school performance.*Educational Researcher*, 18(4), 45-51, 62.

Harner, D.P. (1974, April). Effects of thermal environment on learning skills, *CEFP Journal*, 12, 4-8.

Hathaway, W. E. (1995). Effects of school lighting on physical development and school performance. *Journal of Educational Research*, 88(4) 228-243.

Heschong, L., Daylighting in Schools: An Investigation Into the Relationship Between Daylighting and Human Performance. *Bricks and Mortarboard—Education Week, available at* http://www.edweek.com/ew/ew

Henderson, D. L., & Henderson, T. W. (1996). Texas Teachers, Moonlighting, and Morale, Huntsville, Texas, Eric Digest, Number 120

Hoy, W. K., and Miskel, C. G. (1987). Educational Administration: Theory, Research, and Practice. Third Ed. New York: Random House.

Huck, S. W. (2000). Reading Statistics and Research. Third Ed. New York: Longman

Ingersoll, R. M. (2002). The teacher shortage: a case of wrong diagnosis and wrong prescription. *Bulletin* 86 (631).

Ingersoll, R. (2001). *Teacher turnover, teacher shortages, and the organization of schools* (Doc. R-01-1). University of Washington, Center for the Study of Teaching and Policy.

Jenkins, J., & Calhoun, J.F. (1991). Teacher stress: issues and intervention. *Psychology in the Schools,* 28, 60 – 70.

Johnson, E. (July 1, 2001). Let's Hear it for Learning. American School and University, Retrieved from http://asumag.com/magazinearticle

Ko, N. (1979). Response of teachers to aircraft noise. *Journal of Sound and Vibration*, 62, 277-292.

Kyriacou, C. (1987). Teacher stress and burnout: An international review. *Educational Research. 29,* 146-152.

Kyriacou, C., & Sutcliffe, J. (1978). Teacher stress: Prevalence, sources and symptoms. *British Journal of Educational Psychology, 48,* 159-167.

Lackney, J. (2000). Thirty Three Educational Design Principles For Schools & Community Learning Centers. Mississippi State University. Retrieved from http://www.edfacilities.org/index.htm.

Lackney, J. (1999). The relationship between environmental quality of school facilities and student performance. Presented to a Congressional Briefing to the U.S. House of Representatives Committee on Science. Retrieved from http://schoolstudio.engr.wisc.edu/energysmartschools.html

Lockwood, R.E., & McLean, J.E. (1993, November). Educational funding and student achievement: you be the judge. Paper presented at the annual meeting of the Mid-South Educational Research Association, New Orleans, LA.

Lockwood, R.E. & McLean, J.E. (1997). Twenty-five years of data on educational funding and student achievement: What does it mean? *Educational Research Quarterly*, West Monroe 21(2)

Lyons, J. B. (2001). Do school facilities really impact a child's education? Retrieved from http://www.coe.uga.edu/sdpl/articlesandpapers/lyons.html

McGuffey, C.W. (1982). Facilities. In Walberg, H.J. (Ed.) Improving educational standards and productivity: The research basis for policy. Berkeley, CA: McCutchan Publishing. 237-288.

Mendel, P. C. (1987). An Investigation of Factors That Influence Teacher Morale and Satisfaction with Work Conditions. Doctoral Dissertation, Eugene, Oregon: Division of Educational Policy and Management, University of Oregon.

Moore, D. P. (2002). School facility planning's top 10 list. *School Planning & Management*, Dayton, 41(1).

Moore, D. P. (2002). We can't put it off forever. *School Planning & Management*, Dayton, 41(5). ISSN: 10453970

National Center For Educational Statistics. (2002). *The condition of education 2002* (NCES 2002-025). Washington, DC: U.S. Government Printing Office.

No Child Left Behind Act of 2001. Pub. L. No. 107-110. Sec. 5414. (2002).

Nicklas, M. & Bailey, G. Analysis of the Performance of Students in Day lit Schools. Proc. of the 1997 Annual Conference, American Solar Energy Society.

Ostendorf, J. (2001). Indoor Air Pollution Threatens Kids' Health in Schools. United States Environmental Protection Agency, Retrieved from http://www.epa.gov/Region8/air/iaq/iaq.html

Ott, John N. (1976, August/September). Influence of fluorescent lights on hyperactivity and learning disabilities. *Journal of Learning Disabilities*, 9:7, 22-27.

Patrick, B., Hisley, J., & Kempler, T. (2000). What's everybody so excited about: the effects of teacher enthusiasm on student intrinsic motivation and vitality. *The Journal of Experimental Education*, 68(3), 217-236.

Plympton, P., Conway S., & Epstein K. (2000). Daylighting in Schools: Improving Student Performance and Health at a Price Schools Can Afford, paper presented at the American Solar Energy Society Conference. Madison, Wisconsin. Available at http://www.osti.gov/bridge/

Rosenholtz, S., & Simpson, C. (1990, October). Workplace conditions and the rise and fall of teachers' commitment. *Sociology of Education,* 63, 241-257.

Shann, M. H., (1998). Professional commitment and satisfaction among teachers in urban middle schools. *The Journal of Educational Research, 92*(2), 67-72.

Shideler, L., Flooring: A Clean School is a Healthy School. American School & University, May 1, 2001 Retrieved from http://asumag.com

Schneider, M. (2002, November). Do school facilities affect academic outcomes? *National Clearinghouse for Educational Facilities,* Washington, D.C. Retrieved January 31, 2003, from www.edfacilities.org

Stenlund, V. (1995, June). Teacher perceptions across cultures; the impact of students on teacher enthusiasm and discouragement in a cross-cultural context. *The Alberta Journal of Educational Research*. 41(2).

Sterling, P., & Paquette, N. (1998, March). *Toxic Chemical Exposure in Schools: Our Children At Risk.* Montpelier, Vermont: Vermont Public Interest Research Group.

Stricherz, M. (2000). Bricks and mortarboards. *Education Week* 20(14): 30-32.

Symons, C. W., Cinelli, B., James, T. C., & Groff, P. (1997). Bridging student health risks and academic achievement through comprehensive school health programs. *The Journal of School Health*, Kent.

Tanner, K. (2000). The influence of school architecture on academic achievement. *Journal of Educational* Administration; Armidale, 38(4), 309-323.

Washington, R., & Watson, H. F. (1976). Positive Teacher Morale; The Principal's Responsibility. *NASSP Bulletin*, 60, 399.

APPENDIX A

QUESTIONNAIRE

Facilities Questionnaire

Name of school: _____

How many years of teaching experience do you have? _____

How many years of college education do you have? _____

How old is the school where you teach? _____

How many "sick-leave" days have you taken this year? _____

Please circle the number that best describes how you feel about your school's physical environment.

	Strongly Disagree									Strongly Agree
1. My school provides a clean physical environment.	1	2	3	4	5	6	7	8	9	10
2. The equipment I use is in good working order.	1	2	3	4	5	6	7	8	9	10
3. My classroom is often too warm for comfort.	1	2	3	4	5	6	7	8	9	10
4. My classroom is often too cold for comfort.	1	2	3	4	5	6	7	8	9	10
5. My classroom has adequate ventilation.	1	2	3	4	5	6	7	8	9	10
6. My classroom has at least one window.	1	2	3	4	5	6	7	8	9	10
7. My school has clean bathrooms.	1	2	3	4	5	6	7	8	9	10
8. My school's cafeteria is clean.	1	2	3	4	5	6	7	8	9	10
9. I can often smell chemical fumes in my classroom.	1	2	3	4	5	6	7	8	9	10
10. Noise (reverberation) is a problem within my classroom.	1	2	3	4	5	6	7	8	9	10
11. I can hear traffic noise in my classroom.	1	2	3	4	5	6	7	8	9	10
12. Most of the classrooms in my school have acoustical tile on the walls.	1	2	3	4	5	6	7	8	9	10
13. Most of the classrooms in my school are carpeted.	1	2	3	4	5	6	7	8	9	10
14. The students I teach are often lethargic.	1	2	3	4	5	6	7	8	9	10
15. The students I teach often show no interest in school.	1	2	3	4	5	6	7	8	9	10

16. The students I teach are often sick. 1 2 3 4 5 6 7 8 9 10

17. My students are often absent. 1 2 3 4 5 6 7 8 9 10

18. The behavior of the students I teach often hinders my ability to meet my objectives in the classroom 1 2 3 4 5 6 7 8 9 10

19. Student behavior in my classroom is a problem. 1 2 3 4 5 6 7 8 9 10

20. Student behavior in my school is a problem. 1 2 3 4 5 6 7 8 9 10

21. Student behavior causes me substantial stress. 1 2 3 4 5 6 7 8 9 10

22. The students I teach are motivated to learn. 1 2 3 4 5 6 7 8 9 10

23. Student behavior affects my enthusiasm in the classroom 1 2 3 4 5 6 7 8 9 10

24. I often feel sick or lethargic at school. 1 2 3 4 5 6 7 8 9 10

25. I have often considered changing careers. 1 2 3 4 5 6 7 8 9 10

26. I am often frustrated with the behavior of my students. 1 2 3 4 5 6 7 8 9 10

27. I am satisfied with my job. 1 2 3 4 5 6 7 8 9 10

APPENDIX B

RELIABILITY

R E L I A B I L I T Y A N A L Y S I S - S C A L E (A L P H A)

		Mean	Std Dev	Cases
1.	CLEAN	7.4207	2.2969	164.0
2.	EQUIP	7.5732	2.0636	164.0
3.	WARM	6.8232	2.8283	164.0
4.	COLD	6.4329	2.9393	164.0
5.	VENTILAT	6.1890	3.0589	164.0
6.	WINDOW	6.5549	4.1657	164.0
7.	BATHROOM	6.0610	2.7441	164.0
8.	CAFE	7.2927	2.3627	164.0
9.	FUMES	8.3598	2.5354	164.0
10.	NOISE	6.7683	3.0948	164.0
11.	TRAFFIC	8.4329	2.7495	164.0
12.	AC.TILE	2.8171	3.1316	164.0
13.	CARPET	3.5000	3.4043	164.0
14.	SLEEPY	5.5732	2.4446	164.0
15.	LOW.INT	5.3598	2.4716	164.0
16.	SICK.STU	6.1951	2.3285	164.0
17.	ABS.STU	6.0000	2.3835	164.0
18.	BEHAV.OB	6.7134	2.6625	164.0
19.	BEHAV.CL	7.5183	2.4582	164.0
20.	BEHAV.SC	6.4512	2.6592	164.0
21.	BEHAV.ST	7.0610	2.7530	164.0
22.	STU.MOT	5.6707	2.1339	164.0
23.	BEH.ENT	4.5366	2.7523	164.0
24.	TCH.LETH	7.8537	2.3686	164.0
25.	CH.CAREE	7.5366	2.8999	164.0
26.	BEH.FRUS	6.2744	2.7004	164.0
27.	SATISFAC	7.6220	2.2600	164.0

N of Cases = 164.0

Statistics for	Mean	Variance	Std Dev	Variables
Scale	174.5915	1074.4149	32.7783	27

Item Means	Mean	Minimum	Maximum	Range	Max/Min	Variance
	6.4664	2.8171	8.4329	5.6159	2.9935	1.7496

Analysis of Variance

Source of Var	Sum of Sq.	DF	Mean Sq	F	Prob.
Between People	6486.2825	163	39.7931		
Within People	33651.7037	4264	7.8921		
Bet Measures	7460.4192	26	286.93	46.4295	.0000
Residual	26191.2846	4238	6.1801		
Nonadditivity	95.2358	1	95.2358	15.4626	.0001
Balance	26096.0488	4237	6.1591		
Total	40137.9862	4427	9.0666		
Grand Mean	6.4664				

Intraclass Correlation Coefficient

Two-Way Random Effect Model (Consistency Definition):
People and Measure Effect Random
 Single Measure Intraclass Correlation = .1677*
 95.00% C.I.: Lower = .1351 Upper = .2089
 F = 6.4389 DF = (163, 4238.0) Sig. = .0000 (Test Value = .0000)
 Average Measure Intraclass Correlation = .8447
 95.00% C.I.: Lower = .8083 Upper = .8770
 F = 6.4389 DF = (163, 4238.0) Sig. = .0000 (Test Value = .0000)
*: Notice that the same estimator is used whether the interaction effect
 is present or not.

Tukey estimate of power to which observations
must be raised to achieve additivity = .3964

Reliability Coefficients 27 items

Alpha = .8447 Standardized item alpha = .8600

APPENDIX C

DATA

Data Set

School	clean	equip	warm	cold	vent	wind	bath	café	fumes	noise	traffic	tile	carpet	st.leth	int	st.sick
EHS	8	9	10	8	6	10	4	7	10	8	10	1	1	4	4	4
EHS	8	8	2	9	6	1	6	8	10	8	10	1	1	8	8	7
EHS	10	9	10	10	9	10	9	9	1	2	1	10	1	5	5	6
EHS	10	10	10	10	10	10	10	10	10	10	10	5	5	9	4	9
EHS	8	7	5	7	9	10	10	10	10	9	10	1	2	5	4	6
EHS	8	8	10	10	7	10	7	7	10	10	10	1	1	5	5	2
EHS	8	8	9	4	7	10	8	8	10	10	10	10	1	5	5	7
EHS	3	3	6	10	8	10	4	3	8	8	1	10	1	7	2	10
EHS	9	9	7	7	8	8	8	8	8	8	2	1	1	8	8	8
EHS	9	8	3	3	6	9	9	9	8	1	6	9	2	3	2	2
EHS	7	8	8	3	9	10	6	8	9	8	10	1	1	3	2	4
EHS	8	7	3	9	4	1	4	4	10	3	10	5	1	4	4	7
EHS	10	8	3	3	10	10	10	10	9	10	10	1	1	6	9	9
EHS	5	7	4	4	7	1	3	6	6	4	4	7	1	3	4	4
EHS	7	8	9	9	6	10	7	4	9	8	9	2	1	5	5	6
EHS	10	9	9	9	9	10	9	9	10	9	10	1	1	6	9	8
EHS	9	9	9	1	3	1	9	9	9	3	10	1	1	5	1	5
EHS	9	9	1	10	4	1	5	9	10	1	10	10	2	6	6	7
EHS	10	10	10	10	10	10	10	10	10	10	10	5	5	9	4	9
EHS	8	8	6	6	8	10	8	8	10	10	10	10	1	1	3	3
EHS	8	8	7	7	9	10	7	7	10	9	8	1	1	6	6	6
EHS	8	6	8	5	4	1	7	7	9	3	8	2	1	7	3	8
EHS	7	7	4	9	5	10	3	5	6	6	10	1	1	6	9	5
EHS	8	9	2	10	5	10	7	8	10	10	10	1	1	5	6	5
EHS	8	8	3	3	2	1	6	7	8	4	10	1	1	1	1	1
EHS	7	8	5	5	8	10	7	7	8	5	10	1	1	5	7	7
EHS	9	9	6	6	8	10	7	7	4	4	3	1	1	3	3	3

EHS	7	9	10	2	10	10	6	8	10	5	10	3	10	5	3	4
EHS	9	9	10	5	9	10	7	9	10	10	9	3	2	8	7	9
EHS	3	8	9	3	8	1	2	2	9	2	10	1	1	6	7	9
EHS	10	9	10	9	10	10	10	10	10	10	10	10	1	3	3	4
EHS	5	8	9	5	5	10	5	5	9	7	9	1	2	7	3	5
EHS	8	9	8	8	9	10	8	8	8	8	8	1	2	5	5	3
EHS	6	9	10	7	4	10	6	7	9	10	10	1	1	6	8	8
EHS	10	10	10	10	10	10	7	9	10	10	10	10	1	6	4	6
EHS	9	10	2	10	8	10	5	3	2	6	10	1	1	6	3	6
EHS	10	10	6	6	5	10	8	9	10	10	10	1	1	8	9	4
EHS	8	9	10	4	9	10	9	9	10	9	9	10	1	9	9	9
EHS	10	10	7	7	10	10	10	10	10	10	10	10	1	10	10	10
NHS	8	9	6	6	5	1	8	9	9	6	5	1	9	6	8	8
NHS	4	7	8	3	5	1	4	8	8	8	6	1	1	2	4	6
NHS	8	8	10	10	9	1	5	8	8	8	10	3	2	4	4	4
NHS	6	5	7	3	8	1	5	5	9	8	10	1	1	7	7	7
NHS	7	7	8	8	1	1	2	6	2	7	9	1	1	3	3	4
NHS	5	5	7	1	10	7	3	7	6	1	6	5	5	6	4	4
NHS	6	8	5	8	7	1	3	8	10	8	10	1	1	8	6	8
NHS	8	8	2	6	1	1	6	4	10	2	5	1	1	3	3	5
NHS	4	1	8	8	10	10	5	4	1	7	9	10	1	7	4	4
NHS	9	8	3	3	10	10	7	9	9	5	7	1	3	5	3	4
NHS	8	10	10	2	2	1	7	7	10	4	10	1	1	9	9	9
NHS	9	9	1	10	2	1	4	8	10	1	1	1	1	7	4	2
NHS	8	8	8	8	6	10	6	8	10	3	10	1	1	9	9	9
NHS	8	8	5	10	2	1	7	9	10	3	10	10	1	6	8	6
NHS	7	7	7	5	6	1	9	8	4	7	6	4	4	3	4	5
NHS	5	4	9	1	10	10	4	1	1	10	1	10	10	7	9	7
NHS	7	7	8	3	4	1	6	8	9	1	10	7	1	1	2	2
NHS	8	8	8	2	3	1	5	9	10	4	10	1	10	4	4	3
NHS	7	7	8	8	1	8	3	6	5	1	10	1	1	7	3	5

NHS	9	8	1	10	10	1	7	8	1	2	10	1	1	4	9	10
NHS	3	3	6	6	7	10	2	10	10	5	10	6	10	9	2	2
NHS	6	6	6	6	3	1	4	4	10	10	10	1	2	7	6	3
NHS	9	10	9	2	3	1	4	8	8	6	3	1	1	4	6	7
NHS	3	3	2	5	5	1	1	10	4	9	10	1	1	4	4	4
NHS	7	8	5	5	3	1	4	4	5	3	10	1	1	1	2	3
NHS	4	9	1	1	5	1	3	7	10	1	10	6	1	4	5	2
NHS	10	6	7	8	6	1	8	8	9	10	10	1	1	7	8	8
NHS	9	9	3	9	6	1	7	9	9	9	10	1	5	8	9	8
NHS	7	8	1	6	2	1	2	6	2	2	2	1	2	1	2	1
POP	4	8	6	6	5	1	5	8	10	1	10	8	10	6	9	9
POP	8	10	5	5	4	1	7	9	10	10	10	1	10	5	4	7
POP	10	10	10	6	2	1	10	10	10	5	10	1	1	4	5	7
HAR	10	10	9	8	4	1	8	10	9	9	10	2	9	4	3	7
HAR	2	3	4	6	2	1	1	2	9	4	10	1	10	2	5	7
HAR	10	10	9	9	3	1	9	10	9	9	10	2	9	3	3	7
JAS	5	8	9	9	5	10	8	8	10	3	10	1	1	4	1	5
JAS	4	4	5	9	4	1	4	5	10	9	4	1	1	4	2	5
JAS	5	8	10	10	5	10	7	8	10	4	10	1	1	5	2	5
JAS	3	7	7	7	4	10	1	2	8	10	9	1	1	7	7	7
BAL	6	4	5	1	6	1	6	6	10	8	10	1	8	6	5	5
BAL	10	10	10	10	10	10	10	10	10	10	10	1	10	8	8	6
BAL	8	8	10	10	9	10	7	5	9	10	10	1	10	3	2	5
FRA	5	8	10	10	3	10	4	4	10	1	6	1	1	1	1	4
FRA	8	9	10	10	9	10	8	9	9	6	10	1	2	4	9	8
FRA	9	1	10	9	10	3	3	3	9	1	7	1	1	2	2	4
LOV	10	10	10	10	9	10	10	10	10	10	9	1	1	9	9	10
LOV	9	8	10	10	9	1	6	5	10	8	10	1	1	8	7	8
LOV	10	10	9	9	9	9	9	9	9	9	9	2	2	9	9	10
MOR	8	8	6	6	10	10	8	8	10	5	10	1	3	6	5	8
MOR	9	9	5	10	10	10	10	10	10	5	10	1	5	3	3	5

MOR	10	10	10	10	10	10	10	10	10	10	10	1	10	10	10	10
MUR	7	7	6	6	3	10	7	5	10	8	10	1	1	3	6	3
MUR	4	7	9	5	2	10	1	6	10	10	10	1	1	3	2	2
MUR	6	7	1	1	10	10	1	5	10	3	1	1	5	3	5	5
MUR	4	5	8	8	9	10	4	9	7	10	10	1	1	9	8	8
MUR	7	9	3	3	10	4	3	7	1	1	10	1	3	4	6	10
WAL	4	6	9	1	5	8	5	4	9	3	4	2	10	6	8	7
WAL	2	3	6	2	3	1	2	2	10	10	10	2	9	3	3	5
WAL	7	9	10	4	7	1	4	4	10	10	10	1	6	7	9	9
WAL	9	10	5	6	2	2	8	2	10	5	10	1	6	9	4	6
WOO	1	8	10	1	3	10	1	8	1	10	10	1	9	2	2	5
WOO	8	10	9	3	5	10	9	9	10	10	10	1	1	10	5	10
WOO	3	3	3	8	4	10	5	7	9	7	1	8	2	8	9	6
WIN	7	8	10	10	9	10	7	10	10	10	1	5	1	9	7	10
WIN	7	6	5	5	1	10	2	6	4	4	1	4	4	5	3	7
WIN	4	7	6	6	9	10	2	9	5	9	7	7	1	3	3	3
WIN	10	5	3	3	10	10	4	10	10	8	10	1	1	6	8	7
WIN	7	5	5	3	2	10	3	8	10	9	10	1	1	10	9	9
WIN	8	7	4	4	6	7	7	7	7	2	5	3	2	4	4	4
WIN	7	5	5	3	2	10	3	8	10	9	10	1	1	10	9	9
WIN	10	5	3	3	10	10	4	10	10	8	10	1	1	6	8	7
WIN	8	7	4	4	6	7	7	7	7	2	5	3	2	4	4	4
WIN	8	5	8	8	2	10	8	10	10	8	10	12	1	9	6	6
S.FO	10	9	10	3	10	10	10	10	10	10	10	1	1	9	6	3
S.FO	10	9	10	3	10	10	10	10	10	6	10	1	1	8	6	4
S.FO	10	10	10	4	7	10	10	10	10	1	10	1	1	5	5	8
ELB	8	7	8	2	6	1	7	8	5	8	7	9	5	2	2	6
ELB	10	6	9	9	10	10	6	10	10	8	10	1	3	4	4	8
ELB	9	10	7	1	9	10	9	9	9	8	10	1	2	5	6	6
ELB	10	10	10	3	10	10	9	9	10	10	10	10	10	9	9	9
ELB	9	9	2	4	2	10	2	7	4	4	8	2	7	3	7	7

ELB	8	8	6	6	4	10	8	10	10	10	10	1	10	3	5	4
ELB	10	10	10	10	7	8	8	9	10	9	10	1	3	5	5	7
LOG	5	3	7	4	7	1	4	4	2	2	2	9	4	8	7	7
LOG	8	9	8	9	9	1	9	10	10	10	10	6	6	9	9	9
LOG	8	9	5	5	8	10	8	8	10	5	10	5	8	5	4	5
HER	8	3	2	10	1	1	2	9	10	9	10	1	1	5	3	4
HER	8	8	8	8	4	10	6	6	10	9	9	1	2	5	4	8
HER	7	6	4	4	5	1	1	5	10	10	10	1	1	4	4	4
HER	9	8	9	10	2	10	9	10	10	8	10	1	2	8	8	10
OCO	9	9	10	1	3	1	9	9	9	9	9	1	10	3	7	8
OCO	8	7	1	9	1	10	9	4	3	4	7	1	10	8	7	4
OCO	10	8	10	10	4	10	8	8	4	8	7	1	10	2	2	8
OCO	9	9	7	7	9	9	8	8	7	7	7	9	8	7	7	7
E.PA	5	8	1	10	4	10	4	7	10	7	10	1	10	8	9	9
E.PA	4	6	6	6	5	5	5	5	6	4	5	5	7	2	2	6
E.PA	3	2	9	2	9	2	3	2	1	6	1	10	2	4	2	3
MOR	9	9	6	6	9	9	9	9	9	9	9	1	2	4	3	4
MOR	3	8	8	8	10	10	2	3	7	9	1	9	2	7	6	6
MOR	9	10	6	6	10	10	10	1	10	10	9	1	2	3	3	4
FAN	6	7	9	9	9	8	5	8	8	9	9	1	9	8	7	7
FAN	8	6	10	10	1	1	7	9	8	9	9	2	8	7	7	7
FAN	9	5	10	3	1	1	9	10	7	10	10	10	7	7	6	7
HAR	4	7	6	6	4	10	1	5	3	2	5	1	1	9	3	7
HAR	3	3	3	9	8	10	1	4	8	1	3	2	1	6	8	9
HAR	9	10	10	10	9	9	9	9	9	10	10	7	2	9	9	9
LAM	6	6	10	10	1	1	6	6	10	6	10	1	2	7	9	8
LAM	4	5	6	6	3	7	3	4	9	9	10	3	6	3	5	10
LAM	5	4	6	6	3	10	3	6	5	9	10	1	10	7	8	8
LAM	10	7	10	10	7	10	7	7	10	10	10	1	7	9	7	9
S.AT	9	9	5	5	6	10	4	9	10	9	10	1	1	4	8	9
S.AT	10	9	10	10	10	1	1	9	10	10	10	1	1	10	6	9

S.AT	10	7	10	10	10	1	1	8	10	10	10	1	1	10	7	9
SEQ	9	9	2	10	2	2	9	9	6	6	10	1	9	6	6	3
SEQ	8	8	6	6	9	10	7	8	9	2	8	1	5	8	8	5
SEQ	8	8	4	10	3	1	8	9	7	7	10	2	7	6	6	4
NEW	7	9	4	4	5	5	6	9	9	3	9	2	2	5	3	5
NEW	3	7	5	4	1	8	3	6	10	6	10	1	10	2	3	3
NEW	1	6	5	5	1	7	4	6	9	5	10	1	10	2	4	3
STO	9	7	8	8	2	1	5	5	10	4	10	1	4	3	4	4
STO	10	10	6	6	10	10	10	1	10	2	10	1	10	2	2	6
STO	9	8	5	5	9	10	9	9	10	10	3	1	10	3	3	6
GAI	10	10	10	10	10	10	10	10	10	10	10	1	1	10	10	10
GAI	10	7	10	10	9	10	9	9	9	9	10	2	1	5	4	6
GAI	10	10	10	10	9	10	10	8	10	10	10	1	1	3	4	9

School	stu.abs	be.ob	be.cl	be.sc	be.st	mot	be.ent	t.leth	career	frus	satis	sch	exp	edu	sch.age	t.sick
EHS	3	5	6	1	4	3	4	9	2	4	5	1	2	4	9	4
EHS	9	8	9	6	9	6	5	7	9	7	9	1	3	6	13	0
EHS	7	9	9	10	9	9	7	9	10	9	10	1	35	6	9	2
EHS	9	2	3	3	4	2	3	10	5	2	9	1	8	6	8	5
EHS	7	6	6	5	7	4	4	8	9	7	8	1	3	4	8	1
EHS	2	10	10	8	10	4	2	10	8	10	10	1	4	6	11	0
EHS	7	2	9	6	5	2	2	9	10	3	9	1	3	4	9	1
EHS	8	7	7	4	8	5	2	7	7	10	8	1	6	5	7	27
EHS	8	8	9	7	6	8	2	9	9	6	10	1	22	6	8	3
EHS	2	3	3	1	3	8	3	2	2	3	8	1	32	5	7	9
EHS	3	4	5	2	1	3	2	9	4	2	6	1	8	4	9	6
EHS	3	4	5	5	5	4	5	9	9	3	8	1	2	5	9	1
EHS	10	10	10	7	10	7	4	10	10	8	9	1	15	5	8	0
EHS	3	3	2	4	4	6	4	2	10	5	10	1	25	5	9	0
EHS	4	9	9	8	7	5	4	9	6	6	8	1	5	4	8	1
EHS	9	8	9	3	5	4	1	9	9	8	6	1	17	5	9	1
EHS	5	2	3	9	2	2	3	9	9	2	7	1	24	7	9	7
EHS	3	2	2	2	5	7	2	1	10	9	8	1	30	6	9	1
EHS	9	2	3	3	4	2	3	10	5	2	9	1	8	6	8	5
EHS	3	5	5	6	8	5	8	10	10	6	10	1	2	5	7	1
EHS	7	8	9	8	9	7	2	9	10	9	10	1	12	6	9	2
EHS	7	6	7	7	9	3	8	8	9	6	1	1	1	4	6	2
EHS	5	8	9	5	8	6	4	9	9	8	9	1	2	5	7	0
EHS	7	4	6	4	7	2	6	6	5	8	6	1	13	6	10	4
EHS	1	3	3	7	7	4	7	5	10	5	9	1	1	6	8	0
EHS	6	5	6	4	4	8	6	6	10	6	9	1	3	5	9	0
EHS	4	3	4	3	7	5	5	5	4	4	9	1	12	6	10	5
EHS	5	8	9	3	8	2	5	10	7	5	7	1	1	6	10	1
EHS	8	10	10	9	10	7	10	10	10	9	9	1	16	6	9	2
EHS	6	5	9	9	8	3	4	10	10	4	5	1	26	6	9	1

EHS	4	5	5	2	2	5	1	9	1	3	6	1	13	5	8	2
EHS	5	6	9	5	9	4	2	9	2	4	3	1	19	6	9	10
EHS	4	4	5	5	3	7	1	5	7	4	8	1	12	7	9	7
EHS	9	10	10	7	10	8	1	9	10	10	9	1	10	6	7	3
EHS	3	7	7	3	7	5	3	8	10	6	9	1	1	4	9	2
EHS	8	1	1	1	1	3	1	6	1	1	2	1	7	5	8	1
EHS	4	10	10	9	10	8	1	10	10	10	10	1	6	5	9	2
EHS	9	9	10	10	9	8	2	10	10	9	9	1	26	6	9	2
EHS	10	10	10	10	10	9	10	10	10	10	10	1	14	4	9	8
NHS	9	9	10	6	9	8	6	9	3	9	10	2	14	7	28	5
NHS	5	8	8	8	8	7	3	8	9	8	8	2	31	7	28	1
NHS	3	4	4	7	6	3	6	9	8	4	8	2	1	4	28	1
NHS	8	9	9	8	9	5	4	9	9	8	9	2	10	4	28	8
NHS	3	4	5	6	6	2	2	8	10	6	9	2	5	6	28	4
NHS	1	7	8	8	8	9	8	7	7	8	6	2	2	6	28	6
NHS	7	6	9	2	8	5	4	10	7	5	8	2	9	4	28	1
NHS	4	5	8	8	4	2	3	6	7	1	8	2	11	5	28	3
NHS	4	3	3	3	3	5	10	2	1	2	1	2	7	10	28	4
NHS	7	4	5	8	4	4	4	5	3	3	7	2	2	5	28	5
NHS	9	9	9	9	9	8	3	10	10	9	8	2	28	4	28	5
NHS	4	9	10	10	9	7	5	9	9	6	8	2	10	5	28	5
NHS	9	8	8	8	8	8	3	9	9	7	7	2	22	4	28	0
NHS	6	9	9	8	8	6	10	10	8	9	8	2	5	6	28	5
NHS	6	7	9	9	8	5	6	10	4	6	8	2	8	5	28	5
NHS	6	10	10	9	9	8	8	1	4	10	2	2	13	4	28	3
NHS	5	3	3	4	5	4	1	5	4	2	5	2	3	4	28	0
NHS	3	7	8	5	4	7	2	3	3	3	4	2	37	7	28	12
NHS	7	2	3	4	3	7	1	5	3	3	7	2	15	4	28	2
NHS	10	10	10	9	9	6	4	9	9	9	8	2	12	8	28	2
NHS	2	4	2	1	1	3	10	10	9	2	9	2	1	4	28	1
NHS	5	5	8	7	10	5	2	6	3	3	7	2	18	5	28	13

NHS	7	8	9	6	8	8	2	10	9	9	9	2	15	6	28	4
NHS	4	3	4	4	5	6	2	5	5	3	6	2	6	5	28	2
NHS	3	4	8	4	10	3	7	10	10	9	9	2	6	6	28	3
NHS	1	8	9	5	9	4	4	10	10	5	9	2	2	7	28	9
NHS	8	8	8	8	9	8	9	10	9	9	9	2	5	4	28	3
NHS	5	8	9	7	8	5	9	9	9	9	10	2	33	5	28	0
NHS	2	3	4	4	2	7	4	3	5	1	9	2	6	6	28	5
POP	9	10	10	9	3	8	1	8	1	9	9	3	14	4	16	3
POP	8	5	9	6	9	6	7	10	5	4	8	3	6	5	16	10
POP	5	5	5	8	3	7	3	5	6	3	7	3	10	5	16	5
HAR	8	7	8	9	9	7	3	9	7	7	9	4	3	5	11	5
HAR	2	5	7	4	4	4	4	6	1	4	3	4	9	9	11	2
HAR	7	7	7	10	10	8	3	9	6	6	10	4	5	5	11	5
JAS	5	6	10	10	10	8	3	4	10	3	10	5	25	5	40	8
JAS	2	2	2	2	2	3	2	7	4	2	6	5	11	12	40	6
JAS	5	7	10	10	9	7	4	5	10	4	10	5	27	5	40	8
JAS	7	10	10	6	9	6	5	9	5	8	9	5	18	7	40	4
BAL	3	10	10	5	10	6	5	10	10	8	9	6	27	4	12	0
BAL	6	10	10	9	10	8	2	10	10	10	10	6	30	5	12	1
BAL	4	4	4	2	3	4	1	10	10	4	8	6	26	6	12	3
FRA	4	5	7	8	7	2	1	6	9	6	8	7	22	6	30	2
FRA	7	10	10	8	10	9	2	8	9	9	9	7	20	5	30	7
FRA	4	4	7	7	7	3	1	6	10	6	9	7	20	5	30	2
LOV	10	10	10	10	10	9	10	10	10	10	9	8	33	5	13	4
LOV	6	6	7	3	5	5	1	8	9	7	8	8	4	4	13	2
LOV	10	10	10	10	10	10	10	9	9	9	10	8	35	5	13	3
MOR	6	5	6	7	3	6	3	6	6	4	6	9	5	4	30	5
MOR	4	2	4	8	4	6	3	6	3	3	8	9	15	6	30	4
MOR	10	10	10	10	10	10	10	10	10	10	10	9	26	6	30	0
MUR	4	10	9	9	9	4	5	4	9	9	7	10	3	4	13	0
MUR	5	8	8	3	9	7	5	5	10	4	4	10	7	8	13	8

MUR	4	4	6	6	6	8	3	9	9	3	3	10	25	5	13	0
MUR	7	10	10	8	10	5	10	7	9	10	6	10	10	8	13	12
MUR	7	7	8	7	9	2	7	10	10	4	10	10	9	5	13	3
WAL	7	8	9	9	9	9	3	9	9	8	7	11	11	4	27	4
WAL	5	3	8	8	5	4	3	10	2	4	6	11	17	5	27	6
WAL	9	9	9	9	9	8	9	10	10	9	9	11	14	5	27	2
WAL	9	9	9	10	5	9	3	10	10	8	10	11	13	5	27	5
WOO	3	9	10	9	10	6	2	6	10	9	7	12	15	6	7	3
WOO	10	8	9	8	9	4	3	10	10	9	2	12	1	4	7	2
WOO	6	9	9	8	9	6	5	8	10	9	9	12	13	8	7	6
WIN	8	8	7	9	9	6	7	10	10	9	10	13	4	7	35	3
WIN	6	3	6	6	5	5	7	7	8	5	7	13	7	4	35	45
WIN	6	4	7	7	4	5	6	9	8	6	8	13	3	5	35	0
WIN	5	9	10	10	10	7	7	10	10	9	10	13	29	5	35	2
WIN	9	10	10	8	10	7	1	10	9	8	7	13	23	6	35	0
WIN	5	7	8	5	6	3	6	5	4	7	8	13	3	7	35	1
WIN	9	10	10	8	10	7	1	10	9	8	7	13	23	6	35	0
WIN	5	9	10	10	10	7	7	10	10	9	10	13	29	5	35	2
WIN	5	7	8	5	6	3	6	5	4	7	8	13	3	7	35	1
WIN	5	10	10	10	10	7	10	10	10	7	2	13	2	8	35	0
S.FO	9	9	9	9	9	8	9	10	10	9	10	14	26	6	6	1
S.FO	9	9	9	8	8	8	3	7	4	7	9	14	15	6	6	2
S.FO	6	4	3	1	2	5	3	7	4	1	8	14	1	7	6	4
ELB	4	2	3	4	2	5	1	4	3	3	6	15	26	4	27	1
ELB	8	8	8	8	9	7	8	9	4	7	8	15	21	8	27	0
ELB	6	5	6	6	7	6	4	8	8	8	9	15	24	5	27	4
ELB	9	7	6	9	9	5	5	10	10	7	10	15	4	4	27	1
ELB	9	8	7	7	7	7	4	6	9	7	9	15	13	8	27	2
ELB	6	7	9	7	9	6	2	4	10	5	10	15	3	4	27	2
ELB	7	6	6	7	3	7	2	7	8	5	7	15	0	4	27	4
LOG	7	5	3	5	5	5	7	4	2	5	3	16	16	6	5	2

LOG	9	9	10	9	10	9	9	1	10	9	10	16	33	6	5	0
LOG	4	8	8	6	8	4	6	8	4	7	7	16	18	7	5	2
HER	4	3	6	8	6	3	3	3	4	3	8	17	10	5	27	9
HER	5	9	8	9	9	5	9	5	1	1	6	17	3	5	27	3
HER	5	9	9	3	9	4	3	5	7	4	9	17	6	8	27	2
HER	9	8	8	8	8	8	1	9	10	4	10	17	19	7	27	0
OCO	8	9	9	9	9	8	2	9	9	9	9	18	9	8	10	60
OCO	4	4	4	4	7	4	6	9	10	4	3	18	22	6	10	9
OCO	4	3	6	6	8	3	2	10	5	5	7	18	33	10	10	1
OCO	7	7	7	7	7	8	7	10	8	8	9	18	4	5	10	0
E.PA	8	9	9	8	10	9	5	8	9	9	8	19	8	5	12	10
E.PA	7	4	6	6	4	2	2	10	5	3	5	19	7	9	12	3
E.PA	3	6	4	4	7	2	9	4	5	8	3	19	13	4	12	4
MOR	5	9	10	4	9	9	1	9	10	9	10	20	9	5	32	1
MOR	6	4	8	7	9	4	8	9	10	9	10	20	4	4	32	3
MOR	4	10	10	3	10	10	1	10	10	10	10	20	9	5	32	2
FAN	8	8	9	8	10	7	3	9	4	8	7	21	26	5	26	1
FAN	7	8	8	8	5	3	2	8	2	2	7	21	20	5	26	2
FAN	6	4	3	5	1	3	2	8	10	2	6	21	15	5	26	2
HAR	5	3	5	2	2	3	4	9	10	3	5	22	15	5	52	9
HAR	3	9	9	8	9	5	8	9	9	9	9	22	15	6	52	8
HAR	9	9	9	9	9	9	9	10	10	9	10	22	8	5	52	3
LAM	8	10	10	10	10	7	10	6	3	10	5	23	19	10	15	7
LAM	9	10	10	6	10	3	6	10	10	10	5	23	7	4	15	1
LAM	9	10	10	9	10	5	8	9	10	8	1	23	21	5	15	3
LAM	10	10	10	10	10	3	9	10	10	9	1	23	13	5	15	5
S.AT.	9	9	9	9	3	7	2	10	9	7	9	24	9	6	9	2
S.AT.	1	10	10	1	1	7	2	9	9	4	7	24	4	5	9	1
S.AT.	1	10	10	1	1	6	1	10	10	4	6	24	3	5	9	0
SEQ	6	10	10	10	10	6	4	7	10	10	8	25	10	6	13	3
SEQ	8	9	10	9	7	8	7	9	10	4	9	25	8	6	13	4

SEQ	6	10	9	9	9	6	5	6	9	9	9	25	9	9	13	0
NEW	4	2	2	3	2	3	3	7	3	2	7	26	34	5	45	7
NEW	4	4	9	3	6	5	6	3	3	5	5	26	5	5	45	5
NEW	5	6	8	1	7	4	5	3	3	6	4	26	2	5	45	6
STO	5	6	5	5	8	7	5	10	10	4	9	27	30	6	7	3
STO	6	5	10	2	10	5	5	10	10	6	8	27	15	4	7	5
STO	6	5	9	3	9	6	5	10	10	6	8	27	17	4	7	6
GAI	10	10	10	10	10	7	10	10	10	10	10	28	22	4	3	0
GAI	8	3	8	8	3	6	7	8	9	8	10	28	6	7	3	2
GAI	9	4	5	8	7	2	3	9	10	10	7	28	19	6	3	0

Adjusted Data Set

School	clean	equip	warm	cold	vent	wind	bath	café	fumes	noise
1	8.05	8.38	6.92	6.74	7.28	8.08	7.00	7.51	8.69	7.13
2	6.86	7.03	5.83	5.62	5.24	3.00	4.86	7.10	7.21	5.21
3	7.33	9.33	7.00	5.67	3.67	1.00	7.33	9.00	10.00	5.33
4	7.33	7.67	7.33	7.67	3.00	1.00	6.00	7.33	9.00	7.33
5	4.25	6.75	7.75	8.75	4.50	7.75	5.00	5.75	9.50	6.50
6	8.00	7.33	8.33	7.00	8.33	7.00	7.67	7.00	9.67	9.33
7	7.33	6.00	10.00	9.67	7.33	7.67	5.00	5.33	9.33	2.67
8	9.67	9.33	9.67	9.67	9.00	6.67	8.33	8.00	9.67	9.00
9	9.00	9.00	7.00	8.67	10.00	10.00	9.33	9.33	10.00	6.67
10	5.60	7.00	5.40	4.60	6.80	8.80	3.20	6.40	7.60	6.40
11	5.50	7.00	7.50	3.25	4.25	3.00	4.75	3.00	9.75	7.00
12	4.00	7.00	7.33	4.00	4.00	10.00	5.00	8.00	6.67	9.00
13	7.60	6.00	5.30	4.90	5.70	9.40	4.70	8.50	8.30	6.90
14	10.00	9.33	10.00	3.33	9.00	10.00	10.00	10.00	10.00	5.67
15	9.14	8.57	7.43	5.00	6.86	8.43	7.00	8.86	8.29	8.14
16	7.00	7.00	6.67	6.00	8.00	4.00	7.00	7.33	7.33	5.67
17	8.00	6.25	5.75	8.00	3.00	5.50	4.50	7.50	10.00	9.00
18	9.00	8.25	7.00	6.75	4.25	7.50	8.50	7.25	5.75	7.00
19	4.00	5.33	5.33	6.00	6.00	5.67	4.00	4.67	5.67	5.67
20	7.00	9.00	6.67	6.67	9.67	9.67	7.00	4.33	8.67	9.33
21	7.67	6.00	9.67	7.33	3.67	3.33	7.00	9.00	7.67	9.33
22	5.33	6.67	6.33	8.33	7.00	9.67	3.67	6.00	6.67	4.33
23	6.25	5.50	8.00	8.00	3.50	7.00	4.75	5.75	8.50	8.50
24	9.67	8.33	8.33	8.33	8.67	4.00	2.00	8.67	10.00	9.67
25	8.33	8.33	4.00	8.67	4.67	4.33	8.00	8.67	7.33	5.00
26	3.67	7.33	4.67	4.33	2.33	6.67	4.33	7.00	9.33	4.67
27	9.33	8.33	6.33	6.33	7.00	7.00	8.00	5.00	10.00	5.33
28	10.00	9.00	10.00	10.00	9.33	10.00	9.67	9.00	9.67	9.67

School	traffic	tile	carpet	s.leth	st.int	s.sick	st.ab	be.ob	be.cl	be.sc
1.	8.64	3.90	1.59	5.62	5.13	6.03	5.79	5.92	6.74	5.41
2.	7.93	2.79	2.76	5.28	5.21	5.17	5.28	6.34	7.21	6.38
3.	10.00	3.33	7.00	5.00	6.00	7.67	7.33	6.67	8.00	7.67
4.	10.00	1.67	9.33	3.00	3.67	7.00	5.67	6.33	7.33	7.67
5.	8.25	1.00	1.00	5.00	3.00	5.50	4.75	6.25	8.00	7.00
6.	10.00	1.00	9.33	5.67	5.00	5.33	4.33	8.00	8.00	5.33
7.	7.67	1.00	1.33	2.33	4.00	5.33	5.00	6.33	8.00	7.67
8.	9.33	1.33	1.33	8.67	8.33	9.33	8.67	8.67	9.00	7.67
9.	10.00	1.00	6.00	6.33	6.00	7.67	6.67	5.67	6.67	8.33
10.	8.20	1.00	2.20	4.40	5.40	5.60	5.40	7.80	8.20	6.60
11.	8.50	1.50	7.75	6.25	6.00	6.75	7.50	7.25	8.75	9.00
12.	7.00	3.33	4.00	6.67	5.33	7.00	6.33	8.67	9.33	8.33
13.	6.90	3.80	1.50	6.60	6.10	6.60	6.30	7.70	8.60	7.80
14.	10.00	1.00	1.00	7.33	5.67	5.00	8.00	7.33	7.00	6.00
15.	9.29	3.57	5.71	4.43	5.43	6.71	7.00	6.14	6.43	6.86
16.	7.33	6.67	6.00	7.33	6.67	7.00	6.67	7.33	7.00	6.67
17.	9.75	1.00	1.50	5.50	4.75	6.50	5.75	7.25	7.75	7.00
18.	7.50	3.00	9.50	5.00	5.75	6.75	5.75	5.75	6.50	6.50
19.	5.33	5.33	6.33	4.67	4.33	6.00	6.00	6.33	6.33	6.00
20.	6.33	3.67	2.00	4.67	4.00	4.67	5.00	7.67	9.33	4.67
21.	9.33	4.33	8.00	7.33	6.67	7.00	7.00	6.67	6.67	7.00
22.	6.00	3.33	1.33	8.00	6.67	8.33	5.67	7.00	7.67	6.33
23.	10.00	1.50	6.25	6.50	7.25	8.75	9.00	10.00	10.00	8.75
24.	10.00	1.00	1.00	8.00	7.00	9.00	3.67	9.67	9.67	3.67
25.	9.33	1.33	7.00	6.67	6.67	4.00	6.67	9.67	9.67	9.33
26.	9.67	1.33	7.33	3.00	3.33	3.67	4.33	4.00	6.33	2.33
27.	7.67	1.00	8.00	2.67	3.00	5.33	5.67	5.33	8.00	3.33
28.	10.00	1.33	1.00	6.00	6.00	8.33	9.00	5.67	7.67	8.67

School	be.st	st.mot	enth.	t.leth	career	frus	satis	exp	col	sc.age
1.	6.51	5.13	3.82	8.00	7.64	5.97	7.87	12	5	9
2.	6.86	5.69	4.90	7.48	6.76	5.79	7.45	12	5	28
3.	5.00	7.00	3.67	7.67	4.00	5.33	8.00	10	5	16
4.	7.67	6.33	3.33	8.00	4.67	5.67	7.33	6	6	11
5.	7.50	6.00	3.50	6.25	7.25	4.25	8.75	20	7	40
6.	7.67	6.00	2.67	10.00	10.00	7.33	9.00	28	5	12
7.	8.00	4.67	1.33	6.67	9.33	7.00	8.67	21	5	30
8.	8.33	8.00	7.00	9.00	9.33	8.67	9.00	24	5	13
9.	5.67	7.33	5.33	7.33	6.33	5.67	8.00	15	5	30
10.	8.60	5.20	6.00	7.00	9.40	6.00	6.00	11	6	13
11.	7.00	7.50	4.50	9.75	7.75	7.25	8.00	14	5	27
12.	9.33	5.33	3.33	8.00	10.00	9.00	6.00	10	6	7
13.	8.00	5.70	5.80	8.60	8.20	7.50	7.70	13	6	35
14.	6.33	7.00	5.00	8.00	6.00	5.67	9.00	14	6	6
15.	6.57	6.14	3.71	6.86	7.43	6.00	8.43	13	5	27
16.	7.67	6.00	7.33	4.33	5.33	7.00	6.67	22	6	5
17.	8.00	5.00	4.00	5.50	5.50	3.00	8.25	10	6	27
18.	7.75	5.75	4.25	9.50	8.00	6.50	7.00	17	7	10
19.	7.00	4.33	5.33	7.33	6.33	6.67	5.33	9	6	12
20.	9.33	7.67	3.33	9.33	10.00	9.33	10.00	7	5	32
21.	5.33	4.33	2.33	8.33	5.33	4.00	6.67	20	5	26
22.	6.67	5.67	7.00	9.33	9.67	7.00	8.00	13	5	52
23.	10.00	4.50	8.25	8.75	8.25	9.25	3.00	15	6	15
24. .	1.67	6.67	1.67	9.67	9.33	5.00	7.33	5	5	9
25.	8.67	6.67	5.33	7.33	9.67	7.67	8.67	9	7	13
26.	5.00	4.00	4.67	4.33	3.00	4.33	5.33	14	5	45
27.	9.00	6.00	5.00	10.00	10.00	5.33	8.33	21	5	7
28.	6.67	5.00	6.67	9.00	9.67	9.33	9.00	16	6	3

School	t.sick	fr.lun	gtw	gtsci	gt.soc	gt.mat	gt.e	act.sci	act.r	act.m
1.	3.2	29.2	92	70	86	96	98	19.8	20.1	19.4
2.	4.0	28.8	90	76	85	95	96	18.4	18.5	18.4
3.	6.0	.7	96	96	97	99	100	21.5	22.6	21.8
4.	4.0	.7	95	91	96	98	99	21.6	22.4	21.7
5.	6.5	48.0	92	64	64	83	95	19.7	20.8	18.3
6.	1.3	43.2	78	59	61	79	88	18.3	17.6	17.4
7.	3.7	20.5	90	71	79	93	93	20.0	21.4	19.4
8.	3.0	29.9	89	72	84	91	97	19.5	19.7	19.0
9.	3.0	27.9	80	67	80	90	94	19.4	17.8	18.0
10.	4.6	31.3	81	60	75	89	93	19.5	21.8	17.8
11.	4.3	.5	98	94	97	98	98	22.0	22.7	22.8
12.	3.7	8.9	94	79	91	95	96	20.9	22.0	21.8
13.	5.4	24.7	88	76	78	94	98	19.5	19.0	18.2
14.	2.3	3.7	91	83	88	96	97	21.1	22.2	21.3
15.	2.0	41.4	79	57	64	87	92	18.7	19.3	18.1
16.	1.3	8.6	84	81	83	95	96	21.0	19.8	20.8
17.	3.5	11.3	91	81	89	94	96	22.1	22.8	22.2
18.	17.5	9.2	95	90	94	98	99	21.0	21.4	21.1
19.	5.7	9.0	91	88	95	98	100	20.0	19.5	19.7
20.	2.0	38.2	87	62	81	92	95	17.2	16.3	17.8
21.	1.7	31.9	86	67	88	92	97	20.7	21.0	19.4
22.	6.7	31.9	82	63	77	92	98	18.8	18.9	19.1
23.	4.0	55.9	86	70	85	87	95	15.3	14.2	17.5
24. .	1.0	83.0	69	60	66	71	84	.	.	.
25.	2.3	5.2	92	88	90	94	97	21.3	21.5	20.8
26.	6.0	21.2	86	71	82	89	97	19.2	19.5	19.3
27.	4.7	12.1	94	79	88	92	98	18.5	18.9	18.8
28.	.7	33.2	78	64	75	81	89	20.5	21.3	20.9

School	act.e	act.c	sat.m	sat.v	sat.tot	ph.e	t.sat	st.be	p.gtw	p.gts
1.	18.6	19.6	515	511	1026	6.92	5.61	7.37	86.92	70.24
2.	17.6	18.3	528	518	1046	5.50	5.83	6.87	87.04	70.62
3.	21.4	21.9	546	536	1082	6.61	6.40	6.25	93.10	86.82
4.	21.4	21.9	522	530	1052	6.51	5.80	6.42	94.37	89.73
5.	17.9	19.3	445	463	908	5.90	5.65	6.63	82.94	61.35
6.	17.4	17.8	445	468	913	7.69	5.80	9.08	82.17	60.29
7.	19.8	20.4	484	490	974	6.18	5.27	7.92	88.06	75.17
8.	19.1	19.4	473	467	940	7.77	8.37	9.00	85.31	68.14
9.	17.7	18.4	481	479	960	8.15	6.57	6.83	86.87	70.86
10.	19.5	19.8	458	475	933	5.63	6.32	7.10	86.86	70.07
11.	22.0	22.5	579	556	1135	5.60	7.05	8.19	92.86	86.89
12.	20.7	21.5	518	510	1028	6.10	6.96	8.25	92.00	83.94
13.	17.9	18.8	473	478	951	6.12	6.92	8.00	88.19	74.06
14.	20.8	21.5	517	516	1033	7.64	6.47	7.17	92.96	87.48
15.	18.1	18.7	490	487	977	7.41	5.94	7.18	84.03	62.58
16.	20.5	20.7	470	480	950	6.62	6.97	5.83	91.12	84.06
17.	21.9	22.4	520	519	1039	6.13	6.15	5.56	91.60	82.88
18.	20.8	21.2	518	518	1036	7.02	5.98	7.75	91.94	85.44
19.	18.9	19.6	491	485	976	5.33	5.63	6.41	92.00	83.90
20.	15.4	16.8	454	435	889	6.92	6.03	9.66	84.92	63.82
21.	20.2	20.5	479	487	966	7.10	6.03	6.08	85.36	67.62
22.	18.1	18.7	488	476	964	5.74	6.90	8.50	86.21	68.52
23.	12.8	15.0	433	426	859	6.42	8.30	7.31	80.97	54.70
24. .	.	.	404	364	768	6.90	6.07	7.83	.	.
25.	20.4	21.1	520	513	1033	6.54	7.33	8.34	93.42	87.88
26.	18.7	19.3	518	519	1037	5.59	4.07	4.25	88.35	74.54
27.	17.9	18.7	496	488	984	6.87	5.33	8.41	89.60	79.28
28.	20.2	20.7	514	498	1012	8.36	6.97	9.25	85.83	68.13

School	pgtsoc	pgtmat	pgteng	pactsci	pactr	pactmat
1.	82.18	91.51	95.71	19.08	19.29	19.06
2.	82.20	91.54	95.73	19.14	19.37	19.11
3.	96.21	98.85	98.73	20.99	21.51	21.28
4.	95.78	99.21	99.17	21.49	22.22	21.67
5.	67.69	83.92	92.65	18.65	18.69	17.85
6.	69.73	84.14	92.33	18.41	18.18	17.71
7.	82.18	91.11	95.41	20.07	20.25	19.71
8.	77.55	88.36	94.11	19.19	19.15	18.76
9.	81.15	90.80	95.35	19.31	19.48	19.14
10.	80.65	90.89	95.55	19.15	19.41	19.03
11.	94.62	97.87	98.28	21.17	21.63	21.28
12.	90.96	96.40	97.89	20.86	21.40	20.89
13.	82.80	91.95	95.97	19.73	20.04	19.56
14.	90.99	96.31	97.84	21.54	22.11	21.36
15.	76.25	88.30	94.32	18.16	18.20	18.03
16.	85.36	92.97	96.31	21.44	21.83	20.89
17.	89.64	95.77	97.66	20.76	21.31	20.75
18.	86.08	93.81	96.87	21.57	22.12	21.08
19.	91.05	96.47	97.92	20.84	21.39	20.88
20.	80.86	90.83	95.38	17.98	18.08	18.20
21.	77.76	88.71	94.36	19.04	19.05	18.70
22.	80.51	90.58	95.29	18.91	19.07	18.83
23.	68.10	84.06	92.61	17.37	17.28	16.97
24.	.	.	.	.	.	
25.	91.51	96.97	98.28	21.51	22.21	21.42
26.	85.23	92.96	96.24	19.65	19.89	19.63
27.	86.75	93.38	96.28	20.47	20.68	20.26
28.	78.23	89.32	94.77	19.04	19.17	18.77

School	pacteng	pactcomp	psatm	psatv	psattot
1.	18.11	18.99	492.67	486.56	979.23
2.	18.18	19.05	492.37	486.84	979.21
3.	20.93	21.30	544.16	529.81	1073.98
4.	21.10	21.74	534.83	27.05	1061.87
5.	17.09	18.19	433.71	449.81	883.53
6.	17.46	18.08	451.42	459.62	911.04
7.	19.58	20.04	492.72	494.41	987.13
8.	18.60	19.06	479.90	481.34	961.24
9.	18.48	19.22	489.17	486.52	975.69
10.	18.02	19.00	484.24	481.94	966.18
11.	21.19	21.46	538.35	528.01	1066.35
12.	20.37	21.00	519.77	514.38	1034.15
13.	18.83	19.65	491.65	490.45	982.10
14.	21.26	21.71	518.35	518.66	1037.01
15.	16.88	17.91	472.44	468.58	941.02
16.	21.22	20.86	514.04	510.31	1024.35
17.	21.08	21.61	497.11	506.64	1003.75
18.	20.34	20.98	520.11	514.40	1034.51
19.	16.73	17.82	491.21	477.77	968.98
20.	18.25	18.89	479.04	479.33	958.37
21.	17.89	18.77	486.92	482.14	969.07
22.	15.61	16.89	440.98	444.86	885.84
23. .	.	.	.	.	.
24.	20.98	21.65	516.97	517.02	1033.99
25.	19.02	19.66	504.78	497.85	1002.63
26.	20.32	20.58	511.62	508.31	1019.93
27.	18.01	18.86	477.47	477.81	955.28

APPENDIX D

TABLES

Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Eta Sq
Corrected Model	GT.WRITE	375.167	3	125.056	5.766	.004	.429
	GT.SCI	2617.953	3	872.651	26.736	.000	.777
	GT.SOC	1590.879	3	530.293	13.588	.000	.639
	GT.MAT	479.396	3	159.799	16.031	.000	.676
	GT.ENG	90.998	3	30.333	5.057	.008	.397
	ACT.SCI	40.716	3	13.572	14.975	.000	.661
	ACT.READ	57.001	3	19.000	7.717	.001	.502
	ACT.MAT	46.976	3	15.659	17.290	.000	.693
	ACT.ENG	70.851	3	23.617	14.187	.000	.649
	ACT.COMP	53.773	3	17.924	15.489	.000	.669
	SAT.MAT	19035.688	3	6345.229	13.679	.000	.641
	SAT.VERB	13884.234	3	4628.078	11.976	.000	.610
	SAT.TOT	64602.540	3	21534.180	13.321	.000	.635
Intercept	GT.WRITE	3088.355	1	3088.355	142.397	.000	.861
	GT.SCI	2360.106	1	2360.106	72.308	.000	.759
	GT.SOC	4205.926	1	4205.926	107.767	.000	.824
	GT.MAT	3964.400	1	3964.400	397.701	.000	.945
	GT.ENG	3699.121	1	3699.121	616.676	.000	.964
	ACT.SCI	131.094	1	131.094	144.652	.000	.863
	ACT.READ	134.366	1	134.366	54.576	.000	.704
	ACT.MAT	152.951	1	152.951	168.889	.000	.880
	ACT.ENG	135.891	1	135.891	81.630	.000	.780
	ACT.COMP	139.676	1	139.676	120.696	.000	.840
	SAT.MAT	133742.133		133742.133	288.329	.000	.926
	SAT.VERB	110982.017	1	110982.017	287.193	.000	.926
	SAT.TOT	488387.619	1	488387.619	302.111	.000	.929
YRS.EXP	GT.WRITE	5.302	1	5.302	.244	.626	.011
	GT.SCI	1.573	1	1.573	.048	.828	.002
	GT.SOC	118.249	1	118.249	3.030	.095	.116
	GT.MAT	47.439	1	47.439	4.759	.040	.171
	GT.ENG	10.641	1	10.641	1.774	.196	.072
	ACT.SCI	.785	1	.785	.867	.362	.036
	ACT.READ	.249	1	.249	.101	.754	.004
	ACT.MAT	3.891E-02	1	3.891E-02	.043	.838	.002
	ACT.ENG	2.285	1	2.285	1.373	.253	.056
	ACT.COMP	.582	1	.582	.503	.485	.021
	SAT.MAT	1394.075	1	1394.075	3.005	.096	.116
	SAT.VERB	165.986	1	165.986	.430	.519	.018
	SAT.TOT	2522.135	1	2522.135	1.560	.224	.064
YRS.COL	GT.WRITE	4.274	1	4.274	.197	.661	.008
	GT.SCI	40.333	1	40.333	1.236	.278	.051

	GT.SOC	27.680	1	27.680	.709	.408	.030
	GT.MAT	3.404	1	3.404	.341	.565	.015
	GT.ENG	5.410E-02	1	5.410E-02	.009	.925	.000
	ACT.SCI	2.314	1	2.314	2.553	.124	.100
	ACT.READ	3.559	1	3.559	1.445	.241	.059
	ACT.MAT	.712	1	.712	.786	.384	.033
	ACT.ENG	.998	1	.998	.600	.447	.025
	ACT.COMP	1.744	1	1.744	1.507	.232	.061
	SAT.MAT	1336.435	1	1336.435	2.881	.103	.111
	SAT.VERB	133.029	1	133.029	.344	.563	.015
	SAT.TOT	2312.754	1	2312.754	1.431	.244	.059
FREE	GT.WRITE	285.536	1	285.536	13.165	.001	.364
LUNCH	GT.SCI	2152.857	1	2152.857	65.958	.000	.741
	GT.SOC	1090.959	1	1090.959	27.953	.000	.549
	GT.MAT	306.323	1	306.323	30.730	.000	.572
	GT.ENG	54.513	1	54.513	9.088	.006	.283
	ACT.SCI	34.454	1	34.454	38.017	.000	.623
	ACT.READ	45.853	1	45.853	18.624	.000	.447
	ACT.MAT	38.518	1	38.518	42.532	.000	.649
	ACT.ENG	65.708	1	65.708	39.471	.000	.632
	ACT.COMP	46.594	1	46.594	40.262	.000	.636
	SAT.MAT	12972.079	1	12972.079	27.966	.000	.549
	SAT.VERB	11460.387	1	11460.387	29.657	.000	.563
	SAT.TOT	48818.120	1	48818.120	30.198	.000	.568
Error	GT.WRITE	498.833	23	21.688			
	GT.SCI	750.714	23	32.640			
	GT.SOC	897.639	23	39.028			
	GT.MAT	229.271	23	9.968			
	GT.ENG	137.965	23	5.998			
	ACT.SCI	20.844	23	.906			
	ACT.READ	56.626	23	2.462			
	ACT.MAT	20.829	23	.906			
	ACT.ENG	38.289	23	1.665			
	ACT.COMP	26.617	23	1.157			
	SAT.MAT	10668.608	23	463.853			
	SAT.VERB	8888.062	23	386.437			
	SAT.TOT	37181.460	23	1616.585			
Total	GT.WRITE	211549.000	27				
	GT.SCI	154345.000	27				
	GT.SOC	190322.000	27				
	GT.MAT	229789.000	27				
	GT.ENG	248869.000	27				
	ACT.SCI	10682.310	27				
	ACT.READ	11033.960	27				
	ACT.MAT	10502.940	27				
	ACT.ENG	9959.010	27				

	ACT.COMP	10661.510	27
	SAT.MAT	6655283.000	27
	SAT.VERB	6601868.000	27
	SAT.TOT	26511051.000	27
Corrected	GT.WRITE	874.000	26
Total	GT.SCI	3368.667	26
	GT.SOC	2488.519	26
	GT.MAT	708.667	26
	GT.ENG	228.963	26
	ACT.SCI	61.560	26
	ACT.READ	113.627	26
	ACT.MAT	67.805	26
	ACT.ENG	109.140	26
	ACT.COMP	80.390	26
	SAT.MAT	29704.296	26
	SAT.VERB	22772.296	26
	SAT.TOT	101784.000	26

---

a R Squared = .429 (Adjusted R Squared = .355)
b R Squared = .777 (Adjusted R Squared = .748)
c R Squared = .639 (Adjusted R Squared = .592)
d R Squared = .676 (Adjusted R Squared = .634)
e R Squared = .397 (Adjusted R Squared = .319)
f R Squared = .661 (Adjusted R Squared = .617)
g R Squared = .502 (Adjusted R Squared = .437)
h R Squared = .693 (Adjusted R Squared = .653)
i R Squared = .649 (Adjusted R Squared = .603)
j R Squared = .669 (Adjusted R Squared = .626)
k R Squared = .641 (Adjusted R Squared = .594)
l R Squared = .610 (Adjusted R Squared = .559)
m R Squared = .635 (Adjusted R Squared = .587)

APPENDIX E

FIGURES

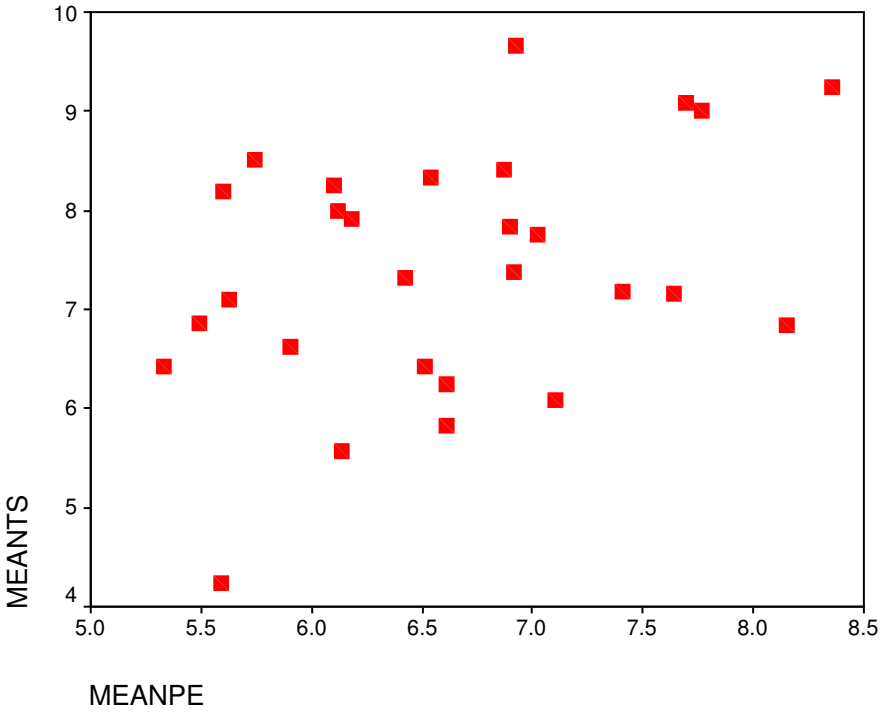


Figure 2

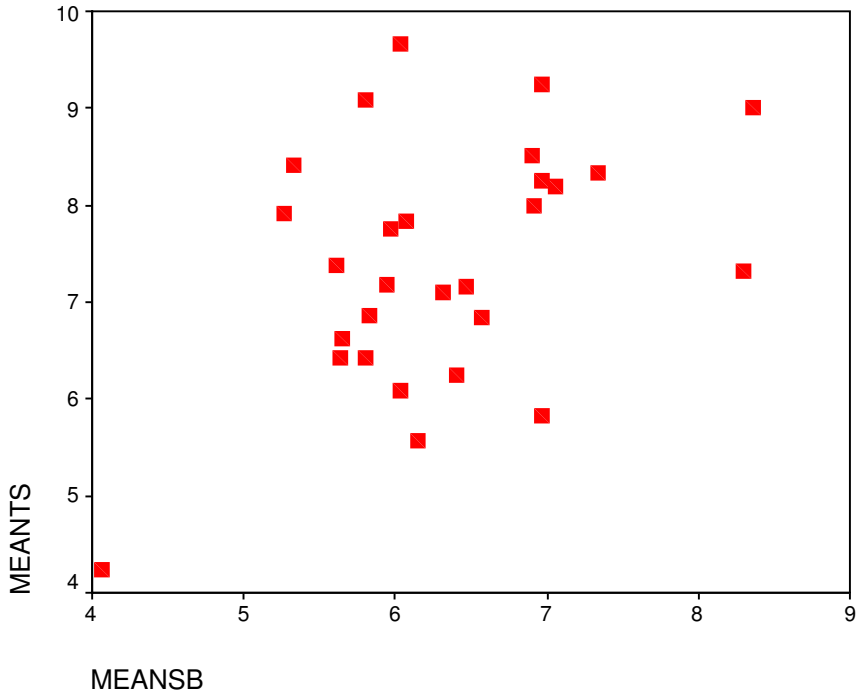


Figure 3

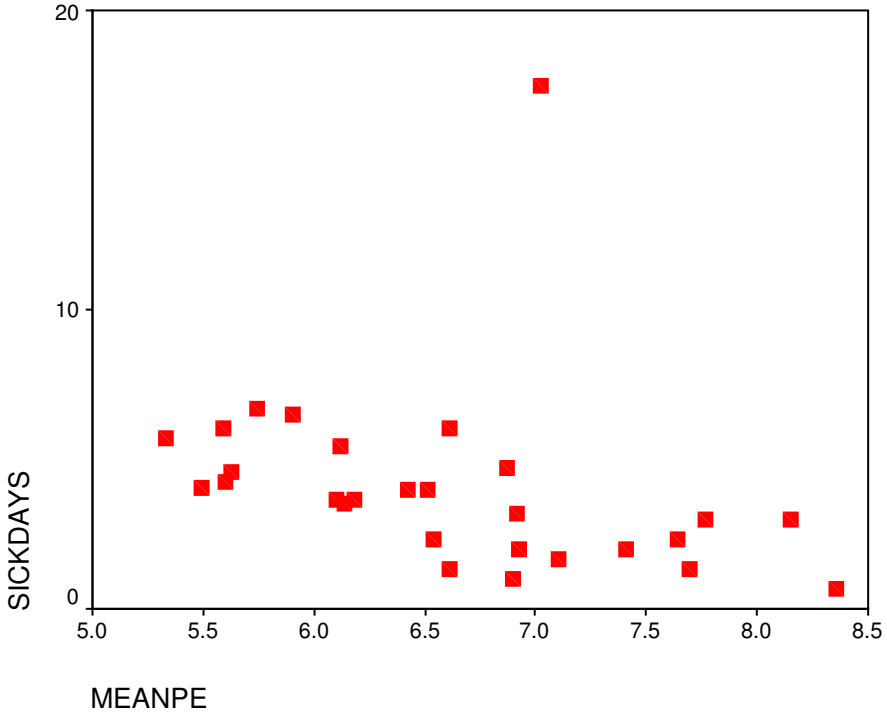


Figure 4

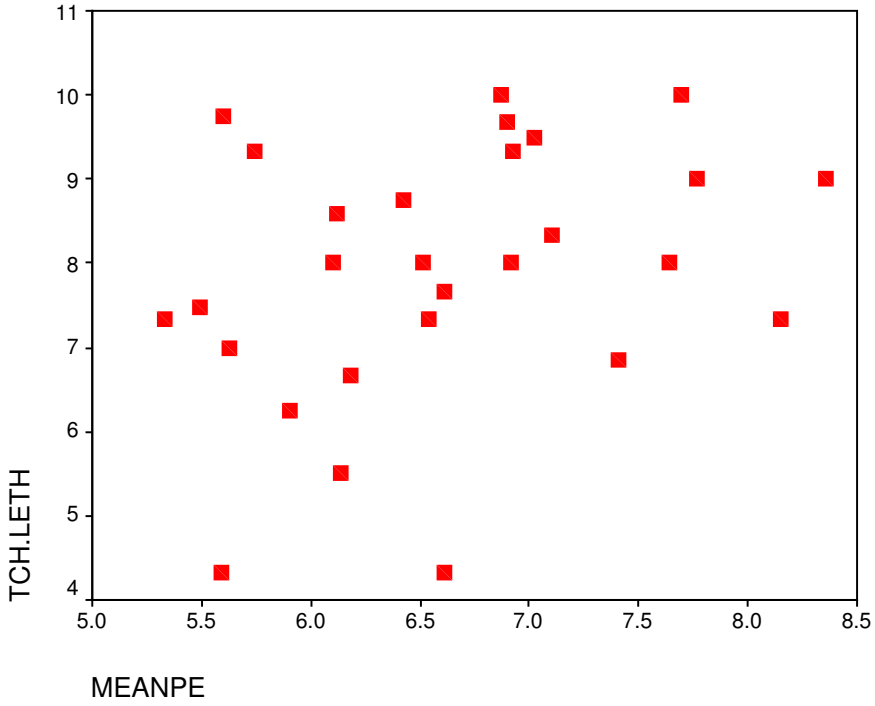


Figure 5

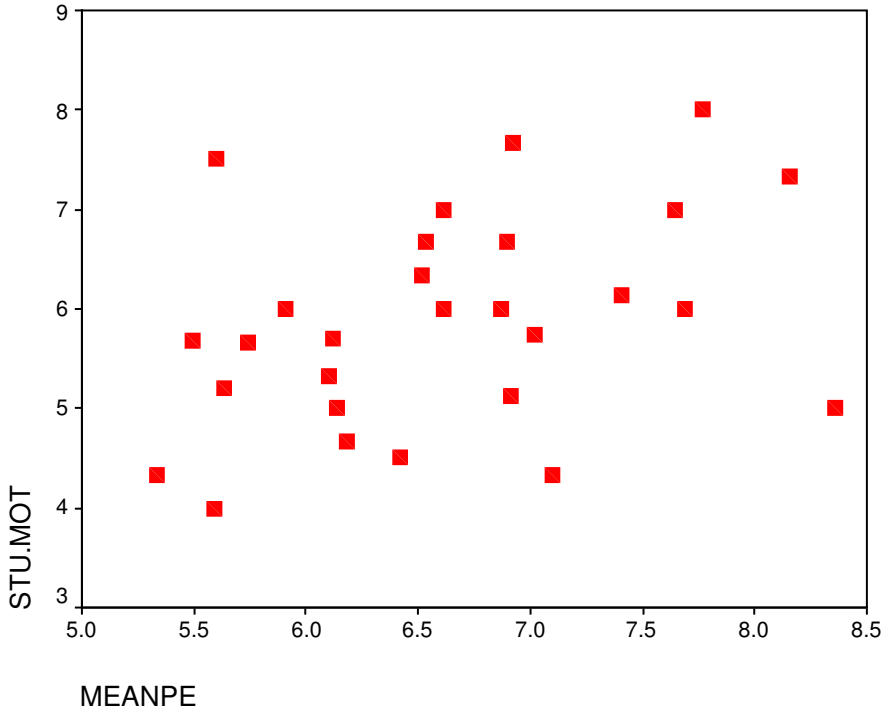


Figure 6

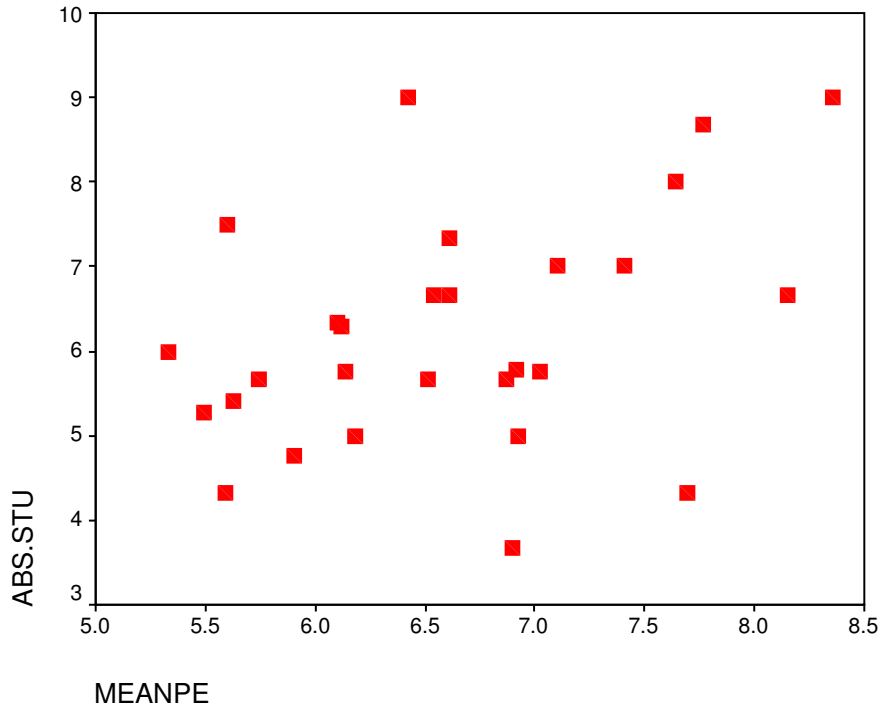


Figure 7

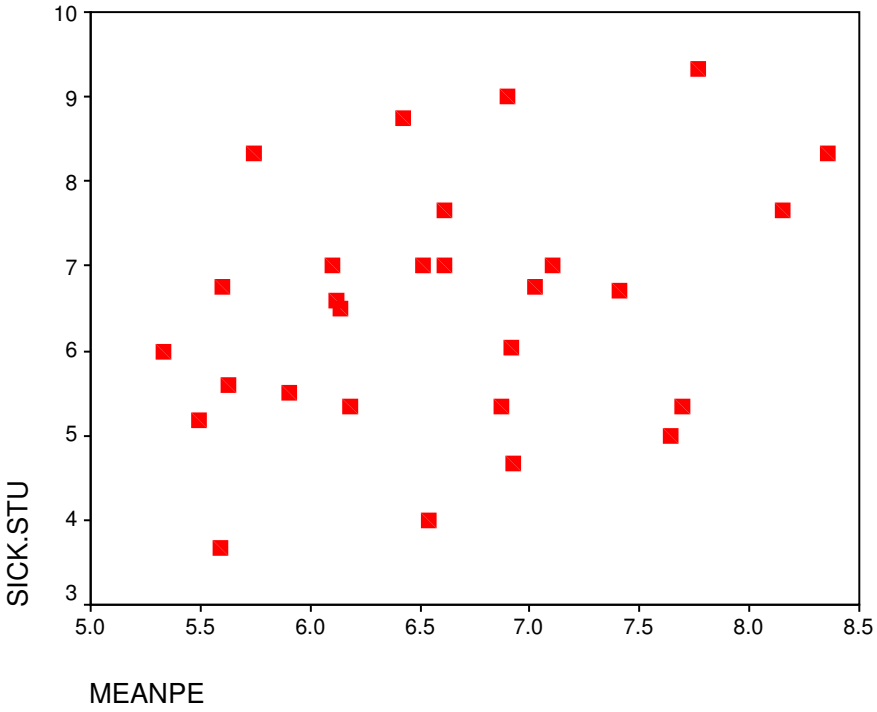


Figure 8

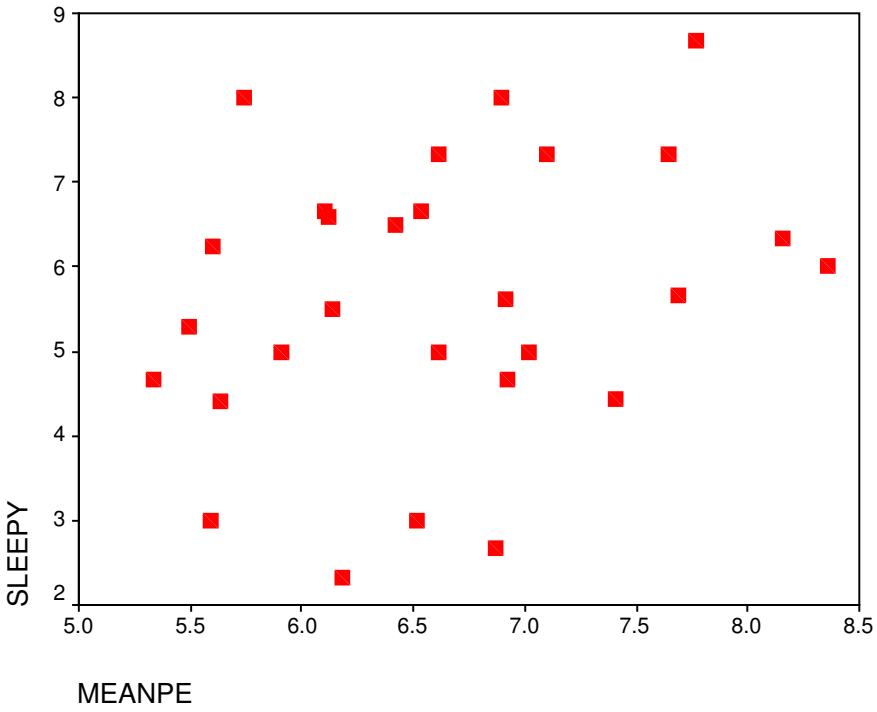
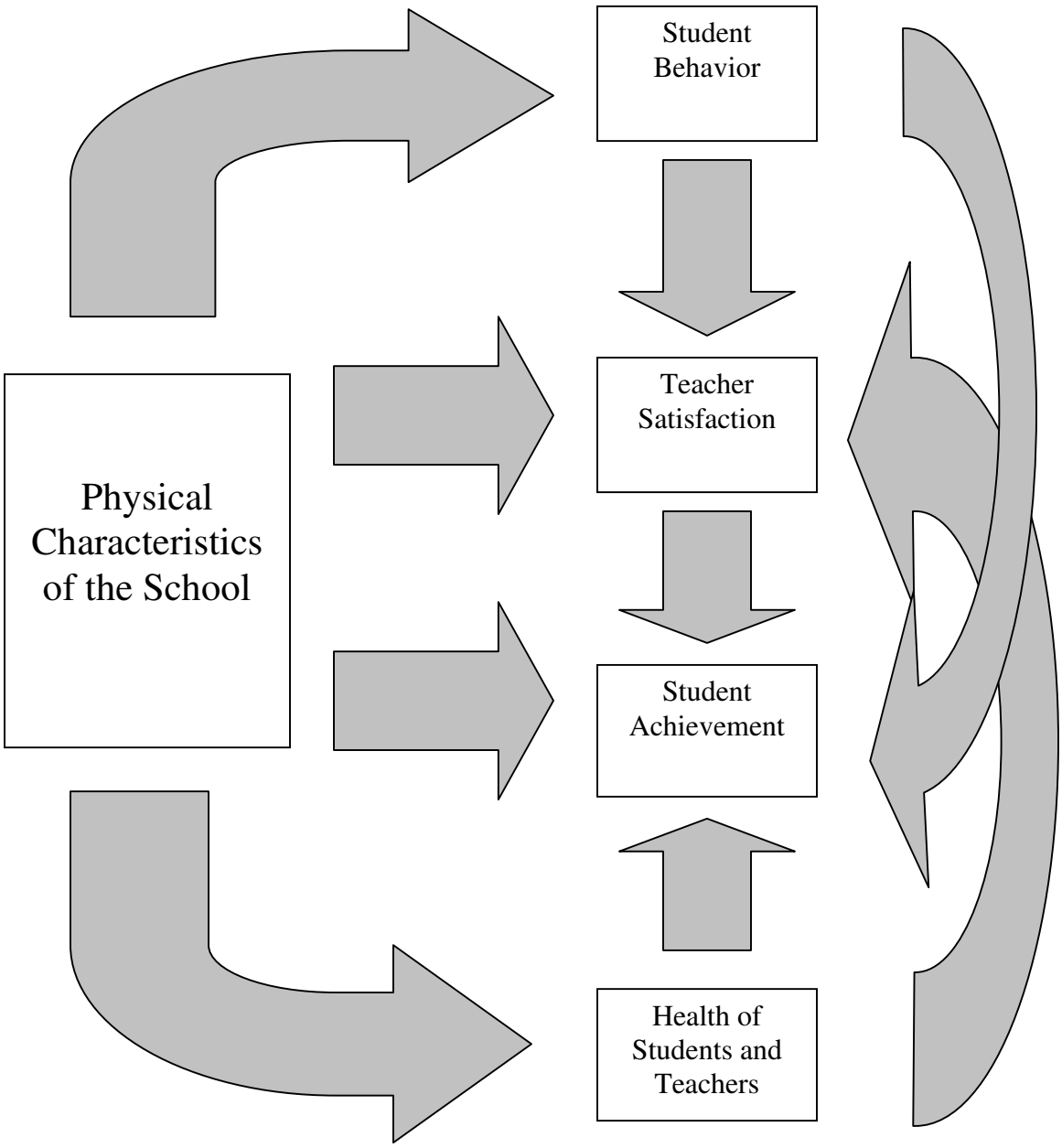


Figure 9

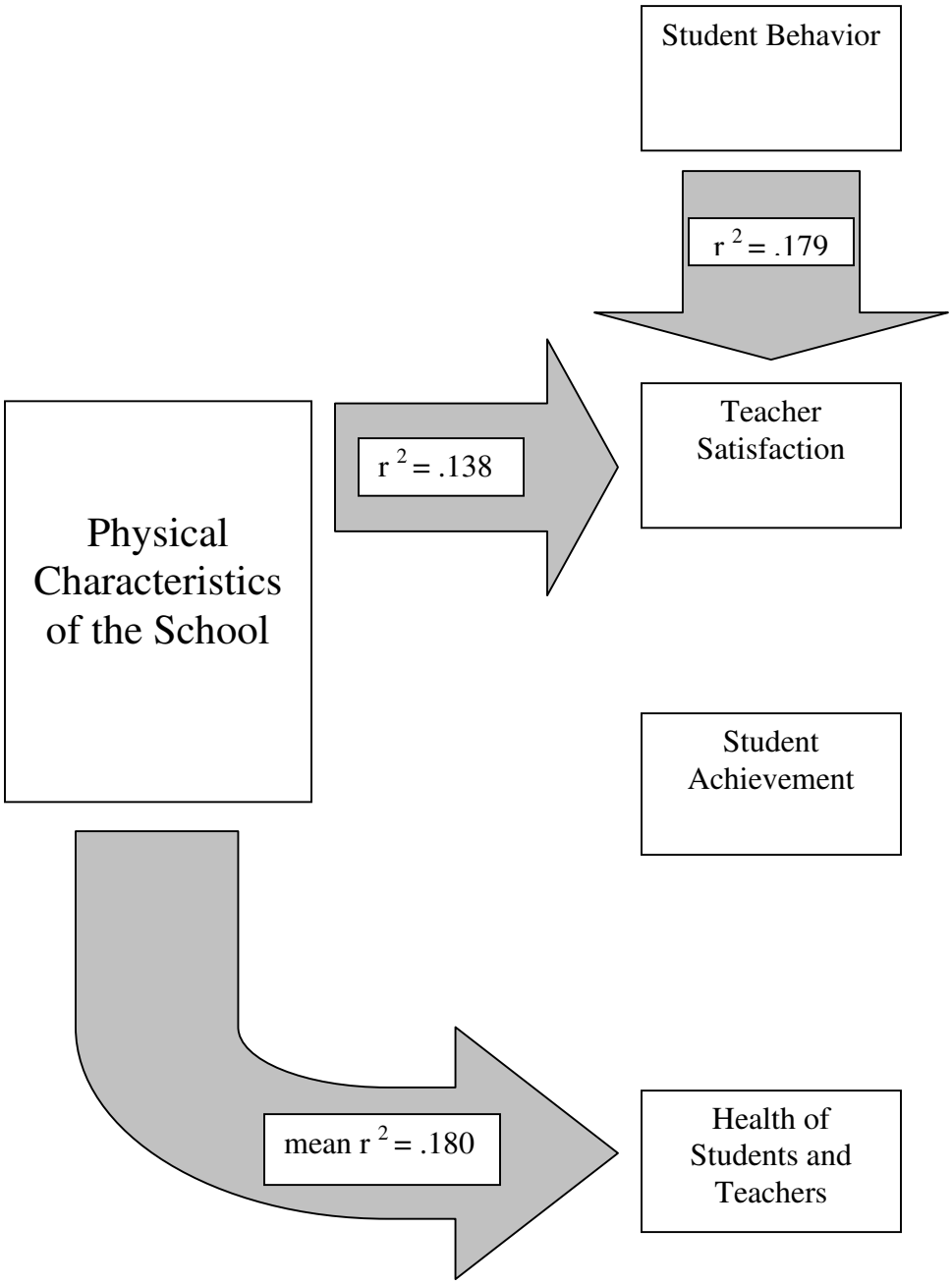
APPENDIX F

GRAPHICS

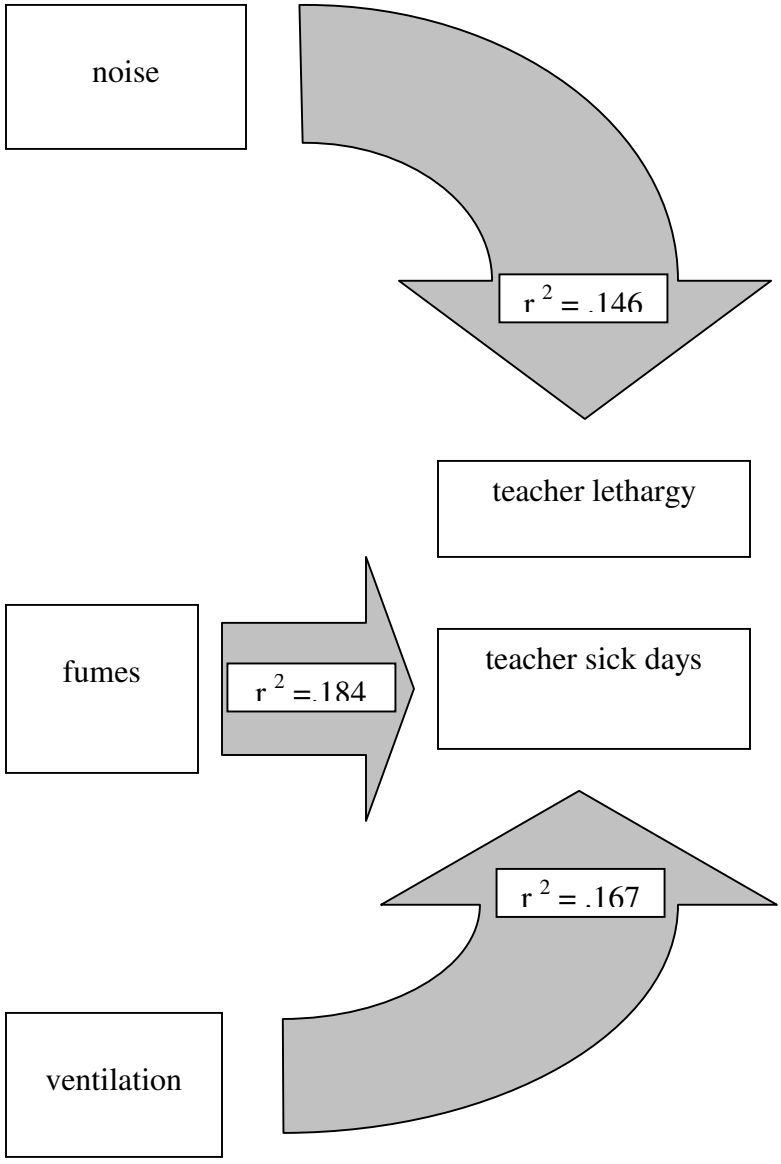
Research Hypothesis



Findings


Student Behavior
r 2 = .179
Teacher Satisfaction
r 2 = .138
Physical Characteristics of the School
Student Achievement
mean r 2 = .180
Health of Students and Teachers

Findings: Teacher's Health Predictors



Findings: Student's Health Predictors