THE IMPACT OF SCHOOL FACILITIES ON STUDENT ACHIEVEMENT, ATTENDANCE, BEHAVIOR, COMPLETION RATE AND TEACHER TURNOVER RATE IN SELECTED TEXAS HIGH SCHOOLS

A Dissertation

by

ROBERT SCOTT MCGOWEN

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

December 2007

Major Subject: Educational Administration

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Approved by:

Chair of Committee,	Luana Zellner
Committee Members,	Virginia Collier
	Robert Hall
	Ben Welch
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ABSTRACT

The Impact of School Facilities on Student Achievement, Attendance, Behavior, Completion Rate and Teacher Turnover Rate at Selected Texas High Schools. (December 2007)

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Chair of Advisory Committee: Dr. Luana Zellner

The purpose of this study was to explore the possible relationship between school facility conditions and school outcomes such as student academic achievement, attendance, discipline, completion rate and teacher turnover rate.

School facility condition for the participating schools was determined by the Total Learning Environment Assessment (TLEA) as completed by the principal or principal's designee on high school campuses in Texas with enrollments between 1,000 and 2000 and economically disadvantaged enrollments less than 40%. Each school in the study population was organized by grades nine through twelve. Data for achievement, attendance, discipline, completion rate and teacher turnover rate were collected through the Public Education Information Management System (PEIMS) managed by the Texas Education Agency.

Student achievement, attendance, discipline, completion rate and teacher turnover rate and their relation to school facilities were investigated using multiple regression models to compare sections and subsections of the TLEA with each of the five dependent variables. Major research findings of this study included the following: first, student achievement, attendance and completion rate measures were not found to be statistically significant in relation to school facility conditions as measured by the TLEA at the 0.05 level; second, discipline, or behavior, was found to be significantly related to the TLEA. This indicates that the subsections of the TLEA could be used to predict discipline factors for schools in the study population; third, teacher turnover rate was found to be related to the TLEA subsections of Specialized Learning Space and Support Space, with the correlation to Support Space being indirect.

Literature from prior studies infers that relationships do exist between all five of the study’s dependent variables. However, this study only yielded significant findings in the areas of student discipline and teacher turnover.

The researchers recommendations based upon this study include the following: administrators and designers should take into account factors such as interior environment and academic learning space when planning schools to positively impact student discipline; school design and construction should focus on specialized learning spaces and other academic areas more than administrative support spaces when striving to increase teacher satisfaction with physical working conditions.

DEDICATION

This dissertation is dedicated to my parents, Ron and Linda McGowen, who have always supported my academic endeavors; to my sons, Ty, Sully, Cody and Davis, to whom I will hopefully instill a love of learning; and to Michelle McGowen and Elisa Barry, whose support and patience were critical to the completion of this task.

ACKNOWLEDGEMENTS

I want to express my gratitude to the chair of my committee, Dr. Luana Zellner, who was a constant source of inspiration and information. Dr. Zellner was always quick to provide assistance and guidance. Dr. Robert Hall spent endless hours introducing me to and attempting to instill an appreciation for statistical analysis. I appreciate Dr. Hall's patience and assistance. I would also like to thank fellow educators Dr. Virginia Collier and my good friend, Dr. Ben Welch, for serving on my committee and for their patience with this process.

Additional thanks go to Joyce Nelson, Clarice Fulton and Bill Ashworth of the EAHR Department for their endless support and their patience with my many questions. I could not have cleared the many hurdles to the degree without their assistance.

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CHAPTER I

INTRODUCTION

The No Child Left Behind Act (2001) is the latest federal approach in the improvement and closing of gaps in student academic performance. Traditionally, high schools have received much of the attention in the discussion of school reform. This is possibly due to the sequential proximity that high schools have to the world of higher education or the world of work. Universities and employers are claiming billions of dollars in expenses to remediate high school graduates (Fiske, 1991). In economic terms, the improvement of American schools would seem beneficial to our colleges and companies. However, costs of improvement can grow exponentially for public school systems. The greatest single expense and most enduring transaction made by school officials is that of school facilities. It is estimated that more than $127 billion would be required to meet the national need for new or renovated academic space (Kerr, 2003). The evaluation of these buildings, in light of reform movements, allows planners and educators to align academic initiatives, such as improved test scores, with the tangible factors of the schoolhouse such as lighting and indoor air quality (Blair & Pollard, 1998).

This national push for increased student performance continues as our school buildings deteriorate. Students interviewed about the greatest needs of their schools note items such as functional restroom facilities rather than curriculum development or test

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This dissertation follows the style and format of the *Journal of Educational Research*.

scores (Glickman, 2004). Not only do the government-mandated standards rise, but so do the numbers of children in American schools. The average school where these students are in attendance is 42 years old (Rowand, 1999). Hence, the question exists as to how we can expect students to achieve in the absence of an adequate physical environment.

With these statistics regarding our school buildings, much research has continued to focus on pedagogical and curriculum trends and not directly on the environment surrounding the learner and the educator (Gregory & Smith, 1987).

A new body of academic inquiry is growing with a focus on the physical environment in the educational process. Studies may find specific design functions at their core. For instance, studies in the Capistrano Unified School District (CUSD) in Orange County, California found that the students in classrooms with natural lighting, large windows or well-designed skylights performed 19 to 26 percent better than their peers in classrooms without these features (Hale, 2002). Recent concerns with mold-related health issues are driving schools to focus on the impact that poor indoor air quality has on the attendance and achievement rate of students (De Patta, 2002). Even the impact of furnishings in educational settings has been addressed. Anchorage, Alaska schools developed a committee dedicated to selecting “equipment in which students can work comfortably, furnishings that create an aesthetically pleasing ambiance, and furniture that stands up to the rugged treatment it receives from daily student use” (Kennedy, 2003d).

More profoundly, studies are increasing their focus on the impact that the environmental design will have on student outcomes. When the learning process is at the core of design priorities, there is a significant likelihood that the facility will positively influence performance (Blair, 1998). The correlation appears to be positive between facility design and learning. Chan (1996) clarifies that poor learning facilities can foster negative attitudes just as exceptional designs may bolster achievement. The growth of brain-based research has provided a shot in the arm for facility design studies. Caine and Caine (1990) make the point that brain-based research is not an independent movement in education, but an approach from which all learning research will benefit. The brain is a physiological system and can be stimulated, both positively and negatively, by its physical surroundings (Chan & Petrie, 1998).

From the common concerns of mischievous children to the horrid fears of Columbine-like violence, the topic of student behavior is threaded throughout educational research (Kennedy, 2003e). Kennedy (2003e) points out that school officials must not only deal with the students in the prevention of misbehavior and violence, but also on the physical nature of the school building. Along with behavior, attendance and morale play large roles in school success. Killeen, Evans and Danko (2003) go as far as to promote the inclusion of students in facility design in attempts to increase ownership and attendance. The impact of the physical environment on educators in not ignored in current research. It has been determined that the surroundings in which people function can greatly impact moods, satisfaction and self-worth (Ma & MacMillan, 1999).

Facility appraisal should be one of the many roles assumed by educational leaders. Maiden and Foreman (1998) claim that school administrators should be “armed with a general understanding of the relationship between various physical features of a facility and the learning climate" (p.41). It stands to reason that facility evaluation would warrant equitable scrutiny and effort to that of ventures into pedagogy and curriculum.

A growing body of research contributes to the belief that school facility design impacts student achievement, behavior, attendance and teacher retention (O'Neill, 2000). The financial plight of Texas public schools would also deem it necessary to closely investigate the effectiveness of these expensive building projects (Clark, 2001). This exercise will likely lead to a physical surrounding that supports growth and learning.

Statement of the Problem

A recent study by the American Society of Civil Engineers reports that 75 percent of the nations' school buildings are inadequate (Kerr, 2003). This has occurred coincidentally while student performance for many of our nation's students has remained stagnant (U.S. Department of Education, 2003). The research is clear that a strong link exists between the school building and the learning process (Blair, 1998). Oft cited researchers Earthman and Lemasters (1996) have pointed out that students surrounded by a safe, modern and environmentally controlled environment experience a positive effect on their learning.

School finance trends in Texas have shown a notable increase in funding for educational facilities (Clark, 2001). However, studies are needed to draw a clear comparison between the quality of our school buildings and academic outcomes. Long time Texas educators, such as retired Texas A&M University professor Harold Hawkins, point out the limited depth of research in this area (O'Neill, 2000). In order for educational leaders to support reform that will boost student performance, they will need to understand the relationship existing between the school facility and learning.

Purpose of the Study

The purpose of this study is to examine the possible impact of school facility quality on student achievement, attendance, behavior, dropout rate, and teacher turnover rate in selected Texas high schools. Subsequently, the researcher will attempt to identify the aspects of school facility design that have the greatest potential to impact learning. The findings of this study have implications for policy and practice regarding the planning, funding and design of school facility construction and renovation.

Research Questions

The study will be guided by the following research questions:

1. To what extent do school facilities impact student achievement as reported by the Academic Excellence Indicator System (AEIS) at selected Texas high schools?
2. To what extent do school facilities impact student attendance as reported by the Academic Excellence Indicator System (AEIS) at selected Texas high schools?
3. To what extent do school facilities impact student behavior as reported by the Academic Excellence Indicator System (AEIS) at selected Texas high schools?

4. To what extent do school facilities impact student completion rate as reported by the Academic Excellence Indicator System (AEIS) at selected Texas high schools?
5. To what extent do school facilities impact teacher turnover rate as reported by the Public Education Information Management System (PEIMS) at selected Texas high schools?

Assumptions

1. Administrators understand the purpose of the instrumentation and answered honestly and to the best of their ability.
2. The researcher will be impartial in collecting and analyzing the data gathered.
3. The person who receives the instrument or their designee will be the individual that completes the instrument.

Limitations

1. Findings from this study may not be generalized beyond the schools participating in the study.
2. Only identified 2003-04 school administrators at selected Texas high schools with enrollments between 1,000 and 2,000 and economically disadvantaged populations less than 40% were surveyed.
3. Objectivity of the responses to the survey instrument may have been affected by personal biases of the school personnel completing the instrument.

4. It is impossible to identify all variables impacting student achievement, attendance, behavior, attendance, dropout rate, and teacher turnover rate. This could result in error variance and less significant correlation in the identified variables.
5. Correlations do not necessarily represent a causal relationship.

Operational Definitions

Academic Excellence Indicator System (AEIS): A statewide system that compiles an array of information on the performance of students and school finance in every school and district in Texas each year. The system involves district accreditation status, campus and district performance ratings, and other campus, district and state-level reports on finance, population and staffing.

Completion Rate: The percentage of students who meet high school graduation requirements within a given four-year period. This does not include students who transfer out of their respective cohort for reasons such as out-of-state transfers, private school enrollment or home-school enrollment.

Dropout Rate: The percentage of students who leave high school before reaching completion marked by graduation or a successful score on a graduate equivalency exam. Students moving to other educational programs are not included in the dropout rate. This rate is part of the AEIS report provided by PEIMS.

Economically Disadvantaged Students: Students who qualify for free or reduced lunch.

Education Service Center (ESC): One of twenty state service centers established by the Texas Legislature in 1967 to provide school districts with technical and developmental support. School districts are assigned to their respective ESC based upon geographic proximity.

High School Campus: A school campus that serves students in ninth through twelfth grades or tenth through twelfth grades.

Public Education Information Management System (PEIMS): A statewide reporting system whereby school districts provide information on district organization, finance, staff, and students to the Texas Education Agency (TEA). TEA determines reporting criteria and validity.

School Facilities: Defined through the use of the Total Learning Environment Assessment (TLEA), developed for a prior study of Texas public schools (O'Neill, 2000). It is an instrument that rates facility conditions on such factors as educational adequacy, environment for education, space flexibility, and cosmetic condition.

Socioeconomic Status (SES): Categorization based upon the percent of economically disadvantaged students. This factor is used as a covariate to control student achievement, attendance, behavior, dropout rate and teacher turnover rate variance to SES. SES is also used along with enrollment to establish cohort groups of campuses.

Student Achievement: The number students passing TAKS (Texas Assessment of Knowledge and Skills) tests during the 2002-03 school year. Data is provided for a percentage of students passing all tests as well as disaggregated by percentages passing Language Arts, Math, Science and Social Studies.

Student Attendance Rate: Total number of days students were in attendance during the 2002-2003 school year divided by the total number of days students were in membership during the 2002-2003 school year.

Student Behavior: Counts and percent of students placed in alternative education programs under Chapter 37 of the *Texas Education Code*. Disciplinary placement counts are obtained from PEIMS records. Districts report the disciplinary actions taken toward students who are removed from the classroom for at least one day.

Texas Assessment of Knowledge and Skills (TAKS): Criterion-referenced test required by the State of Texas since 2002. Texas high school students are assessed in Language Arts, Math, Science and Social Studies during grades nine through eleven.

Teacher Turnover Rate: Total FTE (Full Time Equivalent) count of teachers employed in the fall of year one who were not employed the fall of year two, divided by the total teacher FTE count for the fall of year one. This will be calculated as a three-year average for the years 1999-2000, 2000-2001, and 2001-2002 school years.

Significance Statement

With the implementation of No Child Left Behind Act (2001), schools must continue to improve student performance. All the while, Texas schools are seeing a significant increase in enrollment. There were 97,000 more students enrolled in Texas public schools in 2001-2002 than in the previous year. Therefore, school districts must provide more space for growing enrollments while focusing on student achievement increases. It has been estimated that technological advances and enrollment increases will create a $200 billion price tag for school construction (White, 1998).

Economic limits will not allow for inexhaustible resources to build and equip schools (Clark, 2001). We must be able to pinpoint the design factors that best support instructional programs. Educators must also be equipped with a knowledge base and skill level in facility appraisal (O'Neill, 2001). This, in turn, will provide designers and policymakers with data that will drive school facility planning and construction for years to come.

Currently, there are limited quantitative data available drawing correlations between facility quality and student performance, especially in the high school setting. Texas schools are growing and Texas educators are striving to meet state and national standards. This study will provide data specific to high schools in Texas. It will potentially have implications for policy-making, funding formulas and facility design.

Organization of the Dissertation

This dissertation consists of five chapters and organized in the following manner: Chapter I includes an introduction to the study, problem statement, statement of purpose, questions guiding the research, assumptions, limitations, definition of terms, and a statement of significance.

Chapter II contains the literature review pertinent to the impact of school facilities on student performance and teacher retention. Chapter III consists of a description of the procedures, instrumentation, methodology of research and general design of the study. Chapter IV presents and analyzes the data obtained by the study. Chapter V includes the summary of results, conclusions and associated recommendations related to the study and for further study.

CHAPTER II

REVIEW OF LITERATURE

This study examines the impact of school facilities on outcomes in selected Texas high schools. This chapter is included to provide insight, as evidenced by a review of pertinent literature, into the content of school facilities and their bearing on school improvement efforts. The chapter opens with a description of the condition of American school facilities. The examination then ensues on the relationship between school design and student variables such as achievement, attendance, behavior and dropout rate. The review of literature then focuses on the role of school facilities in the professional development of educators and on the establishment of community. The chapter concludes with an investigation of facility assessment and with the manner in which school facility design has evolved as a result of modern research.

Condition of American Schools

The baby boom of the late 1940's spurred an unprecedented school construction era in the late 1950's and early 1960's as the "boomers" reached school age. This heightened need for school buildings led to construction that was often inexpensive and inadequate (Colgan, 2003a). Colgan (2003a) notes that nearly three-fourths of the nation's 80,000 schools are in need of repair or replacement. The U.S General Accounting Office (GAO) has issued a report stating that more than $112 billion are needed to bring current campuses up to standard (Moseley-Braun, 1997). According to

United States Senator Moseley-Braun (1997), the $112 billion price tag quoted by the General Accounting Office does not include modern computer and communication technology.

As the average campus age reaches 45 years (Dewees, 1999), the challenges facing our school buildings are not likely to decrease. In Texas, the picture is just as concerning. The GAO reported in 1995 that nearly half of the state's schools had at least one inadequate feature or building and that three out of four schools were in need of repair or upgrades. This same report by the General Accounting Office (1995) noted that more than 30% of Texas campuses reported insufficient technology capacity. One out of four Texas schools lacked science laboratory space to meet national and state educational needs (General Accounting Office, 1995).

As the nation focuses on slumping student success (No Child Left Behind Act, 2001) coupled with a growing body of research linking physical school environment with student achievement, the concern over decaying American schools is reaching an urgent status (Crampton, Thompson & Hagey, 2001). The undesirable condition of a majority of schools (U.S. General Accounting Office, 1995) is attributed by many scholars as a direct result of limited financial resources that are earmarked for infrastructure improvement and maintenance (Crampton & Thompson, 2002). The problem is certainly pertinent to Texas school districts. Crampton and Thompson (2002) report that Texas ranks fifth nationally in the amount of dollars needed to bring school infrastructure to acceptable conditions. A combination of aging buildings, rising enrollment and decreasing or stagnant financial resources are creating a recipe for disaster as far as the condition of school buildings are concerned (Brady, 2002).

Educational leaders have begun to speak out about the condition of our school buildings. The American Federation of Teachers (Jehlen, 1999) has issued a call for the federal government to increase funding for school infrastructure improvement. The AFT's call was echoed by organizations such as the AFL-CIO, former President Bill Clinton and the Building Trades Council (Jehlen, 1999). Court cases have traditionally voiced that the burden for funding educational facilities lied with the states (Melvin, 1984). However, the majority of the burden for facility funding continues to fall upon local entities (Ralston, 2003). Many local governments have utilized the property tax to fund schools and school construction. However, this method of funding has not been without controversy (Oden & Piccus, 1992).

A discussion of the condition of American schools and the financial straits facing the task of improving our educational facilities must include the topic of equity in school construction funding. A study of the past thirty years in school facility funding shows that inequities exist in Texas even though programs such as the Existing Debt Allotment and the Instructional Facilities Allotment have attempted to level the playing field (Clark, 2001). The question of inequities established by discrepancies in property values among school districts is a topic of an enormous amount of litigation. For example, Arizona's Superior Court forced the state legislature to establish a state committee to determine the allotments paid from three new sources created to supplement the effort of local taxpayers in poorer districts (Geiger, 2001a). Similar involvement by the courts resulted in the infusion of millions of dollars of school construction funding for New Jersey school districts determined to fall below the equity line (Erlichson, 2001; Johnston, 2001).

A vast majority of supplemental school construction funding from federal and state sources is targeted at poor schools located predominately in urban or rural areas (Johnston, 2001). While states vary in how to measure need amongst districts, the financial value of district property or the socioeconomic status of district students often outweigh the actual condition of school buildings when supplemental funding is distributed (Sandham, 2001). In California, for example, formulas for state funding also factor in the growth in enrollment that districts expect in the near future (Sandham, 2001). However, Sandham (2001) notes in *Education Week* that discrepancies arose in the accuracy of district enrollment projections as well as the problems caused by the "first-come, first-served" atmosphere that arose with the state funding applications. Furthermore, the robust economy of the late 1990's persuaded many voters to support local bond elections, providing hundreds of millions of dollars in local property tax revenue for new school construction (Kennedy, 1999). However, Kennedy (1999) notes that a vast majority of this construction addressed enrollment growth and did little for existing facilities.

Another financial factor contributing to the deterioration of our nation's school buildings is the reduced funding available to district personnel to properly maintain school facilities. The National Center for Education Statistics reported that more than one in four schools were built prior to 1950 and that the average school building was 42 years old (Kennedy, 2000). The 1999 NCES report further noted that campuses rapidly deteriorate after 40 years and that most are abandoned after 60 years (Kennedy, 2000). The *American School and University* magazine conducts an annual survey of school maintenance and operations funding (Agron, 2003). Survey author Agron (2003) notes that budgets for school facility maintenance have dropped for the sixth consecutive year. The survey revealed that maintenance budgets have reached an all-time low of 7.4% of the total operating funds of the average school district (Agron, 2003).

The failure to adequately fund school facility maintenance not only postpones needed improvements and additions, but it also accelerates that deterioration of our schools. Reports indicate that more than 30% of schools require extensive repairs and another 40% require replacement of major components due to a lack of preventative maintenance (Geiger, 2002). School finance author, Phillip Geiger (2002) estimates that on average $2 million of required capital improvements could have been saved with an adequate maintenance program. Such a maintenance program requires sufficient funding combined with a well-sequenced, data-driven schedule of work (Krysiak, 1999). In New York, school facilities had reached such a deplorable condition that the legislature stepped in and required the establishment of five-year maintenance plans to be submitted by each public school district (Agron, 1998).

School leaders continue to scramble for dollars to build, renovate or maintain educational facilities and politicians still debate over which entities should provide such funding. Meanwhile, millions of students in the United States attend school surrounded by inadequate facilities (U.S. General Accounting Office, 1995). According to a report from the National Priorities Project (2000) entitled *Recess is Over!*, Texas students in deteriorating schools score 10 to 17 points lower on state standardized tests than their counterparts attending schools with adequate facilities. *Recess is Over!* (National Priorities Project, 2000) purports that students in these substandard school facilities are also more likely to be less orderly and distract teachers from their instructional duties.

One must not rely upon published reports to hear what American students think of the buildings in which they attend school. Renowned educational author and professor Carl D. Glickman (2004) notes that students interviewed regarding the challenges that they face on a daily basis are more likely to note deplorable building conditions rather than curriculum standards. In preparation for his book *Letters to the Next President,* Glickman (2004) interviewed one student who noted working toilets and tissue in the restrooms as the greatest need in her school. A growing body of research literature is finding that such concerns by American students are valid and that building condition has a profound impact on student success and professional development of teachers.

Facilities and Student Achievement

“Learning is a complex activity that puts students’ motivation and physical condition to the test” (Lyons, 2002, p. 10). It has been a long-held assumption that curriculum and teaching have an impact on learning. However, it is becoming more apparent that the physical condition of our schools can influence student achievement. Earthman, Cash and Van Berkum (1996) recently found that 11^{th} grade students in above standard buildings scored higher as measured by the Comprehensive Test of Basic Skills than did their counterparts attending class in substandard facilities. The National Priorities Project (2000) report indicates that Texas students follow the trend found in the study conducted by Earthman et al. (1996).

In a Virginia study, Cash (1993) developed research that examined the impact of various factors of building condition on student achievement in a manner that controlled for socio-economic status of the students. Cash (1993) found that when socio-economic factors were constant, facility condition had a significant correlation with student achievement. Specifically, Cash (1993) found that air conditioning, absence of graffiti, condition of science laboratories, locker accommodations, condition of classroom furniture, wall color and acoustic levels correlated with student achievement at a significant level when controlling for socio-economic status of students.

Chan (1996) conducted a similar study of the impact of physical environment on student success. This study classified 165 Georgia schools into one of three categories: Modern Learning, Obsolete Learning, or Half Modern Learning Environment. Other than building age, differences in the three categories included lighting, color schemes, air control and acoustic levels (Chan, 1996). As one might expect, Chan (1996) found student achievement to be highest in Modern Learning Environments and lowest in Obsolete Learning Environments. Chan (1996) concluded that technologies and adaptabilities of modern environments better equipped students for success and that to ignore that fact was to disregard the physical difficulties of learning.

Building Age and Student Achievement

Such studies regarding differences in student performance based upon building condition have focused on many factors of facility quality. With the average American school building maturing to 45 years old (Dewees, 1999), facility age is a common discrepancy of building condition that is studied in correlation with student achievement. Bowers and Burkett (1989) studied differences in achievement between secondary students in two buildings, one built in 1939 and one built in 1983. In this study, all other building variables were consistent between the two schools. Bowers and Burkett's

(1989) study revealed that the students in the modern building scored significantly higher in reading, language and mathematics than their counterparts in the older building.

The age of a building can influence many of the individual factors used in evaluating the condition of an educational facility (Earthman & Lemasters, 1996). Earthman and Lemasters (1996) noted that in each case of their study, age of the building had significant impact on student achievement and behavior. Furthermore, the study indicated that age was a surrogate for other variables of building condition such as lighting, temperature control, proper lighting, sound control, support facilities, laboratory condition and aesthetic values (Earthman & Lemasters, 1996).

The development of curriculum or instructional strategies can exaggerate the differences in building age. Chan (1996) found that many building had become obsolete despite their structural soundness. Chan’s (1996) study found an impact of building age similar to that of the aforementioned studies. However, his key conclusion was that many of these facilities have become obsolete because their failure to adjust to or accommodate innovations in curriculum development, instructional strategies and content development (Chan, 1996). For instance, new instructional models call for accommodations such as modular furniture, flexible floor plans, mobile technology, electronic chalkboards and expandable networking (Lyons, 2002).

Cornell University joined forces with the Council of Educational Facility Planners International to conduct a study of the renovation of Syracuse City Schools and how that renovation impacted student achievement (Moore & Warner, 1998). Rather than the typical correlation study, the Cornell study provided a valuable before-and-after look at achievement in schools that were renovated. Significant impact was found in student achievement after facilities in these Syracuse schools were refurbished. Most significant was the improvement in mathematics scores of sixth grade students (Moore & Warner, 1998).

The correlation between building age and student achievement has been found to be significant in Texas studies. O'Neill and Oates (2001) report that building age had the highest correlation with student achievement of all building factors investigated in a 1999 study of middle schools in Central Texas. The study indicated that the strongest relationship between building age and student achievement existed in the area of eighth grade students passing reading. O'Neill and Oates (2001) found this correlation to be consistent with numerous other studies that linked building age with factors establishing student achievement, such as the research conducted by Bower and Burkett (1989).

As school buildings age, they not only provide hurdles for teachers and students. Older buildings have been found to actually cause the loss of instructional time (Stricherz, 2000). In his *Education Week* article, Stricherz (2000) notes that a Florida study found that 96 teaching days were lost in Virginia schools in 1998 due to poor building conditions complicated by age. The Virginia study found that half of the teaching days lost was due to air conditioning failures.

School Size and Student Achievement

Knowing that building age can contribute to the deterioration of facility conditions does not, in itself, assist practitioners in the improvement of student achievement. Many other factors of facility design have been linked to academic success of students. As enrollment numbers climb, the issue of school size becomes relevant to the task of improving student performance. School size questions came to the forefront after the Columbine disaster, where two students designed and carried out a violent plan undetected by the adults in the school (Kennedy, 2003a). Kennedy (2003a) notes that educators have been battling this disconnectedness that seems more prevalent at larger schools. Smaller schools have shown a greater capacity to develop personal connections among students and staff that tend to prevent violent or antisocial behavior (Yaunches, 2002).

An issue related to school size is the ability for students and staff to establish personal links with one another and with the physical environment. This notion has been adopted by school designers as they design entire campuses or as they lay out classroom plans that allow for small-group or individualized instruction (Cook, 2002). Bryk (1994) found that students in smaller learning environments achieved at higher levels than their cohorts in larger schools. This University of Chicago study (Bryk, 1994) supported suggestions that smaller high schools not only provided a safer environment than their large counterparts but they also promoted advanced academic achievement. In an examination of hundreds of such studies, the Educational Research Information Clearinghouse commissioned a report that supported the assumption that smaller schools provide more attention to and support for individual student success (Raywid, 1999).

Despite the wealth of research espousing the benefit of smaller schools, statistics indicate that districts continue to erect larger campuses (Viadero, 2001). *Education Week* reports that a majority of our nation’s students attend schools with enrollments of 750 or more, while seven states report average high school sizes of more than 1,000 students

(Viadero, 2001). Hofstra University's Mary Anne Raywid (1999) reports that educational leaders continue to ignore the impact of school size on student achievement. Raywid (1999) suggests that policy makers and scholars have turned a deaf ear to the debate of school size, favoring a focus on curriculum and pedagogy. This trend seems to follow suit with parents and teachers. A recent New York City survey indicates that less than half of teachers and parents would favor dividing large high schools into those with enrollments of less than 500 (Viadero, 2001).

Why would educators, school board members and politicians continue to promote the construction of larger schools? Much of the research suggests that there are financial motives. *American School and University* magazine reports that restricted funding and lack of available land encourage districts to continue to trend of constructing larger school facilities (Kennedy, 2001b). The ability to serve more students with common facilities such as cafeterias, libraries and other physical plant features makes the larger school appear much more cost efficient on a cost-per-pupil basis (Nathan, 2002a).

However, studies based upon cost-per-graduate instead of cost-per-pupil indicate that smaller schools are as efficient financially as their larger counterparts (Nathan, 2002a). School systems promoting smaller campuses have also found that the sharing of student-support facilities such as libraries and gymnasiums have lowered the construction and operating costs of decreasing school size (Nathan, 2002b). Supplemental funding for the construction and maintenance of smaller schools has also become available in the wake of school size research. The Gates Foundation, along with the Carnegie Foundation, provided more than $38 million in support of building smaller schools (Kennedy, 2001b). Under the Clinton Administration, the United States Department of Education established the Smaller Learning Communities program with $45 million in grants for program participants.

Arguments other than cost efficiency exist in reluctance to build smaller schools. Some of this resistance finds its roots in more affluent communities, where research indicates that the link between school size and student achievement is not as strong (Howley & Bickel, 2002). Support for larger schools is also based upon the premise of student choice. Proponents of large schools, especially large high schools, base their position upon the assumption that larger schools provide a wide range of curricular choices such as advanced classes and fine arts. (Viadero, 2001). The size and variety of course offerings also affords larger schools the luxury of employing more specialized and diverse staff members (Stevenson & Pellicer, 1998). Similar arguments for larger schools espouse the ability of large schools to support extracurricular programs such as athletic teams, theatrical productions student clubs and competitions (Viadero, 2001).

The small-school movement is an issue that is not solely addressed by building more schools in attempts to keep campus enrollment down. The high school setting in particular has provided a number of alternative design methods that aid is establishing smaller learning communities. One such method is the schools-within-schools, where larger campuses are broken up into smaller groups of student and teachers assigned to interdisciplinary teams (Raywid, 2002). Modern schools are being designed by architects in attempts to accommodate small groups such as “houses,” “families,” “clusters” and other small learning communities (Cook, 2002). Some high schools are allowing students to attend schools-within-schools arranged to fit a particular curriculum theme

(Gewertz, 2001). Gewertz (2001) reports that these smaller themed learning communities utilize the original campus layout with renovations allowing for specialized laboratories in each smaller sub-school.

As the research builds in support of smaller schools, states and local governments are carefully considering this issue as a way to address educational reform and academic achievement. Private foundations and governmental entities are providing financial incentives for the construction of smaller learning communities in an attempt to offset any disadvantage of economy of scale that may occur with smaller schools (Krysiak & DiBella, 2002). Some state governments are rescinding policies that had, in the past, encouraged or mandated the consolidation of smaller schools (Cutshall, 2003). While policies and funding are assisting districts in creating smaller learning communities, educational leaders are still faced with the task of identifying physical environmental factors that impact academic achievement of their students. Within any size of school setting, it is important that students are given a clean and bright surrounding so that learning can take place in an optimal setting.

Lighting and Student Achievement

Just as empirical research exists linking school size and age with student performance, a growing list of studies is finding a relationship between classroom lighting and academic achievement. Our reactions, motivations, moods and sense of well-being are greatly impacted from the illumination of our surrounding environment (Ruck, 1989). Ruck (1989) noted that the issue of illumination has driven building design for centuries as evidenced by ancient architecture and its attention to natural lighting. Differing degrees of illumination, namely natural lighting, can be used to stimulate productivity and increase creativity in offices and schools (Ruck, 1989).

An Orange County, California study showed a significant correlation between natural lighting and student success (Hale, 2002). Hale (2002) reports that students in the Capistrano Unified School District with natural lighting provided by windows or skylights scored 19 to 26 points higher on standardized tests than their cohorts with little or no natural lighting in their classrooms. This study (Hale, 2002) does not clearly assign whether the improvement in student performance was due to increased light, quality of light or the physiological effect of natural lighting.

In a middle school study, student performance was compared across three campuses. The study found that students in classrooms with large or high amounts of windows and skylights outperformed other students by five to 14 points on end-of-course tests (Rouk, 1997). Ruck (1989) stated that windowless environments generate a great amount of tension, especially when coupled with restricted spaces and monotonous tasks. Lackney (1994) found that windowless spaces contribute to negative attitudes on the part of students and teachers.

Natural lighting, or daylight, has shown to be effective in improving the quality and quantity of lighting in instructional areas. Daylight has been and is still the standard by which artificial light is measured (Fielding, 2000). Fielding (2000) reports that studies by Kuller and Lindsten (1992) and the Heschong Mahone Group (1999), indicate a positive correlation between day lighting and academic performance. In Texas, districts have realized the academic benefit of natural lighting. The Austin Independent School District initiated a lighting program that increased natural lighting in instructional areas in order to increase student comfort, which would likely improve academic performance across all subject areas (Clanton, 1999).

While the issue of lighting cannot singularly address all academic success variables, it is important to note that quality lighting increases the comfort of students and that comfort often translates into higher scores and increased performance (Rodgers, 1998). Design experts also promote the consideration of the developmental stages of students when establishing lighting systems (Bushweller, 1998). This effort on establishing comfort is more than an exercise in providing luxury to children. Design factors such as lighting can create an atmosphere where students are physically supported to concentrate on academic endeavors. Recently, the focus on effective learning environments has shone on healthy physical surroundings.

Facility Health and Student Achievement

Four decades ago, energy conservation became an important goal and had a profound impact upon building design. Resulting were facilities that were increasingly "tightened" against outside air infiltration in order to make them more energy efficient (O'Neill, 2000). This design approach has resulted in significant energy savings, yet it has been discovered that "tightening" buildings has led to higher levels of airborne gases from building materials and organic hazards such as bacteria and viruses (Witzling, Childress & Lackney, 1994). Witzling et al. (1994) have noted that this effort of energy efficiency has led to serious elements of sick building syndrome.

Designers have recently increased efforts in the elimination of environmental problems such as noise, glare, mold, poor ventilation and temperature extremes (Rydeen, 2003). Rydeen (2003) notes that architects who design healthy schools that address the aforementioned concerns decrease distractions and allow students and staff to focus on the learning process. Buildings must not only be designed to be healthy. Districts must also maintain their facilities in an effective manner in order to provide a healthy learning environment (Kennedy, 2003a). For example, poorly maintained roofs may leak allowing moisture to enter the building and increase the growth conditions for mold. The presence of mold could cause respiratory problems for students and teachers or even lead to the closure of the classroom or entire building (Kennedy, 2003b).

Mold and other indoor air quality issues have become the most common concern of designers and administrators in dealing with building health. Issues regarding indoor air quality are increasingly challenging school board members and administrators across the nation (Colgan, 2003b). Colgan (2003b) notes that older schools are more susceptible to mold and indoor air quality problems, but warns that newer buildings are not immune from these effects. In previous decades, the concern over building health was focused on antiquated building materials such as asbestos and lead-based paints. Laws and policies have now been established to protect students from exposure to these items. These laws have had a profound impact on how schools are built and maintained (Centifonti & Gerber, 1997).

As schools have been successful in eradicating asbestos, arsenic in drinking water and lead in paint, mold and its effect on indoor air quality have established a new challenge in maintaining a comfortable environment in which students can learn (Colgan, 2003b). Studies have shown that schools with indoor air quality problems experience a higher rate of health problems with students (Guarneiri, 2003). It then stands to reason that sick children will not be as likely to succeed academically. The research linking specific airborne pathogens with specific student health problems is still in the infancy stage (Smolkin, 2003). Smolkin (2003) reports that schools are working under the consultation of the Environmental Protection Agency to establish maintenance practices and educational programs to assist schools in maintaining healthy buildings while informing parents of the risks that are actually linked to poor indoor air quality. Schools that have adopted the Environmental Protection Agency's Tools for Schools program are beginning to see improved indoor air quality and a positive impact upon student academic performance (Rosenblum & Spark, 2002). As facility health improves, educators find that achievement increases due to improved attendance of healthy, attentive and motivated students.

Facilities and Student Attendance, Behavior and Dropout Rate

School Facilities and Student Attendance

Student attendance has long been linked to success in school. Therefore, it stands to reason that educational leaders and policy makers would be interested in the physical conditions that contribute to absenteeism. The Environmental Protection Agency reports that respiratory problems such as asthma are the leading cause of student absenteeism, leading to more than 10 million missed school days per year (Lyons, 2002). Lyons (2002) states that the Environmental Protection Agency's Science Advisory Board and the Cincinnati Asthma Prevention Study name indoor air pollutants as one of the top causes of asthma complications. The U.S. General Accounting Office reported in 1995 that more than half of our nation's 91,000 public schools have conditions that adversely affect indoor air quality (Lyons, 2002).

Many facility conditions other than indoor air quality have been found to influence student attendance. A study of 139 Milwaukee public schools showed that, when controlled for socioeconomic status, students' attendance and achievement were positively correlated to facility quality (Lewis, 2001). School size, as mentioned earlier, has been found to affect student achievement. A portion of this impact can be greatly attributed to the influence that school size has upon student attendance. Education author Bracey (2001) notes that an abundance of research corroborates the belief that smaller high schools will improve attendance rates. Research in Oregon found better attendance rates in high schools with enrollments between 600 and 900 students (McComb, 2000). McComb (2000) writes that the benefits to attendance do not continue as enrollment dips below 500 students.

Increasing school size was seen as a method of enhancing curriculum offerings while lower per pupil costs. However, the benefits of larger schools have not been realized for many students, especially those from low-income families (Howley, 1994). The increase in size of these campuses has been connected with a decrease in student attendance rates (Raywid, 1996). Smaller schools have been found to foster instructional innovation that, in turn, engages students and provide motivation for class attendance (Irmsher, 1997).

Along with school size, the age of educational facilities can also contribute to attendance rates. Bowers and Burkett (1989) compared schools with ages differing by 44 years. The study found that students in the modern school had favorable attendance data when compared to the students in the older facility. In a study of Texas middle schools, building age had the highest correlation with student variables including student attendance (O'Neill & Oates, 2001).

The illumination of classrooms has also been found to have an impact on attendance as well as achievement. The Alberta Department of Education conducted research that compared children in classrooms with some natural lighting to those attending class with typical electric lighting. This study indicated that students who study under full-spectrum lighting attended school three days more per year than students attending schools in buildings with other lighting (Rouk, 1997) Higher levels of daylight illumination has been found to increase initiative and, in turn, raise motivation for attendance (Ruck, 1989). Schools have realized financial benefits parallel with the academic benefit of improved attendance through the enhancement of classroom lighting. Not only are modern lighting systems utilizing daylight more energy efficient. Schools participating in energy performance contracting have found that, by improving classroom lighting, attendance rates have risen leading to increased state funding (Birr, 2000).

School Facilities and Student Behavior/Discipline/Safety

Factors of physical surroundings that affect behavior are known as ambient environmental conditions (O'Neill, 2000). O'Neill (2000) notes that these factors include temperature, ventilation, lighting, color and noise level. These elements produce comfort or irritation, either of which can affect behavior of building inhabitants. The behavior of students is often driven by how they perceive their surroundings, including their physical environment (Maiden & Foreman, 1998). Annoyed students often become discipline problems. For example, Earthman and Lemasters (1996) found that the thermal environment of the classroom can be very important to the well being of children. Temperature levels have been found to have a significant impact upon attention spans of students (McGuffey, 1982).

Interior factors such as lighting and aesthetic features can affect student behavior and influence discipline referral rates. Evidence exists that fluorescent lighting may increase stress level and hyperactivity more so than full spectrum or incandescent lighting (King & Marans, 1979). Lackney (1994) found that students in rooms without windows had more negative attitudes than children exposed to natural light.

Studies have found that interior color also has an impact upon student attitudes and behavior. Early research on the impact of color took place in industrial settings. Earthman and Lemasters (1996) write of studies that determined certain colors that assist in increasing performance of workers in factory and office settings. Research regarding the impact of color has entered the educational arena and has found a link to teaching and learning. Color has been found to influence student attitude, behavior and learning (Sinofsky & Knirk, 1981). Certain researchers (Papadatos, 1973) have suggested that educators can manipulate atmosphere from constricting to engaging by changing color schemes in instructional areas. Papadatos (1973) suggests that such changes would promote positive perceptions and behaviors as well as increase attendance.

While designers and educators strive to take proactive steps to improve the ambient environment of our classrooms, the sad reality exists that we live in a society that must be conscious of and prepared for violence from within and without our campuses. The occurrence of school violence has led to a collision of seemingly opposite forces of providing a warm, welcoming learning environment versus securing students and staff from attack or sabotage (Kosar & Ahmed, 2000). Kosar & Ahmed (2000) note the example of designing exterior doors that appear welcoming to students, staff and visitors while providing a safe barrier from intruders. Students and staff must be able to flow freely throughout the campus during the school day, yet the building must be protected from unwelcome visitors and unruly students (Kromkowski, 2003). Kromkowski (2003) tells us that architects must consider the security of the campus setting without compromising the flexible learning environment.

Establishing a safe learning environment consists of more than secure entrances and surveillance systems. One must also look at the proximate surroundings of the school (DePatta, 2003). Noted security expert Bill Sewell explained in an interview that, when assessing the safety of a school, one must examine the surrounding neighborhood to determine to what immediate risks the campus may be exposed (DePatta, 2003). DePatta (2003) also learned that a professional evaluation of school security must include interviews with staff and parents in order to ascertain the typical threats that may take place in that particular environment.

One act of student misbehavior that has the most impact upon campus facilities and that is the most perplexing for school safety experts is that of vandalism. A 1998 report by the U.S. Department of Education listed vandalism as one of the top three crimes occurring on school property, along with fights and theft (Black, 2002). Of these three, vandalism obviously has the most physical impact upon school facilities. Due to this fact, designers must take vandalism into account when selecting building materials for school construction (Kromkowski, 2003). While the appropriate building materials will endure vandalism, it is also important to design spaces that deter such misbehavior. Noted school architect Stephen Kromkowski (2003) indicates that areas must be well lit and highly visible in order to remove the blanket of darkness or blind spots that conceal vandals during this criminal act. The same criteria hold for exterior building design, which should eliminate blind areas and supply adequate exterior lighting (Kromkowski, 2003; Pappalardo, 2002).

Once again, the impact of school size surfaces in the discussion of student behavior. On the topic of vandalism, it is theorized by school sociologists that vandals are most likely to be students who are disconnected from fellow pupils and from educators in their schools (Black 2002). While some children vandalize simply for the thrill of it, it is also theorized that vandals are most likely to be students lacking the appropriate counseling to deal with issues of anger and frustration (Black, 2002). Black (2002) reports that when larger schools do not promptly replace or repair facilities damaged by vandalism, they send a message to students that vandalism is allowed. The anonymity that students experience at large schools runs much deeper than the topic of vandalism. Violent acts such as the Columbine tragedy are often carried out by students who feel disconnected and unwelcome in school, yet go undetected by the adults on our campuses (Kennedy, 2003e).

In the wake of recent acts of school violence, technological advances have been made in school security design. Schools have also begun to employ security measures that had previously been reserved for industrial and correctional facilities. Police departments, once seen as the responsibility of municipalities and other governmental entities, are now commissioned by school districts and universities throughout the country (Kennedy, 2003e). *American School and University* magazine author Mike Kennedy (2003e) writes of the millions of dollars included in school bond proposals to upgrade or install digital video surveillance systems designed to monitor student, staff and visitor actions during and after school hours. Surveillance is just on of the methods used by schools to detect unwanted behaviors. Schools are also employing practices such requiring visible identification worn by all students, staff and visitors (Lupinacci, 2002). Electronic access systems have also been introduced to allow schools to limit and track who is given or obtains access to both exterior and interior entrances of the educational facility (Koziol, 2003).

No matter how much effort a school system employs to deter misbehaviors of a violent or disastrous nature, educators must also be prepared for the occurrence of such crimes. The attacks of September 11th have also shown that we are just as vulnerable from without as we are from within (Lehmuller & Switzer, 2002). Events ranging from "shooters" in the school to terrorist attacks to natural disasters have schools developing plans and practicing drills to transform learning environments into protective shelters (Jacobson, 2003). The importance of disaster preparedness is not lost on the federal government. Secretary of Education Rod Paige and Secretary of Homeland Security Tom Ridge recently unveiled a grant program through the Department of Education that provides $30 million in grants to assist districts in preparing emergency-response and crisis management plans (Robelen, 2003). With improved technology and resources, it is incumbent upon schools to protect the children that occupy our classrooms and hallways.

School Facilities and Dropout Prevention

It is also important that we focus on how our facilities might encourage students to continue enrollment, be academically successful and behave appropriately throughout graduation. The research is limited but growing in regard to the role that school facilities have in relation to high school dropouts. In an era of increased graduation requirements, schools are finding it more important to prevent students from dropping out of school instead of meeting the advanced expectations (Viadero, 2001). As with the issues of academic achievement, pupil attendance and student behavior, school size has shown to have an impact upon a student's decision to remain in high school or to drop out (Lee & Burkam, 2001). In a paper presented to a dropout conference hosted by Harvard University, Lee and Burkam (2001) note that, along with curriculum and social relation variables, large schools tend to see more students drop out prior to graduation than their smaller counterparts.

The issue of school size is critical as communities decide upon how large to build new high schools or to enlarge current secondary campuses. Research on small schools has shown that high schools with smaller enrollments are experiencing smaller dropout rates and are expending fewer resources on dropout prevention (Howley, 1994). A study of urban high schools in New York indicated that, when controlling for socioeconomic status, larger inner-city high schools have higher dropout rates and lower graduation rates than smaller NYC high schools (Stiefel, 1998).

Studies are beginning to surface that expose facility-related instructional and curricular strategies that deter students from leaving school prematurely. A Georgia study showed that technology integrated into the classroom and allowing for more real-life applications in the classroom decreased dropout rates (Wright, 1997). A Louisiana study found that student dropout rates were impacted by how grade levels were configured within school buildings (Franklin & Glascock, 1996). Studies such as these are growing and are often combined with the physical environment's impact upon teacher retention and professional development.

School Facilities and Teacher Retention/Professional Development

Recently, federal lawmakers squabbled over how to spend $2 billion on teacher recruitment in the United States (Boles & Troen, 2000). *Teacher Magazine* authors point out that, while new teachers are needed to address retirees and enrollment growth, more emphasis should be placed upon retaining the teachers already employed (Boles & Troen, 2000). In 2000, more than 247,000 teachers left their jobs resulting in a turnover rate exceeding 24 percent (Blair, 2003). Teachers Boles and Troen (2000) note that one of the reasons commonly attributed to novice teachers leaving the profession are poor working conditions. However, past research has considered the issue of poor working conditions one that is not readily addressed in order to keep qualified teacher professionally satisfied (Keller, 2003). With more than half of teachers leaving the profession listing physical environment as one of their reasons for quitting (Blair, 2003), it is imperative that educational leaders address the workplace as a factor of school improvement.

Just as students' attitudes and behaviors are impacted by their physical surroundings, teachers also are influenced by the physical conditions within which they work (Keller, 2003). In a recent survey of teachers in Chicago and Washington, DC, teachers gave their physical working conditions an over grade of a C on an A through F grading scale (Schneider, 2003). Echoing the findings of research aimed at connecting facilities with student achievement, the survey commissioned by the *National Clearinghouse on Educational Facilities* (Schneider, 2003) notes that teachers report inadequate lab space, lack of fine arts accommodations, and small classrooms as deterrents to their jobs of educating children. Schneider (2003) reports that teachers list environmental problems such as poor indoor air quality, noise, low lighting as well as 25 percent indicating that they have taught in non-instructional areas such as hallways or even closets.

Even as school designers must consider commons areas for students such as cafeterias, courtyards and hallways when designing a campus, workspace and commons areas for teachers and other professionals must also be considered. Insufficient workspace is found to be a significant contributor to lagging morale among American teachers (Black, 2001). Teachers have difficulty maintaining their sense of professionalism if they are not provided with private workspace (Hathaway, 1988). As with many other professionals, it stands to reason that teachers should be provided with private working space with telephone, fax machine and computers (Moore & Lackney 1994). If teachers are expected to participate in shared decision-making, then workspace should also be arranged to provide professional interaction with peers and administrators (Moore & Lackney, 1994).

In a study of exemplary schools in the United States and Japan, professors from Texas A&M University found that these outstanding schools provided sufficient workspace for teachers (Viadero, 1990). Viadero (1990) reports in *Education Week* that the group from Texas found the Japanese schools to be especially generous in the area of teacher workspace. Other faculty accommodations found in the outstanding American schools were professional libraries and well-furnished meeting rooms for teachers (Viadero, 1990). Viadero (1990) notes that teachers with higher job satisfaction do a better job of educating children.

Other factors of teacher space contribute to the sense of professionalism among faculty. Teachers need space to engage other teachers. Outside of class time, teachers need adult interaction that takes place in pleasant and appealing places (Stenzler, 1988). Teachers need space to interact professionally and socially, according to Hawkins and Overbaugh (1988). Lack of such space for relaxation and planning is a cause for poor morale among faculty members.

Job satisfaction is a common factor influencing teacher absenteeism and turnover rate (Keller, 2003). Good physical working conditions in any occupation can have a positive impact upon job satisfaction, attendance, effort, effectiveness and morale (Becker, 1981). According to Keller (2003), it is difficult to separate behavior from work environment when addressing teacher morale and job satisfaction. Physical surroundings impact job satisfaction and, hence, job performance. Decreases in job performance and increases in turnover rate result in real financial cost on the part of school districts as a result of inadequate facilities (Becker, 1981). Becker (1981) notes that adequate space with comfortable temperature, furnishings and lighting will increase the satisfaction of occupants and increase individual capabilities as a result.

Teacher retention is critical to the success of educational reform, as reform is a long-range project (Reeves, 2002). Studies, such as that conducted by O’Neill (2000) in

Texas middle schools, indicate that teacher satisfaction with physical working conditions is positively correlated with student academic performance. The writings of Ma and MacMillan (1999) corroborate the findings of O'Neill (2000) in that they found a significant connection between workplace conditions and teacher job satisfaction.

Just as teachers have been involved in the instructional and management decisions of their schools, campus designers have begun to find success in the inclusion of teaching personnel in the design process. One aspect of school design where teacher input is critical is that of teacher workspace (Strange, 2001). Teachers must be given an opportunity to assess their working environment, both the classroom and support areas (Long, 2000). Teaching methods vary, depending upon content area, student age, demographics and technology available. Teaching strategies of the staff should be taken into consideration by school architects when determining the plan of new or renovated facilities (Sanoff, 1996). Stanard (1996) suggests that teachers are best prepared to interject the educational needs of students into consideration during the facility design process.

Allowing teachers to participate in facility design along with consideration of teachers by facility designers is not only critical to staff morale and retention, it has been shown to have a significant impact upon teacher performance (Christopher, 1991). Factors, such as working conditions, which improve teacher job satisfaction have been found to have a direct impact upon school effectiveness (O'Neill, 2000). Fisher and Grady (1998) found that poor facility conditions were a profound factor in teacher job dissatisfaction.

Stockard and Mayberry (1992) contend that the physical environment has been shown to play a significant role in teacher effectiveness. In a study of five urban school districts, the facility conditions were found to be deplorable and the researchers reported a negative effect on teacher effectiveness (Corcoran, 1988). Teachers agree that the facilities in which they teach can deter from the quality of their performance if the physical environment is substandard (Schneider 2003).

Research is growing that urges architects and school leaders to take the teacher into account as much as the learner when designing campuses. Keck (1994) states that school design should consider the effective learner, the effective teacher and the effective organization. The shape, size, arrangement and décor of the classroom and support facilities can either be welcoming or repulsive to teachers and students. This simple fact has been noted to profoundly influence the acts of learning and teaching (White, 1990).

School architecture speaks volumes of a district's commitment to its professional staff by the type of workplaces it provides for teachers (Deal & Peterson, 1999). For example, Deal and Peterson (1999) note that the school signifies that it values professional growth and study by placing a research library for the faculty. In a national study, state Teachers of the Year were surveyed as to how their physical working environment affected their professionalism (Overbaugh, 1990). Overbaugh (1990) found that these outstanding educators were satisfied with the majority of classroom design aspects. However, the research showed that many of the support areas needed for professional development and interaction were inadequate – namely, professional libraries, telephones for teacher use, teacher to teacher conference rooms, planning areas and lounge facilities.

School Facilities and Establishing Community

The meaning that schools hold for both students and the community is evidenced in the architecture that the campuses exhibit (Cutler, 1989). For example, schools in the nineteenth century were built to model the factory-type design that signified efficiency and industrialization (Deal & Peterson, 1999). Cutler (1989) notes that schools recently have transformed from castle-like erections with limestone décor, dark oak stairways and monumental paintings to the modern school that communicates a more personal setting.

Architecture can symbolize many things to a community. Schools are a sustainable part of a community. School buildings can be an icon of a community’s heritage and a celebration of its culture (Malone, 2001). Building designs and construction materials reflect the history and make-up of the area that the school serves. For example, in one New Mexico Pueblo, the school principal insisted that the school’s perimeter be surrounded by an adobe wall instead of a chain-link fence to follow the architectural tradition of the Pueblo (Deal & Peterson, 1989). Deal and Peterson (1999) note that some schools may put up items such as sculptures to reflect the varied ethnic backgrounds of the many students enrolled.

School architecture also symbolizes what is important to a community and to the educational leaders therein (Cutler, 1989). For example, a school with large gymnasiums and a small, isolated library may send the message that athletics is much more important than reading or academic research. The complexity, size and arrangement of space on a campus sends an important message about what is important to a community, faculty, student body, school board or district (Deal & Peterson, 1999).

Restore or Rebuild

Sustainable as they may be, school buildings begin to deteriorate with age. However, communities have found that historic neighborhood schools can be preserved to maintain the cultural significance of an area or town. Districts containing historic facilities have found that restoration and renovation are more publicly acceptable than demolishing these older buildings and replacing them with new construction (Hammond, 2003). Colleges and universities have also taken great strides to maintain historically significant buildings and landscapes in response to the need for community identity and to appease alumni (Biemiller, 2002).

Preserving historic campuses can prove to be challenging for designers and expensive for local taxpayers. Often times, due to outdated materials, modern building codes or technological advances of teaching space, it is less expensive to newly construct a school rather than renovate an antiquated facility (Hammond, 2003). Furthermore, it is often times more expensive to maintain older facilities due to obsolescence of mechanical systems or lack of energy efficiency (Sack, 2002). For years, building planners and educators determined that a district should not exceed 40% percent of the replacement cost in renovation expenses (Yeater, 2003). Yeater (2003) states that rules such as this are arbitrary and becoming less of the norm when dealing with classical buildings and limited state funding.

However, the public outcry to cease the razing of these community icons has created funding opportunities and governmental support for renovating older facilities. The National Trust for Historic Preservation, the National Park Service and the Council of Educational Facility Planners International have lobbied for the preservation of historic school buildings (Sack, 2002). Sack (2002) reports that states such as Vermont and Maine have adopted policies and made funding available to assist districts choosing to restore rather than rebuild.

The preservation of historic school buildings marks a change in educational construction trends. Following the building surge of late twentieth century, towns are beginning to return the neighborhood school to the center of community focus and are longing for nostalgic design (Kacan & Bolling, 2002). Often times, schools may have lost their appeal to citizens as a result of poor maintenance, vacancy or obsolescence. However, designers are discovering that refurbishing these older campuses will return them to their status as a symbol of community history, culture and values (Buffington & Baxter, 2001).

Community Environment and "Green" Buildings

School architecture may also espouse the value that a community places in natural resources and the environment (Malone, 2001). Malone (2001) includes the description of an elementary school in McKinney, Texas that utilizes recycled building materials and utilizes energy efficient features that not only sustain the environment, but also are used to instruct students in environmental science. Projects such as the one in McKinney are becoming known as green schools. Leary (2003) notes that green buildings assist teachers in developing an understanding within students of the relationship between themselves and nature. The U.S. Department of Energy suggests that American school districts would collectively save $1.5 billion annually through the construction of green schools (Leary, 2003).

Green schools, or sustainable schools, are schools that are environmentally friendly through design features that utilize native materials, are fueled by renewable resources and that maximize natural energy (Ritchey, 2003). Not only are these ecologically-friendly facilities more efficient, "green" concepts such as natural lighting and increased ventilation create learning environments that boost student academic achievement and health of building occupants (Leary, 2003). These sustainable designs create facilities that have a minimal effect on the environment and are more cost effective than traditionally designed schools (DeVolder, 2002).

The movement toward sustainable school design has led to the formation of the U. S. Green Building Council and its Leadership in Energy and Environmental Design, or LEED (Bernheim, 2003). Sustainable design has also received support of federal, state and local initiative due to its reduced cost, increased energy efficiency and decreased impact upon the environment (Bolin, 2003). Along with direct savings connected with constructing green buildings, other savings such as lessened legal expenses needed for indoor air quality claims are experienced by districts choosing this route (Leary, 2003). In order to provide the most successful sustainable design, Bolin (2003) suggests including representatives from all stakeholder groups, including those community members who will occupy and utilize the facility.

Community Involvement in School Facility Design and Use

Increasingly, public schools are highly integrated with other community functions (O'Neill, 2000). "This includes the development of a community center as part of the normal operations of the school, and making the school a hub for community activities" (O'Neill, 2000, p. 49). This heightened interaction between school and community is a reflection of the increasing perception of the school as a lifelong learning community (Moore & Lackney, 1993). Facilities can motivate community members to participate with the educational process, support school initiatives and utilize the building due to a welcoming design (Deal & Peterson, 1999). Deal and Peterson (1999) report that messages are transmitted to the community subtly by facility features such as carefully manicured landscaping, which signifies the love and care that children receive on the campus.

The fact that educational facilities serve as cultural icons and that the citizens view and utilize the campus as their own justifies the inclusion of community members in the building design process. The typical school district would have numerous reasons to desire community participation in the design process. One such motivation would be the desire to build community support for the financing of the construction project (Moore, 2003). Community members can bring a technical advantage to the design process by providing suggestions in order to meet the educational and social needs of their children (Bray & Kuhnen, 2002). Involved citizens can also bring community values to the design table and their participation instills pride in the new or renovated facility (Meno & Karnyski, 2002).

Funding for new school construction or significant renovation usually requires the approval of taxpayers in the form of a bond referendum. Citizens will demand information from district officials, such as the intended use of new buildings or the condition and capacity of existing facilities (Bell, 2003). Bell (2003) led a building process in 2000 that took a slower pace in order to allow input from community members and staff from all content and support areas. Members of this leadership team gathered human data that was shared with building architects before any technical plans were ever placed on paper (Bell, 2003). Such opportunities for citizen participation, along with an aggressive communication campaign, will greatly increase a district's likelihood of gaining voter support for a construction project (Moore, 2003).

Contributing to the facility design process is an important way for parents to be involved in their children's educational experience. A wealth of research links parent involvement with student success (Moore, 2003). The idea of involving parents in the design process creates a dually successful situation for districts by increasing parental contributions to the learning process and by gaining their support for building projects (Moore, 2003). In additional efforts to expand the design team, some districts have allowed students to play an active role in the process of planning school facilities (Arora, 2001).

Including community members in the process of designing educational facilities can take many forms. In some instances, local citizens are allowed to take part in decision making regarding site selection, building layout and design of parks and playgrounds (Schneider, 2001). Other times, community members are asked to participate in the collection of demographic data important for enrollment projections and site determination (Henry, 2000). However, the most common method for involving citizens in the school design process is through membership of an advisory committee (Carey, 2001). According to Carey (2001) it makes sense to involve citizens in the design process since the school facilities belong to the taxpayers. The act of planning involves more than just facts, it includes ideas and opinions that should be shared by all stakeholders (Carey, 2001).

The fact that public school facilities belong to district citizens drills much deeper than the simple fact that taxpayer dollars pay for the construction and upkeep of buildings. Community members and organizations occupy and utilize school facilities on a regular basis. The most common and obvious use involves access to activity centers such as athletic fields, gyms and natatoriums (Fickes, 2003a). The benefits of such arrangements are numerous. Most notable is the increased financial and physical capacities realized when community entities join with school districts in the construction, maintenance and use of educational facilities (Ritchey, 2002). Ritchey (2002) notes that such joint ventures increase the financial capacity for construction or renovation and make the most efficient use of limited real estate.

In addition to athletic and recreational use of school properties, citizens are realizing academic benefits from their public educational facilities. Schools are providing library access to citizens so that they may use the literature and technology for personal and professional research (Sapp, 2001). School buildings stay open afternoons, evenings and weekends to host such activities as youth outreach programs, Community Theater and adult education classes (Kennedy, 2001a).

Opening school doors to community members is not without its obstacles. The fact that an increasing number of people are allowed in the school buildings during various hours of the day and evening could have safety and security implications (Kromkowski, 2003). Evening and weekend activities taking place on campuses are less likely to have the proportion of adult supervision as is available during the school day. This fact increases the need to prevent vandalism and theft in school buildings (Kromkowski, 2003). Deciding which groups are allowed to use school facilities can also present legal questions for district administrators (Jenkins, 2002).

Ultimately, it is more common than not that schools benefit from opening their doors to the community. Citizens of all ages gain a respect for and tend to support districts that allow them to make optimum use of educational facilities (Sullivan, 2002). Taxpayers' dollars have a greater impact when community entities partner with schools for the development of facilities and grounds (Geiger, 2003). Communities have also recognized benefits such as neighborhood revitalization and economic development when they become actively involved in the design and use of school facilities (Dolan, 2001; Rittner-Heir, 2003a). Hence, American schools have returned to a practice of opening its school doors to citizens as it did in the mid-20th century (Kennedy 2001a).

School Facility Assessment

School administrators execute many tasks throughout the school year. In the quest to improve academic performance in order to meet mandates such as No Child Left Behind Act (2001), principals and other educational leaders tend to focus on curriculum and pedagogy rather than the physical learning environment. However, researchers Maiden and Foreman (1998) state that all school administrators should possess a basic understanding of facility assessment and use this knowledge to continually evaluate the condition of school buildings and its impact upon student success.

The building principal is not the only individual who should be mindful of the role that facilities play in school success. Teachers, parents and students are encouraged to reflect upon the condition of their school buildings (Sanoff, 2001). Sanoff (2001) notes that facility assessment can include tasks as simple as determining the arrangement of classroom furniture or concepts as complex as an obsolescence study of the mechanical, electrical and plumbing systems. Assessment can include various methods of data collection, including direct observation, interview and simulation (Friedman, Zimring & Zube, 1978).

School facility assessment normally conjures up thoughts of designers, architects, engineers and other professionals trained specifically to evaluate buildings. However, a growing trend considers that the users of a building such as teachers, students and community members, are the most reliable people to assess school facilities (Sanoff, 2001). This involvement of building occupants helps to ensure that facility quality assessment is an ongoing process rather than one only done when design professionals visit the building (Lackney, 1999).

School facility assessment can focus on many factors of educational adequacy and excellence. Most obvious is an investigation of the environmental factors that impact academic performance and the delivery of curriculum (Sanoff, 2001). However, schools are increasingly evaluating the safety and security of their campuses. Efforts to improve safety and security should consider facility systems as well as policies and preparedness (Vigue, 2002). Vigue (2002) reports that a site survey assessing campus safety and security should address the school's perimeter integrity, internal access control and entryways. Facility assessment can determine the likelihood that building design may contribute to misbehavior and violence by examining sightline obstruction, door hardware security and space for student circulation (Reid, 2000).

Facility assessments can often prove to be expensive and time-consuming. However, formative facility assessments can be executed by school administrators during the normal course of their job duties. Software and other assessment instruments have been developed to assist the layperson in determining building condition (Oualline & Rabenaldt, 2002). Other technological advances, such as hand-held computers containing facility condition history, have made data access more efficient for building managers as they assess the physical environment (Bhimani & Pantaleo, 2001). The aforementioned justifications for facility assessment and the advanced technology assisting with building evaluation are but two reasons that educational leaders should be knowledgeable regarding campus assessment. Additionally, an extensive and accurate assessment of current facilities can assist in persuading elected officials and taxpayers to financially support improved and innovative construction (Rabenaldt, 2000).

The Evolution of School Facility Design

History of School Facility Design

Any discussion of the progress made in the design of educational facilities should begin with the history of school building architecture. Early schoolhouses of the seventeenth century were as uncivilized as the frontier that they served. Most of these facilities were one-room structures with limited furnishings functioning primarily as shelter (O'Neill, 2000). As towns grew, additional rooms were added for additional space with little regard for modernizing the schools (Graves, 1993). The nineteenth century ushered in such advances as chalkboards, gas lighting and central heating (O'Neill, 2000). As the century progressed, the need to separate children based upon age prompted schools to separate students into grade levels and to separate older students into specific rooms for instruction in certain content areas (Siegel, 1995).

The first fully graded public school facility in the United States was Boston's Quincy Grammar School (O'Neill, 2000). The Quincy school was a four-story structure built to house 660 students. This structure strayed from the traditional bench seating for students, using individual desks and chairs for each pupil (Graves, 1993). The Quincy design established a pattern for nineteenth century school design across the United States (Cutler, 1989). According to Graves (1993), schools following the Quincy design would have a façade based upon local preference although the basic layout of classrooms remained constant.

Early school design failed to consider the instructional process. The psychological and physical needs of children were greatly ignored (O'Neill, 2000). At the turn of the twentieth century, O'Neill (2000) notes that schools such as Frank Lloyd's Hillsdale Home School began to convert to a more open design concept. Contemporary educators such as John Dewey also took note of the physical environment and its impact upon student success. Arrangement of the building and classrooms allowed for active student participation. One such stride in this direction was the unbolting of student chairs and desks from the floor (Siegel, 1995).

The 1940's noted an increase in class size as well as attention to characteristics such as increased student access and natural lighting (Graves, 1993). However, the traditional, egg-crate design prevailed throughout the early and mid twentieth century. During the 1960's and 1970's, educational research indicated that students performed better in a variety of settings and groupings. The response from architects was to design schools with open plans meant to provide flexibility in student grouping (Siegel, 1995). Many of these open designs failed due to a lack of input from understanding by educators. This lack of staff development involved in the design process spelled the doom of open-concept schools (Rittner-Heir, 2003b).

After a lull in enrollment growth during the 1970's and early 1980's, the number of students in our nation's schools began a steady rise in 1984. As the number of American students grew, national leaders took an increased interest in education and educational goals. President George Bush began the formation of national educational goals in 1989 and that emphasis was carried forward by President Bill Clinton in the 1990's (Kennedy, 2003c). The release of the U.S. General Accounting Office (1995) report entitled *School Facilities, Condition of America's Schools* brought specific attention to the inadequacies of many educational facilities and the high price tag for bringing these schools up to standard. The past decade has seen an insurgence of technology into the educational program, and hence in school buildings.

Technology and School Design

The role of technology in the classroom is actually an issue of literacy. The term "literacy" now refers to concepts beyond reading and writing. Literate students must be knowledgeable of and skillful with globalization, automated social interaction, the World Wide Web, and new cultural dynamics (Stokes, 2000). Stokes (2000) provides examples of the way in which technology will transform education: from augmenting traditional textbooks to providing Web-based tutorials outside of the classroom.

Interactive technology is a common part of the world from which American students come. The world of work increasingly relies upon technological skills as well as concepts of interaction and information processing (Day & Spoor, 1998). "Technology is the inescapable companion of the 21st century citizen" (Day & Spoor, 1998, p. 32). Day and Spoor (1998) note that the infusion of technology into the educational program impacts design components such as infrastructure, interior design, classroom size and furniture.

Technology has impacted the content of learning as much as it has pedagogy. Programs such as industrial arts have been replaced with technology education. Such changes transform curriculum and facilities (Daniels, 2003). The processing of information that is afforded by technological advances changes the very layout of the classroom. No longer are desks arranged in rows with the teacher positioned at the front of the room from where she can lecture. Many schools are beginning to replace desks with tables so that students can interact with one another. Traditional desks have been replaced by tables and modular furniture in more than 25% of Virginia elementary schools (Daniels, 2003). Daniels (2003) states that these modern furniture arrangements provide the appropriate physical placement for computers and other technological tools.

The need to adjust classroom design to accommodate technological advances exists beyond computer labs and media centers. The National Center for Education Statistics reports that over 75% of United States public schools have computers in classrooms (Syvertsen, 2002). In order to support the increase in technology equipment, school designers must also address items such as lighting, power supply and classroom size. While natural lighting has been found to enhance learning, it can also raise the heat index of a classroom and decrease the life and operation of computers (Syvertsen, 2002). Syvertsen (2002) found that classroom space must be increased to allow room for computer hardware as well as raising ceiling heights to accommodate projectors and video screens.

The increase of electronic media such as computer monitors, LCD projectors, digital whiteboards and file servers have greatly increased the burden placed upon the power infrastructure of school buildings. With the average age of school buildings exceeding 40 years (Dewees, 1999), many of America's schools were not constructed in a manner that would support the electrical loads created by increased technology. The challenges facing older building reach beyond simply adding electrical circuits and service. The power needs for computers, file servers, printers, wireless modems and projectors vary significantly. For example, computers have a low tolerance for power fluctuations and must be not share loads with other electrical equipment (Failla & Birk, 1999). Failla and Birk (1999) caution designers to ensure that modern building codes be strictly adhere to when renovating the power infrastructure of an older facility.

Electrical capacity is not the only wiring issue facing school designers and administrators when dealing with technology integration. The insertion of the World Wide Web and networking into educational programs necessitates the availability of network wiring. Industry standard for data, voice and video transmission is fiber optic wiring. However, educational institutions such as high schools and colleges operate with limited financial resources and find it difficult to create an entire network and purchase equipment for fiber optic systems (Yan, 1999). The speed required for data, voice and video transmissions should be considered when designers and education officials determine the scope of a building or renovation program.

From an infrastructure standpoint, the development of wireless networks has made the most significant impact in recent years. In 2002, two out of three campuses reported some use of wireless technology (Swanquist & Garza, 2003). This technology, according to Swanquist and Garza (2003) is having a direct impact upon teaching and learning strategies. For example, students in some schools transfer their homework assignment from their own personal digital assistant (PDA) to their teacher’s computer as they enter the classroom.

Modern technology advances are transforming the acts of teaching and learning. One technological tool introduced into the instructional program is the use of video conferencing and distance learning. This technology allows students to hear from distinguished lecturers or participate in advanced curriculum that would not be available in their local schools (Yan, 1999). Hardware and software are allowing teachers to vary instruction based upon the need and learning styles of their students. Amplification systems, video systems and interactive whiteboards have expanded the tools available to teachers as they deal with students with varying capabilities and modes of learning (Milshtein, 2003). Technology allows educators to focus on the development of lifelong learners. Through information attainment systems, teachers can focus less on feeding facts to students and more on providing them with the skills to find the facts for themselves (McDonough, 2000).

Advances in technology have changed school design in ways other than instructionally. With heightened security concerns stemming from shootings and terrorist attacks, architects and school officials are increasingly advancing technological tools used for campus safety and security. Digital surveillance cameras are becoming the norm on campuses throughout the country (English, 2003). English (2003) reports that schools in Atlanta have invested hundreds of thousands of dollars improving the safety of their campuses with digital technology. Emphasis has also been placed on designing automated access to buildings that control and record those allowed to enter schools. This technology has advanced to the realm of biometric identification such as hand geometry or face recognition required to enter the most secure areas of schools (Szczerba, 2000). Along with surveillance and access control, the introduction of telephones in classrooms, two-way radios and cellular phones have provided more tools for teachers so that they can communicate with administrators for security purposes (Fickes, 2003b).

School Design and Learning Styles

Efforts to reform education and improve performance of an increasingly diverse student population have led to many advances and adjustments to teaching styles and curriculum delivery. As teaching strategies evolve, so must the physical environment of our schools. Approaches such as interdisciplinary teaming and cooperative learning place different demands on our traditional schools settings (Day, 2001). Day (2001) suggests that modern schools should contain elements such as teaching museums, ecological landscapes, technology studios and flexible furniture systems to meet the special needs of all students. Flexible classroom space increases the capability for the students to interact in participatory learning exercises. Increased classroom size and flexibility will allow teachers to utilize modern educational strategies such as project-based assignments and interactive laboratories in an environment that allows for multiple group sizes and well as individual investigation (Day, 2001).

As educators have become increasingly involved in the design process, facilities have become more flexible and suited to innovative instructional approaches. The developmental level of students housed on the campus must be taken into account when developing instructional space. Sanoff (1997) notes that modern schools will include a wide variety of classrooms in contrast to the twentieth century schools with their egg crate designs and symmetrical classroom designs. Educational researchers are frequently recommending that cognitive learning specialists become actively involved in planning instructional space in efforts to design interiors that maximize student performance across all learning modalities (Hill, 1996).

Brain-based research has profoundly affected both the medical and educational fields. A vast field of literature is focusing on the physiology of the brain and implications for teachers and educational leaders. As this research becomes readily available and analyzed, it will impact decisions ranging from school start times to teaching strategies to assessment methods (Jensen, 1998). Noted brain research scholar Eric Jensen (1998) notes that this body of research will also impact the design of classroom environments.

Brain-based learning scholars promote the creation of a constructivist environment. This term relates to the idea that students learn best when they are able to construct knowledge from their experiences and other connections rather than receive it in a rote manner from the teacher. The constructivist classroom is one in which students interact with the teacher as a facilitator and where they are prompted to take new information and exercise flexibility in fitting the new data into their own experiences and realities (Brooks & Brooks, 1993). This field of research heavily emphasizes the role of the physical environment. Most commonly espoused by brain researchers are the flexibility of learning space to accommodate multiple levels of interactions as well as increased space for projects and other tangible assessments of student performance (Valiant, 1996).

Brain research has broadened the concept of classroom design. Facility planning must now become a holistic and systemic practice, focusing on the physical environment while considering the social and emotional influences of the learning process (Lackney, 1998). Dr. Lackney (1998) offers suggestions for designers as they attempt to create brain-compatible learning environments. These principles include rich color and texture; group learning spaces; linking indoor and outdoor spaces; symbols of community values; safe places; variety of design elements; changing displays; proximity of resources; spatial flexibility; activity centers; passive space; and utilization of the natural environment.

Future of School Design

With enrollment expected to grow exponentially along with heightened accountability for student success, it is definite that school construction must increase and improve during the coming years. Research leans toward smaller campuses with larger classrooms (Cook, 2002). This arrangement assists school leaders in addressing the personalization and safety of a small school while allowing spatial flexibility to accommodate technology and multiple student groupings. In moves that appear retrospective, school buildings are designed with traditional facades and allow increased amounts of natural lighting (Cook, 2002).

Other aspects of school design will change as a result of modern research and limited resources. In order to increase parental involvement, community awareness and access to additional financial resources, schools of the future will be designed to be central to community activity (Geiger, 2001b). In an era of more enduring construction and more limited financial resources, districts must adhere to instructionally and physically sound design approaches in order to avoid the erection of a monument of poor planning that may stand for decades (Stevenson, 2001). This responsibility on the part of school district administrators and trustees calls for the development of a comprehensive building plan that will carry a district throughout years of enrollment growth and community development (Stevenson, 2001).

As schools strive to improve student performance, they must accurately assess their needs as an instructional entity. These needs must then be reflected in the design and arrangement of instructional space (Chan, 1996). Chan (1996) warns educators that schools which ignore the learning needs of their students and the modern teaching research are doomed to allow their facilities to slip into the trap of obsolescence. This mistake could prove costly on a financial and, more importantly, an instructional level.

CHAPTER III

METHODOLOGY

Research Study Population

The Texas Education Agency's *Ask TED* public school directory was used to identify the population of Texas high schools eligible for the study. In order to more closely investigate the correlation between school facilities and campus performance data, the study controlled for factors of school size and socioeconomic status of students. School size, as determined by student enrollment, was based upon figures reported by the Texas Education Agency for the 2002-2003 school year. Socioeconomic status of student population was determined by the percent of economically disadvantaged students reported by the Texas Education Agency for the 2002-2003 school year.

According to the Texas Education Agency, there are 252 public high schools with enrollments between 1,000 and 2,000 students. This enrollment range eliminates possible errors in measurement that might occur with extremely large or small campuses. Of the campuses in this range, 130 have less than 40 percent of their enrollment that is designated economically disadvantaged. To further control for grade alignment differences between campuses, only schools with grades nine through twelve were invited to participate. This reduced the number of schools in the study population to 101.

It was determined that the campus principal or the principal's designee would be the most qualified to evaluate the physical plant of the school in regard to its possible impact upon student performance and staff retention. Therefore, the high school principal for each school in the study population (n=101) were invited to participate in this research study. In all, there were 101 possible respondents who were surveyed for this research project. The entire population received electronic mail with a link to the web site containing the facility-rating instrument.

Design of the Study

This study was descriptive in nature, investigating the possible impact of school facilities on student achievement, attendance, discipline, completion rate and teacher turnover rate in selected Texas high schools. In addition, this study focused on the aspects the physical environment that have the potential to enhance student learning. Campus principals were asked to evaluate the condition of their high school facility in regard to architectural and cosmetic features as well as maintenance of the physical plant. One commonly held tenet of educational research is to examine new information about the educational phenomena (Gall, Borg & Gall, 1996). Descriptive studies, through their exploratory nature, provide the opportunity to increase the understanding of developments in the field of education. Inferential studies provide analyses that may assist in predicting results across an entire population based upon data gathered from a certain sample (Howell, 2002).

This study was conducted during the 2003-2004 academic year. Data pertaining to building facility conditions were acquired from the selected Texas high schools during the Spring 2004 semester using a research instrument utilized in a similar study of Texas middle schools (O'Neill, 2000). The study followed seven basic steps outlined by Gall et al. (1996) required of research utilizing questionnaires: (1) defining the research objectives, (2) identifying a population or sample, (3) determining variables of the study, (4) designing the instrument, (5) pre-testing or pilot testing, (6) cover letter, (7) distributing the questionnaire and follow-up.

Data on student achievement, attendance, discipline, completion rate and teacher turnover rate were acquired from the Texas Education Agency's website and the TEA Division of Communication and Public Information. Data for student achievement, attendance, discipline, and completion rate was provided for the 2002-03 school year. Data pertaining to the teacher turnover rates were provided for the 2000-2001, 2001-2002, and 2002-2003 school years.

The design of the study allowed for a comparison of student achievement, attendance, behavior, dropout rate and teacher turnover rate with ratings of the school facilities. A significance level of 0.05 was used for this study. According to Gall et al. (1996), this level of significance is commonly selected by educational investigators and that it is more significant than the 0.10 level.

Instrumentation

Based upon the geographic dispersion of the population, it was determined that a survey mailed electronically would be used for data collection. Gall et al. (1996) cite this survey method as appropriate in providing valid assessment of variables studied. Several advantages of this survey method have been identified (O'Neill, 2000). First, it is an efficient way of reaching populations with wider ranges. Secondly, the questionnaire method was less expensive than other survey methods. Finally, stimuli provided to the participants are consistent and opportunities for uncensored responses are greater.

The Total Learning Environment Assessment (TLEA) was developed for a similar study of Austin, Texas area middle schools (O'Neill, 2000). The TLEA was derived from the Council of Educational Facility Planners, International's (CEFPI) *Guide for School Facility Appraisal* (Hawkins & Lilley, 1998) and is supported by the current literature. The CEFPI developed the *Guide* in order to provide an instrument that would systematically assess the quality and educational effectiveness of school facilities (O'Neill, 2000). The permission of the TLEA developer, Dr. David O'Neill, as well as permission from CEFPI was granted before the instrument was utilized in this study. Validity was established for the TLEA through a review of the literature and by a panel of experts as well as pilot-tested by campus administrators (O'Neill, 2000).

In December of 2003, the researcher contacted TLEA author Dr. David O'Neill in order to request permission for use of the instrument in a statewide study of high school facilities. During the telephone conversation, Dr. O'Neill granted permission for use of the TLEA in the study. A letter was also sent to the Council of Educational Facility Planners, International (CEFPI) requesting permission for use of the TLEA in the study of Texas high school facilities. A letter from Elisa Warner, Director of Research for CEFPI, granted permission for use of the TLEA within the parameters of this study.

The first section of the instrument utilized questions that would gather historical information about the campus facilities. Questions in this section pertained to the age of the facility, renovations to the facility and involvement of the faculty in the design of the facility. This section of the instrument also attempts to gather information regarding the degree to which the facility parallels the instructional philosophy of the school and the number, if any, of portable buildings that are utilized on the campus (O'Neill, 2000).

The second section of the TLEA is entitled Educational Adequacy. This section contains the original CEFPI subsections Academic Learning Space, Specialized Learning Space, and Support Space. The developer of the TLEA used the CEFPI items as well as additional questions developed for the Austin middle school study (O'Neill, 2000). O'Neill also added the subsection entitled Community/Parent Space. This section of the survey used a four-point Likert scale with Ranking 1 indicating a response of "strongly disagree," Ranking 2 indicating a "disagree" response, Ranking 3 indicating an "agree" response, and Ranking 4 indicating a response of "strongly agree."

The third section of the TLEA was entitled Environment for Education and consisted of thirty-five items. Subsections of this portion included Exterior Environment and Interior Environment from the original CEFPI instrument and a subsection entitled Visual Reinforcements added by O'Neill (2000). This section of the survey also used a four-point Likert scale with Ranking 1 indicating a response of "strongly disagree," Ranking 2 indicating a "disagree" response, Ranking 3 indicating an "agree" response, and Ranking 4 indicating a response of "strongly agree."

Validity of the Instrument

The establishment of Content Validity for the TLEA was accomplished through a review of the current literature pertaining to facility assessment as well as through a review by a panel of experts. The expert panel utilized by O'Neill (2000) to review the

TLEA consisted of two college professors and one practicing architect. O'Neill made adjustments to the instrument based upon suggestions of the expert panel.

The TLEA was pre-tested by a group of five middle school principals prior to O'Neill's 2000 study of Austin area middle schools. The principals in the pre-test group were not participants in the eventual study. These principals completed the instrument and slight adjustments were made to improve readability and clarity (O'Neill, 2000).

Procedures

This study of Texas high school facilities and their impact upon student performance and staff retention was conducted during the spring and summer of 2004. Each principal of the 101 eligible high schools received and email explaining the purpose and scope of the study and inviting them to participate. The email contained a link to a website hosted by Texas A&M University's College of Education. This website contained an electronic version of the TLEA that allowed participants to complete the survey online. Participants were assured that their school identity would not be divulged in the study.

Twenty-two of the 101 invited participants responded to the initial email. A second email was sent to the remaining invitees reminding them of the purpose of the study and reiterating the fact that the school identity would not be revealed in the study. Furthermore, an offer to share results with the respondents was made. Six additional participants replied in response to the email reminder. A third electronic request, along with reminder telephone calls, was made to the remaining invitees. Two additional participants replied to the third reminder. The total participant count was 30 schools of the 101 original invitees.

The timeframe of emailing responses prior to the end of the academic year contributed to the lack of response, as many school administrators are engaged in time-consuming activities associated with the ending of school. However, it was necessary to contain the study to the spring semester of the academic year due to the increased chance of facility renovations scheduled during the summer months that may significantly alter the ratings of the facilities and would be unrelated to the student performance data of the prior semesters. It was determined to continue with the study at the 30% response rate.

The campus data necessary for a statistical comparison to the TLEA scores was obtained from the Texas Education Agency. Scores for student achievement, attendance, completion rate and discipline referrals was gathered from TEA's website through Academic Excellence Indicator System (AEIS) reports. Student achievement data was based upon Texas Assessment of Knowledge and Skills (TAKS) scores reported for high school grades nine, ten and eleven. Teacher turnover rate was calculated upon all instructional staff at a given high school. The turnover data was gathered using the 2000-2001, 2001-2002, and 2002-2003 school years. This data was provided by the Texas Education Agency's Division of Communication and Public Information in the form of an electronic file transfer.

Data Analysis

This research was conducted as a survey study that used both descriptive statistics and inferential statistics to analyze the data. Data was gathered using basic research methodology as described in *Educational Research: An Introduction* (Gall et al., 1996). Analysis was derived from statistical methods outlined in *Statistical Methods for Psychology* (Howell, 2002). The results of the questionnaire entitled Total Learning Environment Assessment (TLEA) were downloaded from the research website to a Microsoft Excel spreadsheet. The data was then imported into the program entitled Statistical Package for Social Studies (SPSS) version 14.0.1. The program produced both numerical and graphical results of the study. Statistics gathered included means, frequencies, standard deviations and regressions. Findings are depicted using tables and graphs.

Descriptive and inferential analyses were utilized to determine the relationship between dependent variables of student achievement, attendance, discipline, completion rate and teacher turnover rate to those of the independent variables of the sections and subsections of the TLEA measuring school facilities. Relationships were queried using correlation and regression models of statistical analysis.

The data gathered in the first section of the Total Learning Environment Assessment, which contained responses on history of facilities studied as well as the instructional philosophy depicted in the facility, were used primarily as a statement of further description of the facilities of schools participating in the study.

Research Question #1

The research question "To what extent do school facilities impact student achievement as reported by the Academic Excellence Indicator System (AEIS) at selected Texas high schools?" was studied using regression models with Texas

Assessment of Knowledge and Skills (TAKS) scores as the dependent variable and sections of the Total Learning Environment (TLEA) as independent variables. Multiple regression models were derived using combinations of the subsections of the TLEA.

Research Question #2

The research question “To what extent do school facilities impact student attendance as reported by the Academic Excellence Indicator System (AEIS) at selected Texas high schools?” was studied using regression models with attendance rates from AEIS reports as the dependent variable and sections of the Total Learning Environment (TLEA) as independent variables. Multiple regression models were derived using combinations of the subsections of the TLEA.

Research Question #3

The research question “To what extent do school facilities impact student behavior as reported by the Academic Excellence Indicator System (AEIS) at selected Texas high schools?” was studied using regression models with discipline referral rates from AEIS reports as the dependent variable and sections of the Total Learning Environment (TLEA) as independent variables. Multiple regression models were derived using combinations of the subsections of the TLEA.

Research Question #4

The research question “To what extent do school facilities impact student completion rate as reported by the Academic Excellence Indicator System (AEIS) at selected Texas high schools?” was studied using regression models with student completion rates from AEIS reports for each school as the dependent variable and sections of the Total Learning Environment (TLEA) as independent variables. Multiple regression models were derived using combinations of the subsections of the TLEA.

Research Question #5

The research question “To what extent do school facilities impact teacher turnover rate as reported by the Public Education Information Management System (PEIMS) at selected Texas high schools?” was studied using regression models with the three-year average of teacher turnover rates from PEIMS reports for each school as the dependent variable and sections of the Total Learning Environment (TLEA) as independent variables. Multiple regression models were derived using combinations of the subsections of the TLEA.

CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

This chapter presents descriptions and explanations of the findings driven by the research questions of this study of the relation of school facilities to performance indicators of selected Texas public high schools. The results focused on these performance indicators as evidence of school effectiveness. These variables of school performance and school facilities were developed from an extensive review of the literature and similar studies.

In an effort to better understand possible factors that impact school performance, this study set out to develop an analysis of possible linkages between school facilities and school performance indicators. Such an investigation should provide insight to educators, administrators and policy makers as decisions are formulated about effective school facility design and construction. This particular investigation focuses on facilities of selected public high schools in Texas and possible relationships to school performance indicators such as academic achievement, attendance, discipline, completion rate and teacher turnover rate. The research in this investigation expands upon a previous study that was conducted with middle schools in a particular region of Texas (O’Neill, 2000).

Study Population and Parameters

In order to control for the many variables that may also relate to school performance in addition to school facilities, the study population was controlled by enrollment and socioeconomics as defined by the percent of students who receive free or reduced school meals as based upon family income. 101 high schools in Texas met the criteria for the study. With a 30% response rate, the researcher decided to compare data of the survey responders to the non-responders in an attempt to test the degree to which the sample was representative of the population. Data on student achievement, attendance, discipline, and completion rate was gathered on the non-responders. This data was used to compare performance of schools that participated to those schools that made up the remainder of the study population in order to determine if the responding schools were statistically representative of the entire population.

The researcher first compared group statistics in the dependent variable categories of academic achievement, attendance, completion rate and discipline. A visual comparison of means, standard deviations and standard error means for these categories, as shown in Table 1, indicated that the responding schools were similar to those remaining schools in the population that did not respond.

However, it was important to run independent sample tests to determine if, indeed, the responding schools were statistically similar to the non-responding schools. The researcher used Confidence Intervals and Levene's Test for Equality of Variances to test the variation of means. Table 2 illustrates the mean for all dependent variables for the Non-Responders fell within the 95% Confidence Interval for the Responder group.

Table 1.—Group Statistics: Responders/Non-Responders

	Sample	Mean	Std. Deviation	Std. Error Mean
TAKSLA TAKS LA	Responders	82.76	8.24	1.53
	Non-Responders	80.56	6.68	.79
TAKSMath TAKS Math	Responders	62.72	15.53	2.88
	Non-Responders	60.69	10.47	1.23
TAKSSci TAKS Sci	Responders	65.83	14.29	2.65
	Non-Responders	62.03	9.87	1.16
TAKSSS TAKS SS	Responders	89.76	5.83	1.08
	Non-Responders	88.42	4.94	.58
TAKSAll TAKS All	Responders	54.52	16.15	3.00
	Non-Responders	51.13	10.27	1.21
Attendance	Responders	95.04	1.07	.20
	Non-Responders	94.67	1.16	.14
Completion	Responders	95.07	3.28	.61
	Non-Responders	93.02	3.42	.40
Discipline	Responders	4.15	2.53	.47
	Non-Responders	4.16	2.16	.25

Table 2.—Confidence Interval of Dependent Variables for Responders and Non-Responders

				95% Confidence Interval	
Dependent Variable	Sample	Mean	Std. Error	Lower Bound	Upper Bound
TAKSLA TAKS LA	0 Responders	82.759	1.329	80.123	85.395
	1 Non-Responders	80.556	.843	78.883	82.229
TAKSMath TAKS Math	0 Responders	62.724	2.251	58.259	67.190
	1 Non-Responders	60.694	1.428	57.860	63.528
TAKSSci TAKS Sci	0 Responders	65.828	2.097	61.666	69.989
	1 Non-Responders	62.028	1.331	59.387	64.669
TAKSSS TAKS SS	0 Responders	89.759	.967	87.841	91.677
	1 Non-Responders	88.417	.613	87.199	89.634
TAKSAll TAKS All	0 Responders	54.517	2.270	50.014	59.021
	1 Non-Responders	51.125	1.441	48.267	53.983
Attendance	0 Responders	95.045	.211	94.625	95.464
	1 Non-Responders	94.672	.134	94.406	94.938
Completion	0 Responders	95.069	.627	93.824	96.314
	1 Non-Responders	93.022	.398	92.232	93.812
Discipline	0 Responders	4.148	.422	3.311	4.985
	1 Non-Responders	4.164	.268	3.633	4.695

The Levene Test for Equality of Variances tests for the heterogeneity of variance between samples (Howell, 2002). This test, as depicted in Table 3, shows that the dependent variables TAKS Language Arts, TAKS Social Studies, Attendance, Completion Rate and Discipline do not significantly differ in variance between Responders and Non-Responders. However, the variables TAKS Math, TAKS Science, and TAKS All show a t-test score significant at the 0.05 level meaning that the variances between the two samples differ statistically.

Table 3.—Levene's Test of Equality of Error Variances(a)

	F	df1	df2	Sig.
TAKSLA TAKS LA	3.199	1	99	.077
TAKSMath TAKS Math	8.316	1	99	.005
TAKSSci TAKS Sci	8.402	1	99	.005
TAKSSS TAKS SS	1.240	1	99	.268
TAKSAll TAKS All	10.520	1	99	.002
Attendance	.193	1	99	.661
Completion	.131	1	99	.718
Discipline	2.167	1	99	.144

In general, it can be assumed that the sample of schools responding to the study are representative of the study population across the state. It is important to establish this assumption when analyzing data gathered in the study for purposes of predicting results across the population.

Descriptive Statistical Analysis

The survey instrument, the Total Learning Environment Assessment (TLEA), was used in a previous study of Texas middle schools. Although the validity of the instrument was determined in this study (O'Neill, 2000), the researcher for this study decided that an analysis of the distribution of scores on the sections of the TLEA would determine if the instrument had performed as it had in earlier studies. Table 4 shows the descriptive statistics for the subsections of the TLEA.

Table 4.—Descriptive Statistics of the Independent Facility Variables (N=30)

	Mean	S.D.	Skewness	Kurtosis
Academic Learning Space	43.73	8.28	.771	.120
Specialized Learning Space	43.77	8.23	.164	-.695
Support Space	27.80	5.66	-.070	-.308
Community/Parent Space	17.63	2.99	.016	-.530
Exterior Environment	24.00	5.70	-.310	-.501
Interior Environment	69.43	12.30	.079	.281
Visual Reinforcements	12.00	2.10	.311	-.733
Educational Adequacy	132.93	22.71	.428	-.610
Environment for Education	102.27	18.39	.131	-.108
Total Score	235.20	40.28	.341	-.664

The TLEA is divided into two sections and seven subsections. The section entitled Educational Adequacy is comprised of the following subsections: Academic Learning Space, Specialized Learning Space, Support Space and Community/Parent Space. The section entitled Environment for Education consists of the following subsections: Exterior Environment, Interior Environment, and Visual Reinforcements. As is displayed in Figures 1 through 7 below, the distributions for responses to each of the subsections of the TLEA is fundamentally normally distributed. A normal distribution is one that is defined as being symmetric about the mean. The normal distribution is important, especially when using inferential statistical analysis (Howell, 2002). Therefore, it is assumed that inferential statistical analysis can be used with the data gathered from the TLEA for this study of Texas high school facilities.

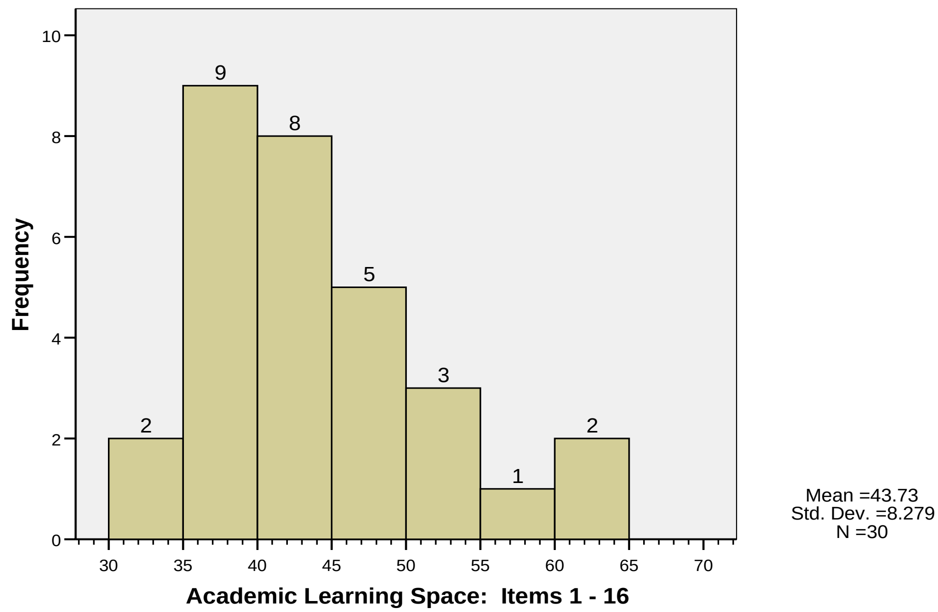


Figure 1. Academic Learning Space: Items 1-16 Frequency Distribution

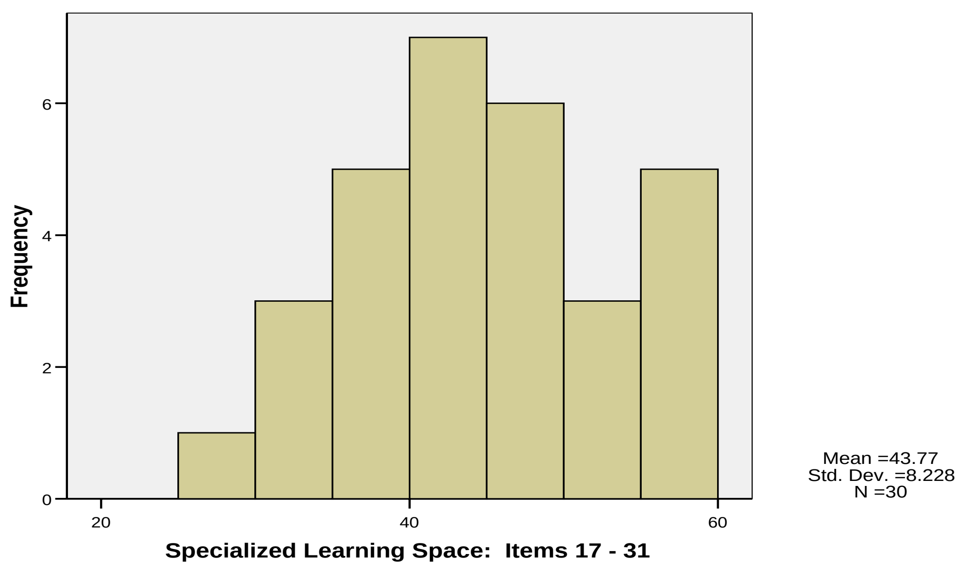


Figure 2. Specialized Learning Space: Items 17-31 Frequency Distribution

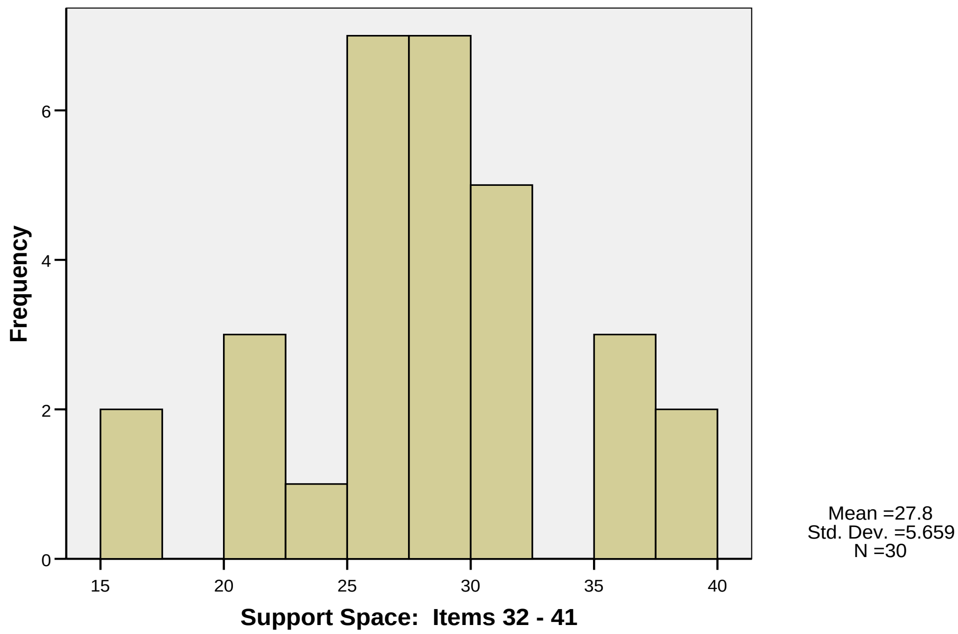


Figure 3. Support Space: Items 32-41 Frequency Distribution

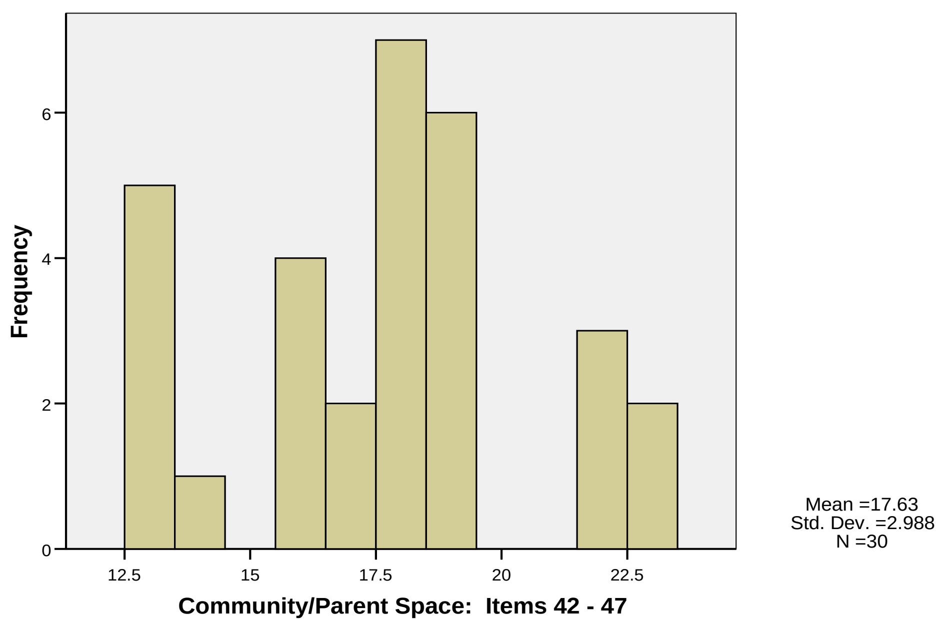


Figure 4. Community/Parent Space: Items 42-47 Frequency Distribution

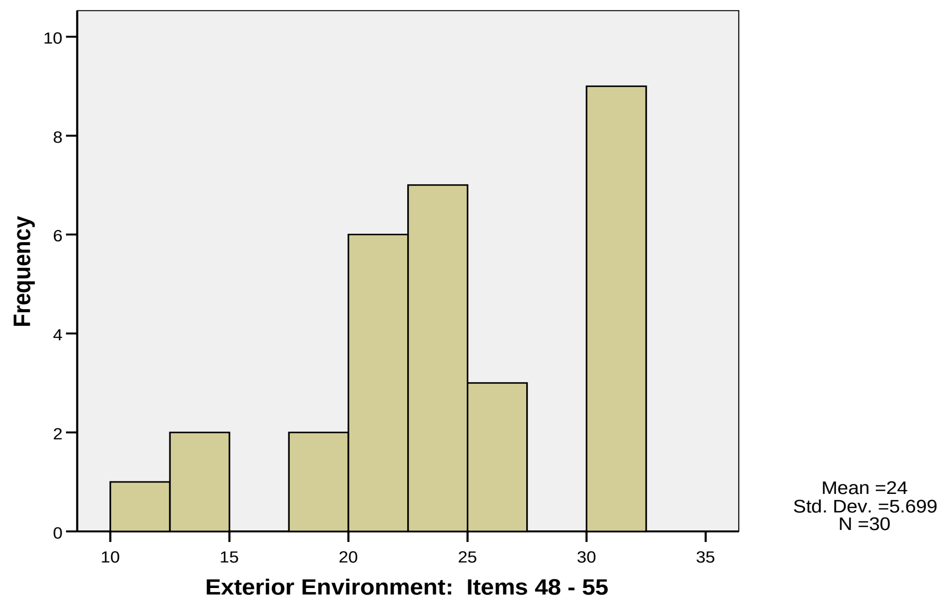


Figure 5. Exterior Environment: Items 48-55 Frequency Distribution

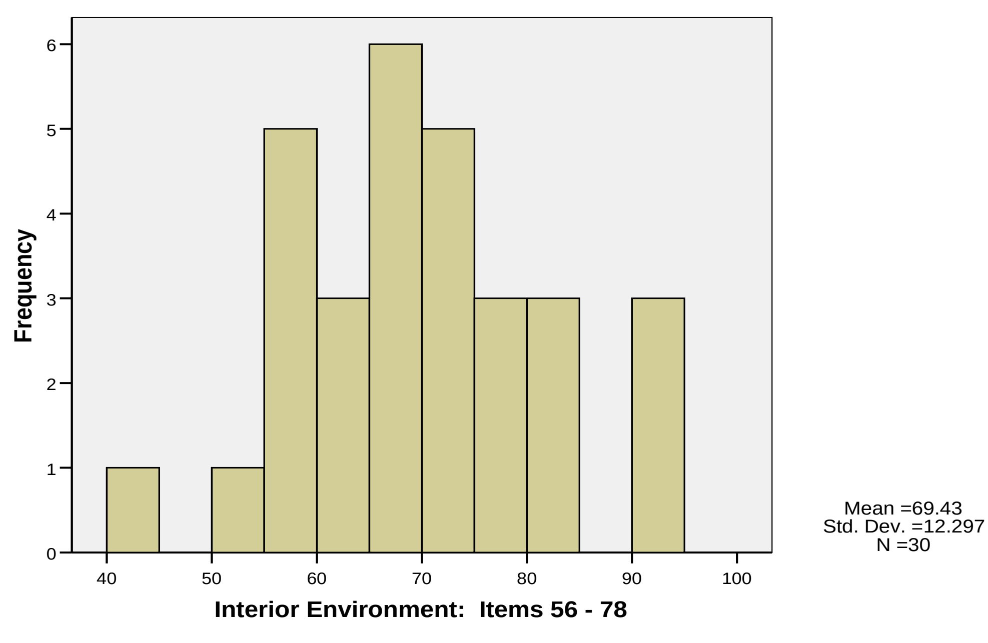


Figure 6. Interior Environment: Items 56-78 Frequency Distribution

Figure 7. Visual Reinforcements: Items 79-82 Frequency Distribution

Inferential Statistical Analysis

Inferential statistics allow us to make predictions across an entire population when given data from a certain sample of that population (Howell, 2002). For this study of Texas high schools, the researcher chose to use inferential statistics to determine the extent to which he could predict outcomes across the entire study population or across all high schools.

Multiple regression analysis provides a statistical equation to assist in determining the accuracy with which one can predict an outcome based upon multiple predictors (Howell, 2002). In the case of this investigation, the researcher sought to determine the ability to predict dependent variables of student achievement, attendance, discipline, completion rate and teacher turnover based upon scores on an assessment of facilities of Texas high schools.

The analysis of the data consisted of running Analysis of Variance (ANOVA) calculations between each dependent variable and the sections or subsections of the TLEA. The data for academic achievement was further divided into scores for TAKS Language Arts, TAKS Math, TAKS Science, TAKS Social Studies and TAKS All. The variables attendance, discipline, completion rate and teacher turnover were represented by a single score for each school.

Research Question #1

Research Question #1 focused on the impact of school facilities upon student academic achievement. Table 5 contains the coefficient scores of the regression model for the comparison of TAKS Language Arts with the two TLEA sections, Educational Adequacy and Environment for Education. Neither of the two independent variable sections shows a significant correlation with the TAKS LA scores, with Educational Adequacy at the 0.145 level and Environment for Education at the 0.113 level. Table 6 displays the ANOVA calculations of this multiple regression model. The two TLEA sections as do not predict TAKS LA at the 0.05 significance level, with a significance score of 0.278 on the multiple regression model.

Table 5.—Coefficients(a) Analysis for TLEA Sections and TAKS Language Arts

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	85.806	8.700		9.863	.000
	Educational Adequacy	.246	.164	.703	1.501	.145
	Environment for Education	-.332	.203	-.767	-1.639	.113

a Dependent Variable: TAKS LA

Table 6.—ANOVA(a) for TLEA Sections and TAKS Language Arts

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	166.537	2	83.269	1.344	.278(b)
	Residual	1672.830	27	61.957		
	Total	1839.367	29			

a Dependent Variable: TAKS LA
b Predictors: (Constant), Environment for Education, Educational Adequacy

The study did not find a significant predictive level for TAKS Math scores based upon the sections of the facility assessment instrument. Table 7 indicates the coefficient scores for TAKS Math and the TLEA Sections. Neither Educational Adequacy nor Environment for Education correlate significantly at the 0.05 level. Table 8 portrays the ANOVA calculation for predictors Educational Adequacy and Environment for Education. This multiple regression model does not show a significant predictive factor, being calculated at the 0.583 level, well outside of the 0.05 level.

Table 7.—Coefficients(a) Analysis for TLEA Sections and TAKS Math

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	76.503	16.164		4.733	.000
	Educational Adequacy	.215	.305	.340	.706	.486
	Environment for Education	-.359	.377	-.459	-.954	.349

a Dependent Variable: TAKS Math

Table 8.—ANOVA(a) for TLEA Sections and TAKS Math

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	235.672	2	117.836	.551	.583(b)
	Residual	5775.295	27	213.900		
	Total	6010.967	29			

a Dependent Variable: TAKS Math
b Predictors: (Constant), Environment for Education, Educational Adequacy

The sections of the TLEA did not prove to be predictive for TAKS Science, as calculated in the multiple regression model used in this study. Table 9 gives the coefficients for each of the predictors as associated with TAKS Science, while Table 10 indicates that the ANOVA for this regression model is not significant at the 0.05 level.

Table 9.—Coefficients(a) Analysis for TLEA Sections and TAKS Science

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	73.858	15.456		4.779	.000
	Educational Adequacy	.214	.292	.357	.735	.469
	Environment for Education	-.283	.360	-.381	-.786	.439

a Dependent Variable: TAKS Sci

Table 10.—ANOVA(a) for TLEA Sections and TAKS Science

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	120.886	2	60.443	.309	.737(b)
	Residual	5280.314	27	195.567		
	Total	5401.200	29			

a Dependent Variable: TAKS Sci
b Predictors: (Constant), Environment for Education, Educational Adequacy

TAKS Social Studies scores did not prove to be able to be predicted using regression models with the TLEA sections. Table 11 indicates that Educational Adequacy and Environment for Education failed to correlate with TAKS Social Studies, with significance levels of 0.368 and 0.359 respectively. While the ANOVA calculations in Table 12 prove that the predictors are not significant at the 0.05 level for TAKS Social Studies, with a significance score of 0.645.

Table 11.—Coefficients(a) Analysis for TLEA Sections and TAKS Social Studies

		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	91.430	6.473		14.125	.000
	Educational Adequacy	.112	.122	.442	.916	.368
	Environment for Education	-.141	.151	-.451	-.933	.359

a Dependent Variable: TAKS SS

Table 12.—ANOVA(a) for TLEA Sections and TAKS Social Studies

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	30.622	2	15.311	.446	.645(b)
	Residual	926.078	27	34.299		
	Total	956.700	29			

a Dependent Variable: TAKS SS
b Predictors: (Constant), Environment for Education, Educational Adequacy

As was indicated with the individual sections of the TAKS academic assessment, the overall TAKS scores (TAKS All) did not prove to be able to be predicted by the independent variables of the TLEA sections Educational Adequacy and Environment for Education. Table 13 indicates the coefficient scores for TAKS All, while Table 14 shows that the ANOVA calculations of this multiple regression model do not prove to be significant at the 0.05 level with a significance score of 0.544. It is interesting to note that on all sections of the TAKS, the scores are negatively correlated with Environment for Education. Although the correlation is not statistically significant, it is curious to note that this seems to vary from the literature showing a direct connection between improved physical environments and student test scores.

Table 13.—Coefficients(a) Analysis for TLEA Sections and TAKS All

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	64.250	17.248		3.725	.001
	Educational Adequacy	.313	.325	.462	.963	.344
	Environment for Education	-.445	.402	-.531	-1.107	.278

a Dependent Variable: TAKS All

Table 14.—ANOVA(a) for TLEA Sections and TAKS All

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	303.338	2	151.669	.623	.544(b)
	Residual	6575.862	27	243.550		
	Total	6879.200	29			

a Dependent Variable: TAKS All
b Predictors: (Constant), Environment for Education, Educational Adequacy

Research Question #2

Research Question #2 deals with the impact of school facilities upon student attendance. Table 15 provides the coefficient scores for the seven TLEA subsections with attendance rates for the participant schools. As with the TAKS scores, the TLEA did not prove to be significant predictors on an individual subsection level or within a multiple regression model, as shown in Table 16. The ANOVA significance score of 0.291 was not significant at the 0.05 level.

Table 15.—Coefficients(a) Analysis for TLEA Subsections and Attendance

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	91.578	1.689		54.219	.000
	Academic Learning Space	-.005	.060	-.031	-.081	.936
	Specialized Learning Space	.103	.062	.655	1.667	.110
	Support Space	-.074	.084	-.326	-.883	.387
	Community/Parent Space	.080	.108	.185	.742	.466
	Exterior Environment	.007	.094	.032	.077	.939
	Interior Environment	-.036	.047	-.339	-.759	.456
	Visual Reinforcements	.162	.154	.264	1.054	.303

a Dependent Variable: Attendance

Table 16.—ANOVA(a) for TLEA Subsections and Attendance

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	14.202	7	2.029	1.311	.291(b)
	Residual	34.052	22	1.548		
	Total	48.255	29			

a Dependent Variable: Attendance
b Predictors: (Constant), Visual Reinforcements, Community/Parent Space, Support Space, Academic Learning Space, Specialized Learning Space, Exterior Environment, Interior Environment

Research Question #3

The relationship between student discipline and school facilities is the focus of Research Question #3. Table 17 and Table 18 provide the statistical analysis of the possible relationship between student discipline and the seven subsections of the TLEA instrument. The coefficient score for Community/Parent Space in Table 17 and ANOVA calculations in Table 18 prove to show a significant relationship at the 0.05 level. However, it should be noted that one concern with the discipline data is the compactness of the scores provided for participant schools, only ranging from 0.7 to 8.8 with a standard deviation of 2.54.

It should also be noted that student discipline was negatively correlated with four of the TLEA subsections: Specialized Learning Space, Support Space, Community/Parent Space and Exterior Environment. This is incongruent with earlier studies utilizing the TLEA and with the majority of the literature on this topic.

Table 17.—Coefficients(a) Analysis for TLEA Subsections and Discipline

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	10.064	2.692		3.739	.001
	Academic Learning Space	.184	.095	.599	1.929	.067
	Specialized Learning Space	-.019	.098	-.061	-.193	.849
	Support Space	-.243	.134	-.542	-1.810	.084
	Community/Parent Space	-.482	.171	-.568	-2.814	.010
	Exterior Environment	-.100	.149	-.225	-.670	.510
	Interior Environment	.025	.075	.119	.330	.745
	Visual Reinforcements	.234	.245	.194	.955	.350

a Dependent Variable: Discipline

Table 18.—ANOVA(a) for TLEA Subsections and Discipline

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	100.057	7	14.294	3.637	.009(b)
	Residual	86.471	22	3.930		
	Total	186.528	29			

a Dependent Variable: Discipline
b Predictors: (Constant), Visual Reinforcements, Community/Parent Space, Support Space, Academic Learning Space, Specialized Learning Space, Exterior Environment, Interior Environment

Research Question #4

Research Question #4 guided the study of the relationship between school facilities and student completion rate. In essence, the student completion rate for a school is the inverse of the dropout rate. Therefore, it was hypothesized that there would be a positive, or direct, correlation between school facility scores and completion rates. Table 19 provides the coefficient scores for the TLEA subsections and the participant schools' completion rates. None of the subsections proved to correlate at the 0.05 significance level with completion rates. Table 20 depicts the ANOVA scores for this regression model and indicates a significance level of 0.338, outside of the accepted 0.05 range.

Table 19.—Coefficients(a) Analysis for TLEA Subsections and Completion Rate

		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	T	Sig.
1	(Constant)	91.631	4.611		19.874	.000
	Academic Learning Space	.051	.163	.122	.315	.756
	Specialized Learning Space	.340	.168	.804	2.022	.056
	Support Space	.001	.230	.001	.003	.997
	Community/Parent Space	.167	.293	.144	.570	.574
	Exterior Environment	-.057	.256	-.094	-.224	.824
	Interior Environment	-.241	.128	-.852	-1.885	.073
	Visual Reinforcements	.093	.419	.056	.222	.826

a Dependent Variable: Completion

Table 20.—ANOVA(a) for TLEA Subsections and Completion Rate

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	97.830	7	13.976	1.212	.338(b)
	Residual	253.724	22	11.533		
	Total	351.554	29			

a Dependent Variable: Completion
b Predictors: (Constant), Visual Reinforcements, Community/Parent Space, Support Space, Academic Learning Space, Specialized Learning Space, Exterior Environment, Interior Environment

When further multiple regression models were calculated, it was determined that the subsections of Interior Environment and Specialized Learning Space could be used to predict completion rate (Table 21). However, it should be noted that the correlation between completion rate and Interior Environment were negatively, or indirectly, correlated as shown in Table 22.

Table 21.—ANOVA(a) for TLEA Subsections Interior Environment and Specialized Learning Space and Completion Rate

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	92.500	2	46.250	4.820	.016(b)
	Residual	259.054	27	9.595		
	Total	351.554	29			

a Dependent Variable: Completion
b Predictors: (Constant), Interior Environment, Specialized Learning Space

Table 22.—Coefficients(a) Analysis for TLEA Subsections Interior Environment and Specialized Learning Space and Completion Rate

		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	93.359	3.367		27.728	.000
	Specialized Learning Space	.380	.123	.898	3.096	.005
	Interior Environment	-.220	.082	-.777	-2.678	.012

a Dependent Variable: Completion

Research Question #5

The final research question of this study investigated the relationship between school facilities and teacher turnover rate. When multiple regression models were run using all seven subsections of the TLEA with the three-year average teacher turnover rates for the participant schools, a significant predictive power could not be determined.

With the exception of Support Space, the significance scores on Table 23 and from the ANOVA calculations in Table 24 show no significance at the 0.05 level.

As with completion rate, the study did find when a specific regression model was run using two specific TLEA subsections (Specialized Learning Space and Support Space) that a significant predictive power was present. Table 25 shows the ANOVA calculations at a significance level of 0.010, which falls within the approved significance level of 0.05.

Table 23.—Coefficients(a) Analysis for TLEA Subsections and Teacher Turnover Rate

		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	12.584	9.872		1.275	.216
	Academic Learning Space	-.180	.349	-.190	-.516	.611
	Specialized Learning Space	-.500	.360	-.523	-1.388	.179
	Support Space	1.173	.493	.845	2.382	.026
	Community/Parent Space	.313	.628	.119	.498	.624
	Exterior Environment	.486	.548	.352	.887	.385
	Interior Environment	-.233	.274	-.364	-.850	.405
	Visual Reinforcements	.271	.898	.072	.302	.766

a Dependent Variable: AveTurnover

Table 24.—ANOVA(a) for TLEA Subsections and Teacher Turnover Rate

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	629.237	7	89.891	1.700	.161(b)
	Residual	1163.338	22	52.879		
	Total	1792.575	29			

a Dependent Variable: AveTurnover
b Predictors: (Constant), Visual Reinforcements, Community/Parent Space, Support Space, Academic Learning Space, Specialized Learning Space, Exterior Environment, Interior Environment

Table 25.—ANOVA(a) for TLEA Subsections Specialized Learning Space and Support Space and Teacher Turnover Rate

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	522.559	2	261.280	5.555	.010(b)
	Residual	1270.016	27	47.038		
	Total	1792.575	29			

a Dependent Variable: AveTurnover
b Predictors: (Constant), Specialized Learning Space, Support Space

Again, it should be noted that Support Space correlated directly with teacher turnover rate, which is not indicative of the literature findings.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

This study was conducted for the purpose of determining the possible impact that school facilities has upon student academic achievement, attendance , behavior, completion rate and teacher turnover rate. The study population consisted of Texas public high schools with enrollments between 1,000 and 2,000 students with economically disadvantaged enrollment between zero and 40%. An analysis of related literature led to the selection of the school facility criteria for this study. An aging of school facilities across the United States had led to heightened interest in how facilities can be maintained, renovated or rebuilt in a way that addresses student outcomes (Colgan, 2003a). With limited resources, school districts have been faced with a rising price tag for addressing facility needs (General Accounting Office, 1995).

Nationally, focus has continued to strengthen on raising student achievement across all populations and socioeconomic groups (No Child Left Behind Act, 2001). This, coupled with a growing body of research linking physical school environment with student achievement, leads to the concern over decaying American schools reaching an urgent status (Crampton et al., 2001). Studies, such as those conducted in Virginia by Cash (1993) show a distinct correlation between effective school facilities and student achievement when factors such as socioeconomic status are controlled. Similarly, teachers need space to interact professionally in order to provide meaningful service to their students and coworkers (Hawkins & Overbaugh, 1988). And the school facility also plays an important role in welcoming parents and community members into the educational process (Hawkins & Overbaugh, 1988).

With this renewed emphasis on school outcomes such as academic achievement, student attendance, discipline, dropout rates and teacher turnover rates, school officials are searching for resources to improve public education. The construction, renovation and maintenance of school buildings represent a large percentage of annual school budgets. Both school administrators and designers must continue to search for facility characteristics that can most efficiently and effectively promote student achievement and educator professionalism. By assessing a school's facility condition and comparing it to performance outcomes, researchers may be able to develop the ability to identify the components of school facilities that can best predict student and staff performance.

This study utilized the Total Learning Environment Assessment (TLEA) to gather quantitative data on the condition of the facilities for the schools participating in the research. This instrument was developed for a prior study of Texas middle schools (O'Neill, 2000). The dependent variable data for student achievement, attendance, discipline, completion rate and teacher turnover rate was gathered from the Texas Education Agency and their Public Education Information Management System (PEIMS).

The study was begun in the 2002-03 school year. For that purpose, the 2002-03 PEIMS report was used for comparison data to the school facility reports. The teacher turnover rate was calculated on a three-year average culminating in the 2002-03 year. School administrators completed the TLEA in order to gather facility scores for each participating school. The administrators were sent an email inviting them to participate on behalf of their school by visiting a web site on the Texas A&M University College of Education web system containing an online version of the TLEA. A follow-up email was sent to those schools in the population who had not responded to the initial invitation. A third follow-up email and phone calls companied with the previous correspondence yielded 30 participant schools from the population of 101 campuses. While the response rate was approximately 30%, it should be noted that the survey procedures are aligned with those procedures prescribed as accepted in educational research (Gall et al., 1996). PEIMS data on the non-responding schools was compared to those who responded to the instrument. It was statistically determined that results from the sample could be generalized across the study population.

Inferential statistical analysis was conducted across each of the five research questions. Each of the two sections and seven subsections of the TLEA was correlated to the PEIMS data for all participant schools. Multiple regression models were identified to be the best method for measuring the effect of multiple predictors upon dependent variables (Howell, 2002). ANOVA calculations were provided for each section of the TAKS student assessment as well as for student attendance, discipline and completion rate. Analysis of variance was also calculated for the dependent variable teacher turnover rate.

Conclusions

The analysis of the research data led to limited statistical significant findings. The search for trends and predictors yielded few conclusions that were quantitatively significant. However, the study revealed areas of interest for each of the five research questions that should lead the researcher and others to develop future studies in order to explore those areas found in the wealth of literature on the topic. The following conclusions are presented for each respective research question.

Research Question #1

To what extent do school facilities impact student achievement as reported by the Academic Excellence Indicator System (AEIS) at selected Texas high schools?

Multiple regression models for student achievement did not yield any analysis of variance at the significance level of 0.05. ANOVA calculations were developed for the Texas Assessment of Knowledge and Skills (TAKS) scores along with the facility variables contained within the two sections and seven subsections of the TLEA. Regression models were run for Language Arts, Math, Science, Social Studies and composite scores on the TAKS test. These scores represented the passing percent of the student population for each school.

Although the correlations were not significant, a positive correlation was calculated for each of the TAKS areas with the TLEA section Educational Adequacy. This is congruent with the literature, where findings determined that facility adequacy was directly related to student performance (O’Neill, 2000). Educational Adequacy on the TLEA instrument deals with topics of size, capacity, support space and infrastructure.

Interestingly, this study yielded negative correlations between the TLEA section Environment for Education and TAKS scores. This is in conflict with the majority of the literature on the topic. Many studies have shown that environmental topics such as lighting, color and indoor air quality positively correlate with increase academic performance (Chan, 1996; Hale 2002; Rydeen, 2003). One possible explanation for these results may be the diminutive size of the sample or from the lack of range between school TAKS scores.

While the findings for Research Question #1 were not statistically significant, the data in regards to facility adequacy did trend similarly to data from previous studies (O'Neill, 2000). Therefore, the relationship between school facilities and student achievement may very well be explored by similar studies focused on larger samples or on more specific, individual student data.

Research Question #2

To what extent do school facilities impact student attendance as reported by the Academic Excellence Indicator System (AEIS) at selected Texas high schools?

As is exhibited in the results provided in Chapter IV, a regression model of the TLEA seven subsections did not yield a statistically significant predictive power for student attendance. The ANOVA calculation yielded a significance level of only 0.291, which did not fall within the acceptable 0.05 level. The review of the literature found that student attendance can often be impacted by various components of school facilities (Bracey, 2001; Lyons, 2002; Rouk, 1997). The results of this study may have varied from prior studies due to the small sample size and the compactness of the data associated with campus attendance rates. Attendance rates for the participant schools only varied from 90.5 to 96.8 percent, with a standard deviation of 1.29. Therefore, this compressed data made it difficult to differentiate between schools based upon attendance percentages.

Research Question #3

To what extent do school facilities impact student behavior as reported by the Academic Excellence Indicator System (AEIS) at selected Texas high schools?

Unlike the dependent variable of attendance, the TLEA sections did portray statistically significant predictors of student behavior, or discipline. When an ANOVA was calculated on a regression model using the seven subsections of the TLEA, the significance level was 0.009, which fell well within the acceptable level. This is similar to findings from previous studies that identified factors of school facilities that may impact student discipline. These factors included temperature, lighting, adequate space and aesthetic features (Earthman & Lemasters, 1996; Lackney, 1994, O'Neill, 2000).

The discipline data for the participant schools was very compact, much like the attendance data. This compactness makes it difficult to draw conclusive statistical predictions based upon this data. The number of disciplinary alternative placement referrals for the participating schools ranged from 0.7 to 8.8 with a standard deviation of 2.54. Again, the compactness of data made it difficult to differentiate between participating schools and drawing conclusions across the population.

Research Question #4

To what extent do school facilities impact student completion rate as reported by the Academic Excellence Indicator System (AEIS) at selected Texas high schools?

When regression models were calculated for all seven subsections of the TLEA, no significant relationship was found between the TLEA subsections and the dependent variable of student completion rate. This varied from prior studies where school facility factors were linked to impacting high school dropout rates, which are the reciprocal of completion rates (Howley, 1994). Once again, this statistical analysis may very well have been complicated by the compacted nature of the data on student completion rate. The completion rates for participant schools varied from 84.4 to 99.5 percent with merely a 3.48 standard deviation.

However, a regression model using two specific subsections of the TLEA did calculate an ANOVA of statistical significance with student completion rate. The subsections Interior Environment and Specialized Learning Space held a significance level of 0.016 with student completion rate. It should be noted that Specialized Learning Space scores actually were negatively correlated with completion rate. Again, this varies from the data found in the review of the literature.

Research Question #5

To what extent do school facilities impact teacher turnover rate as reported by the Public Education Information Management System (PEIMS) at selected Texas high schools?

A multiple regression model of all seven subsections of the TLEA did not prove statistically significant in relation to teacher turnover rate. The ANOVA calculation for this model yielded only a significance score of 0.161. This is not congruent with the review of literature, which noted that working conditions, and specifically physical working conditions, contributed greatly to teacher job satisfaction or dissatisfaction (Blair, 2003; Keller, 2003).

When a regression model was run with specific TLEA subsections, a significant relationship as found to teacher turnover. The subsections Specialized Learning Space and Support Space were related to teacher turnover at a significance level of 0.010. However, Support Space was directly correlated to turnover rate, which varies from most research. It could be surmised that teachers at schools with higher Support Spaces determined that more emphasis should be placed upon academic spaces and, therefore, were less satisfied with their physical working conditions.

Recommendations

The researcher has developed several conclusions based upon the data collection and analysis of this study. The following recommendations are based upon the results of this research and will hopefully guide other investigations as data is gathered and analyzed on this very important topic.

Applying Current Findings

The areas of student behavior (discipline) and teacher turnover rate were the two dependent variables that proved to have statistically significant relationships to school facility conditions as a result of this study. For that reason, school leaders should be guided to further study these relationships in way that will provide direction in the design, construction and maintenance of school facilities.

According to the research data supplied in Table 17 in Chapter IV of this study, student behavior appears most directly correlated with academic learning spaces, and indirectly correlated with support spaces. This may lead designers to give greater emphasis on academic spaces such as classrooms, labs and libraries and less to specialized spaces such as multi-use rooms and gymnasiums. This finding parallels previous determinations of the role that physical surroundings play in affecting student behavior (Maiden & Foreman, 1998).

As for impacting student completion rate, the data indicates that more emphasis should be placed upon the interior environment and specialized learning space as evidenced in Table 21 of the previous chapter. Specialized spaces offering technological training and vocational preparation have been noted in previous research to serve as factors motivating students to remain enrolled in secondary schools (Wright, 1997).

Teacher turnover rate is indicated by the data revealed in this study to be a variable that may be significantly related to school facility conditions (see Tables 23 and 25, Chapter V). Specifically, it appears that when considering support spaces, one can predict a significant impact upon teacher turnover rate, as is echoed in the literature through a 1994 study of teacher perceptions of workspace (Moore & Lackney). Administrators and designers may consider more emphasis on learning spaces and deemphasizing support spaces for administration in attempts to improve working conditions for teachers.

Recommendations for Further Study and Improving Current Methodology

Due to a limited significant relationship between education facilities and school outcomes revealed by this study, the researcher recommends that further investigations of this topic be from a qualitative approach model. A qualitative study could provide information that is either inaccessible in a quantitative mode or useful in deciphering data that is closely clumped together, as were the data for attendance, discipline and turnover rates. Educators would be able to provide descriptions of how the physical environment has impacted their performance and that of their students.

Quantitative studies similar to this research should consider expanding the study population to gather larger study samples. This may assist in providing more statistically significant data. It would also provide practitioners with more readily applied conclusions across similar populations.

Future studies would provide greater impact by focusing on a specific school or set of schools with a deeper investigation of student performance data. For instance, a researcher may wish to study two similar classes of students who are provided similar instruction by a common instructor, but in differing facilities. This approach is possible in schools that contain both old and new facilities on the same campus.

This study was controlled for factors of school size and socioeconomic status of students. Future studies could research across schools of various sizes and degrees of economically disadvantages students.

REFERENCES

Agron, J. (1998). Court rules. *American School and University, 70*(10), 20-25.

Agron, J. (2003). Absence of resources: American school and university 32nd annual M & O cost study. *American School and University, 75*(8), 26-35.

Arora, C. (2001). Artful instruction. *School Construction News, 4*(1), 27-28.

Becker, F. D. (1981). *Workspace: Creating environments in organizations.* New York: Praeger Publishers.

Bell, D. L. (2003). A team approach to building a new school. *School Administrator, 60*(4), 32.

Bernheim, A. (2003). How green is green? Developing a process for determining sustainability when planning campuses and academic buildings. *Planning for Higher Education*, *31*(3), 99-110.

Bhimani, K., & Pantaleo, A. (2001). Getting a grip on facility condition assessments. *College Planning and Management, 4*(11), 31-33.

Biemiller, L. (2002). Preservation decisions vex campus planners. *Chronicle of Higher Education*, *48*(43), 24.

Birr, D. (2000). Meeting the challenge: Providing high-quality school environments through energy performance contracting. *School Business Affairs, 66*(12), 34-36.

Black, S. (2001). Morale matters: When teachers feel good about their work, research shows, student achievement rises. *American School Board Journal, 188*(1), 40-43.

Black, S. (2002). The roots of vandalism. *American School Board Journal*, *189*(7), 30-32.

Blair, J. (2003). With support, teachers would stay put, report finds. *Education Week*, *22*(21), 5.

Blair, L. (1998). Constructing knowledge by design. *Southwest Educational Development Laboratory News*, *10*(4), 3-8.

Blair, L., & Pollard, J. (1998). Corridors to change. *Southwest Educational Development Laboratory News*, *10*(4), 10-15.

Boles, K., & Troen, V. (2000). Why new teachers quit. *Teacher Magazine, 11*(7), 59.

Bolin, R. (2003). It's in the green. *American School and University, 76*(1), 42-47.

Bowers, J. H., & Burkett, C. W. (1989). Effects of physical and school environment on students and faculty. *CEFPI's Educational Facility Planner*, *27*(1), 28-29.

Bracey, G. W. (2001). Small schools, great strides. *Phi Delta Kappan*, *82*(5), 413-14.

Brady, T. (2002). Facility planning for educational change: The perfect storm. *Facilities Manager, 18*(3), 33-35.

Bray, L., & Kuhnen, S. (2002). It's a draw. *American School and University*, *75*(3), 357-359.

Brooks, J. G., & Brooks, M. G. (1993). *In search of understanding: The case for constructivist classrooms*. Alexandria, VA: Association of Supervision and Curriculum Development.

Bryk, A. S. (1994, Fall). Issues in restructuring schools—commentary. Madison, WI: University of Wisconsin School of Education.

Buffington, B., & Baxter, J. (2001). Thoughtful repositioning. *American School and University*, *74*(3), 367-69.

Bushweller, K. (1998). Ergonomically correct classrooms: Consider students developmental needs when furnishing your schools. *Learning By Design, 7*, 18-20.

Caine, R. N., & Caine, G. (1990). Understanding a brain-based approach to learning and teaching. *Educational Leadership*, *48*(2), 66-70.

Carey, K. D. (2001). Hearing the public voice. *Learning By Design, 10*, 10-13.

Cash, C. S. (1993). *Building condition and student achievement and behavior.* Unpublished doctoral dissertation, Virginia Polytechnic Institute and State University, Blacksburg, VA.

Centifonti, G., & Gerber, D. (1997). A report on asbestos management. *School Business Affairs*, *63*(10), 53-56.

Chan, T. C. (1996). *Environmental impact on student learning*. Valdosta, GA: Valdosta State College, School of Education. (ERIC Document Reproduction Service No. ED 406 722)

Chan, T. C., & Petrie, G. (1998). The brain learns better in well designed school environments. *Association of Supervision and Curriculum Development: Classroom Leadership Online*, *2*(3), 1.

Christopher, G. (1991). Effect of architecture on education. *Educational Facility Planner, 29*(1), 11-15.

Clanton, N. (1999). Lighting the school of the future. *School Planning and Management, 38*(12), 33-35.

Clark, C. (2001). Texas state support for school facilities, 1971 to 2001. *Journal of Education Finance, 27*(2), 683-700.

Colgan, C. (2003a). Building boom. *American School Board Journal, 190*(6), 26-29.

Colgan, C. (2003b). Is mold the new asbestos? *American School Board Journal, 190*(10), 14-18.

Cook, G. (2002). What works and why: The Learning By Design review panel explores trends and challenges. *Learning By Design, 11*, 6-7.

Corcoran, T. B. (1988). *Working in urban schools.* Washington, DC: Institute for Educational Leadership.

Crampton, F. E., & Thompson, D. C. (2002). The condition of America's schools: A national disgrace. *School Business Affairs, 68*(11), 15-19.

Crampton, F. E., Thompson, D. C., & Hagey, J. M. (2001). Creating and sustaining school capacity in the twenty-first century: Funding a physical environment conducive to student learning. *Journal of Education Finance, 27*, 633-652.

Cutler, W. W., III. (1989). Cathedral of culture: The schoolhouse in American educational thought and practice since 1820. *History of Education Quarterly, 29*(1), 1-40.

Cutshall, S. (2003). Is smaller better? When it comes to schools, size does matter. *Techniques: Connecting Education and Careers, 78*(3), 22-25.

Daniels, S. H. (2003). School construction: Technology is changing the way kids learn...and the classrooms in which they do it. *Architectural Record, 191*(3), 159-163.

Day, C. W. (2001). From the reviewers: Rethinking school design. *Learning By Design, 10,* 4-6.

Day, W. C., & Spoor, D. (1998). Planning for technology: An administrator's guide to the next century. *American School and University, 70*(6), 31-43.

De Patta, J. (2002). Air fare: Q & A with Mary Smith. *School Construction News*, *5*(5), 19-20.

De Patta, J. (2003). Security evolution. *School Construction News, 6*(5), 16-17.

Deal, T. E., & Peterson, K. D. (1999). *Shaping school culture: The heart of leadership.* San Francisco: Jossey-Bass.

DeVolder, C. (2002). The big picture. *American School and University, 75*(3), 320-323.

Dewees, S. (1999). *Improving rural school facilities for teaching and learning.* Charleston WV: ERIC Clearinghouse on Rural Education and Small Schools. (ERIC Document Reproduction Service No. ED 438 153)

Dolan, T. G. (2001). School as the heart of the community. *School Planning and Management*, *40*(5), 26-29.

Earthman, G. I., & Lemasters, L. (1996). *Review of research on the relationship between school buildings, student achievement, and student behavior*. Paper presented at the Annual Meeting of the Council of Educational Facility Planners, International, Tarpon Springs, FL. (ERIC Document Reproduction No. ED 416 666)

Earthman, G. I., Cash, C. S., & Van Berkum, D. (1996). Student achievement and behavior and school building condition. *The Journal of School Business Management, 8*(3), 26-27.

English, C. (2003). Safe school survey leads to system upgrades. *School Planning and Management, 42*(11), 16-21.

Erlichson, B. A. (2001). New schools for a new millennium: Court-mandated school facilities construction in New Jersey. *Journal of Education Finance, 27*(2), 663-682.

Failla, V. A., & Birk, T. A. (1999). Planning for power. *American School and University, 71*(6), 26-28.

Fickes, M. (2003a). Learning to share. *School Planning and Management, 42*(11), 29-30.

Fickes, M. (2003b). Teacher connections. *School Planning and Management, 42*(10), 26-27.

Fielding, R. (2000). Lighting the learning environment. *School Construction News, 3*(4), 20-21.

Fisher, D., & Grady, N. (1998). Teachers' images of their schools and perceptions of their work environments. *School Effectiveness and School Improvement, 9*(3), 334-348.

Fiske, E. B. (1991). *Smart schools, smart kids: Why do some schools work?* New York: Simon & Schuster.

Franklin, B., & Glascock, C. (1996, October). *The relationship between grade configuration and student performance in rural schools*. Paper presented to the National Rural Education Association conference, San Antonio, TX.

Friedman, A., Zimring, C., & Zube, E. (1978). *Environmental design evaluation*. New York: Plenum.

Gall, M. D., Borg, W. R., & Gall, J. P. (1996). *Education research: An introduction* (6th ed.). New York: Longman.

Geiger, P. E. (2001a). Arizona takes on school construction and renovation. *School Business Affairs, 67*(8), 76-79.

Geiger, P. E. (2001b). School construction: Changing to meet the new trends in education. *School Business Affairs, 67*(12), 8-11.

Geiger, P. E. (2002). Deferred school maintenance creates national crisis. *School Business Affairs*, *68*(1), 43.

Geiger, P. E. (2003). Natomas superintendent seizes opportunity thinks outside the box. *School Planning and Management, 42*(6), 56-59.

Gewertz, C. (2001). The breakup: Suburbs try smaller high schools. *Education Week, 20*(33), 1-16.

Glickman, C. D. (Ed.). (2004). Letters to the next president. New York: Teachers College Press.

Government Accountability Office. *No child left behind act*. (2001). Washington, DC: Author.

Graves, B. E. (1993). *School ways: The planning and design of America's schools.* New York: McGraw-Hill.

Gregory, T. B., & Smith, G. R. (1987). *High schools as communities: The small school reconsidered.* Bloomington, IN: Phi Delta Kappa Educational Foundation.

Guarneiri, M. A. (2003). Indoor air quality in schools: Clean air is good business. *School Business Affairs, 69*(6), 26-30.

Hale, O. (2002). Improving performance. *American School and University*, *75*(2), 32-35.

Hammond, G. S. (2003). Can what is old be new again? *School Planning and Management, 42*(6), 60-63.

Hathaway, W. E. (1988). Educational facilities: Neutral with respect to learning and human performance. *CEFP Journal, 26*(4), 8-12.

Hawkins, H. L., & Lilley, H. E. (1998). *Guide for school facility appraisal.* Phoenix, AZ: Council of Educational Facility Planners, International.

Hawkins, H. L., & Overbaugh, B. L. (1988). The interface between facilities and learning. *Educational Facilities Planner*, *26*(4), 4-7.

Henry, C. (2000). Planning without anxiety. *School Planning and Management, 39*(10), 28-30.

Heschong Mahone Group. 1999. *Daylighting in schools: An investigation into the relationship between daylighting and human performance*. Retrieved December 29, 2003, from http://www.pge.com/pec/daylight/valid.html.

Hill, F. (1996). Learning modalities: Facility design impacts on performance. *Educational Facility Planner, 33*(4), 8-9.

Howell, D. (2002). *Statistical methods for psychology*. Pacific Grove, CA: Duxbury.

Howley, C. (1994). *The academic effectiveness of small-scale schooling*. Charleston, WV: ERIC Clearinghouse on Rural Education and Small Schools. (ERIC Document Reproduction Service No. ED 372 897)

Howley, C., & Bickel, R. (2002). The influence of scale. *American School Board Journal, 189*(3), 28-30.

Irmsher, K. (1997). *School size.* Eugene, OR: ERIC Clearinghouse on Educational Management. (ERIC Document Reproduction Service No. ED 414 615)

Jacobson, L. (2003). Disaster drills emphasize plans to 'shelter' pupils at school. *Education Week, 22*(33), 6.

Jehlen, A. (1999). *What a mess! Too many of our schools are falling apart or overcrowded—so when is congress going to do something about it?* Retrieved December 6, 2003, from http://www.aft.org//publications/american_teacher.

Jenkins, J. K. (2002). Noncurricular use of school facilities: Legal issues to consider. *School Business Affairs, 68*(11), 44-47.

Jensen, E. (1998). *Teaching with the brain in mind.* Alexandria, VA: Association of Supervision and Curriculum Development.

Johnston, R. C. (2001). Urban renewal. *Education Week, 20*(40), 32-35.

Kacan, G. M., & Bolling, R. E. (2002). A call for preservation. *American School and University, 75*(3), 338-340.

Keck, D. (1994). Future school facility design: Clues from emerging definitions of teaching and learning plus new thoughts about learning organizations. *Educational Facility Planner, 32*(3), 2.

Keller, B. (2003). Question of teacher turnover sparks research interest. *Education Week, 22*(33), 8.

Kennedy, M. (1999). Bursting through: How schools are meeting the enrollment explosion. *American School and University, 71*(9), 18-26.

Kennedy, M. (2000). Aging gracefully. *American School and University, 72*(9), 20-26.

Kennedy, M. (2001a). Building on community. *American School and University, 73*(10), 14-18.

Kennedy, M. (2001b). Thinking small. *American School and University, 74*(1), 16-22.

Kennedy, M. (2003a). Comfort zone. *American School and University, 75*(8), 20-25.

Kennedy, M. (2003b). History in the making. *American School and University, 75*(10), 20-34.

Kennedy, M. (2003c). Paying for protection. *American School and University, 76*(2), 20-26.

Kennedy, M. (2003d). Picking the right pieces. *American School and University*, *75*(9), 50-55.

Kennedy, M. (2003e). Staying vigilant. *American School and University*, *76*(1), 8-10.

Kerr, J. (2003, September 5). Civil engineers issue infrastructure alert: Say roads, bridges and schools in bad shape. *Houston Chronicle*, p. A6.

Killeen, J., Evans, G., & Danko, S. (2003). The role of permanent student artwork in students' sense of ownership in an elementary school. *Environment and Behavior, 35*(2), 250-263.

King, J., & Marans, R. W. (1979). *The physical environment and learning process* (Report No. 3290ST2). Ann Arbor, MI: University of Michigan Architectural Research Laboratory.

Kosar, J., & Ahmed, F. (2000). Building security into schools. *School Administrator, 57*(2), 24-31.

Koziol, J. (2003). Ins and outs of campus access. *American School and University, 76*(1), 48-52.

Kromkowski, S. (2003). Welcoming and secure. *American School and University, 76*(1), SS4-SS6.

Krysiak, B. H. (1999). Keeping up with what you have. *School Business Affairs, 65*(7), 49-53.

Krysiak, B. H., & DiBella, C. M. (2002). Why small schools now? *School Business Affairs, 68*(7), 25-29.

Kuller, R., & Lindsten, C. 1992. Health and behavior of children in classrooms with and without windows. *Journal of Environmental Psychology, 12*, 305-317.

Lackney, J. A. (1994). *Educational facilities: The impact and role of the physical environment of the school on teaching, learning and educational outcomes*. Milwaukee, WI: University of Wisconsin-Milwaukee, Architecture and Urban Planning Research.

Lackney, J. A. (1998). *12 design principles based on brain-based learning research.* Retrieved January 18, 2004, from http://www.designshare.com/Research/BrainBasedLearn98.htm.

Lackney, J. A. (1999). *Assessing school facilities for learning/assessing the impact of the physical environment on the educational process: Integrating theoretical issues with practical concerns*. Starkville, MS: Mississippi State University, Educational Design Institute. (ERIC Document Reproduction Service No. ED 441 330)

Leary, K. (2003). The educational advantages of green: Saving, teaching, learning. *Educational Facility Planner, 38*(2), 35-36.

Lee, V., & Burkam, D. (2001, January). *Dropping out of high school: The role of school organization and structure.* Paper presented at Harvard Graduate School of Education Dropouts in America Conference, Cambridge, MA.

Lehmuller, P., & Switzer, A. (2002). September 11: An elementary school at ground zero. *Principal, 81*(4), 52-54.

Lewis, M. (2001). *Facility conditions and student test performance in the Milwaukee public schools.* Scottsdale, AZ: Council of Educational Facility Planners International.

Long, L. (2000). Listening to another voice. Assessing the work environment. *Facilities Manager, 16*(2), 35-38.

Lupinacci, J. (2002). A safe haven. *American School and University, 75*(4), 36-30.

Lyons, J. B. (2002). The learning environment: Do school facilities really affect a child's education? *Learning By Design, 11*, 10-13.

Ma, X., & MacMillan, R. B. (1999). Influences of workplace conditions on teachers' job satisfaction. *Journal of Educational Research, 93*(1), 39-47.

Maiden, J., & Foreman, B. (1998). Cost, design and climate: Building a learning environment. *School Business Affairs, 64*(1), 40-44.

Malone, S. (Ed). (2001). *Sustainable schools, sustainable communities: The view from the West CAE spring 2001 conference.* Washington, DC: American Institute of Architects, Committee on Architecture for Education.

McComb, J. (2000, March). *Small schools*. Issue brief presented to the Oregon Legislative Policy and Research committee, Salem, OR.

McDonough, J. (2000). Engaged learning. *American School and University, 72*(9), 60-64.

McGuffey, C. W. (1982). Facilities. In W. Herbert (Ed.), *Improving educational standards and productivity* (pp. 237-288). Berkeley, CA: McCutchan.

Melvin, L.D. (1984). The law of public school finance. *Contemporary Education, 55*(3), 149-155.

Meno, L., & Karnyski, M. (2002). An evolving mission. *American School and University, 75*(3), 360-361.

Milshtein, A. (2003). Accommodating students' learning styles. *College Planning and Management*, *6*(3), 30-31.

Moore, D. (2003). Building good community relations. *School Planning and Management*, *42*(11), 16-20.

Moore, D. P., & Warner, E. (1998). *Where children learn: The effect of facilities on student achievement.* Retrieved December 27, 2003, from http://www.cefpi/cefpi/issue8.html.

Moore, G. T., & Lackney, J. A. (1993). *Design patterns for American schools: Responding to the reform movement*. Milwaukee, WI: University of Wisconsin-Milwaukee, Center for Architecture and Urban Planning Research. (ERIC Reproduction Service No. ED 375 515)

Moore, G. T., & Lackney, J. A. (1994). *Educational facilities for the twenty-first century: Research analysis and design patterns.* Milwaukee, WI: University of Wisconsin-Milwaukee, Architecture and Urban Planning Research.

Moseley-Braun, C. (1997). Education, infrastructure and America's future. *School Planning and Management, 36*(1), 10-11.

Nathan, J. (2002a). Smaller, saner schools: Using research on small schools and shared facilities to help children and communities. *Learning By Design, 11*, 14-16.

Nathan, J. (2002b). Using small-schools and shared-facilities research. *Principal Leadership, 2*(6), 37-41.

National Priorities Project, Inc. (2000). *Recess is over: It's time to address our overcrowded and deteriorating schools.* Retrieved November 18, 2003, from http://www.natprior.org/recess/recess.html.

O'Neill, D. (2000). *The impact of school facilities on student achievement, behavior, attendance, and teacher turnover rate at selected Texas middle schools in Region XIII ESC.* Unpublished doctoral dissertation, Texas A&M University, College Station, TX.

O'Neill, D., & Oates, A. (2001). The impact of school facilities on student achievement, behavior, attendance, and teacher turnover rate in Central Texas middle schools. *Educational Facility Planner, 36*(3), 14-22.

Oden, A., & Piccus, L. O. (1992). *School finance: A policy perspective.* New York: McGraw-Hill.

Oualline, J., & Rabenaldt, C. (2002). The next phase. *American School and University, 74*(12), 172-174.

Overbaugh, B. L. (1990). *School facilities: The relationship of the physical environment to teacher professionalism.* Unpublished doctoral dissertation, Texas A&M University, College Station, TX.

Papadatos, S. P. (1973). Color them motivated-color's psychological effects on students. *National Association School Principals Bulletin, 57*(370), 92-94.

Pappalardo, W. J. (2002). Proofing schools against vandalism. *School Administrator, 59*(6), 32.

Rabenaldt, C. (2000). Making your case. Facilities upgrade and retrofit. *American School and University, 72*(11), 20-24.

Ralston, J. W. (2003). *Adequacy and equity of facility funding for the Kentucky public school system*. Unpublished dissertation, University of Kentucky, Glasgow, KY.

Raywid, M. A. (1996). *Taking stock: The movement to create mini-schools, schools-within-schools, and separate small schools*. Madison, WI: Center on Organization and Restructuring of Schools. (ERIC Document Reproduction Service No. ED 393 958)

Raywid, M. A. (1999). *Current literature on small schools*. Charleston, WV: ERIC Clearinghouse on Rural Education and Small Schools. (ERIC Document Reproduction Service No. ED 425 049)

Raywid, M. A. (2002). The policy environments of small schools and schools-within-schools. *Educational Leadership, 59*(5), 47-51.

Reeves, D. (2002). *The daily disciplines of leadership: How to improve student achievement, staff motivation and personal organization*. San Francisco: Jossey-Bass.

Reid, D. L. (2000). Building a safe environment. *American School and University, 73*(3), 386-390.

Ritchey, D. (2002). Sharing services and facilities: Making it work. *School Business Affairs, 68*(8), 22-26.

Ritchey, D. (2003). Smart energy choices free up dollars for capital improvements. *School Business Affairs, 69*(1), 38-40.

Rittner-Heir, R. (2003a). Schools and economic development. *School Planning and Management, 42*(4), 16-20.

Rittner-Heir, R. (2003b). What went wrong. Detours in the history of school construction. *American School Board Journal, 190*(6), 39-42.

Robelen, E. W. (2003). Agencies offer security advice and money. *Education Week, 22*(27), 17-20.

Rodgers, P. A. (1998). Case study: An elementary school that saves energy and is visually comfortable. *Architectural Record, 186*(8), 159-60.

Rosenblum, S., & Spark, B. (2002). A guide to lowering test scores. *Leadership, 32*(1), 30-31.

Rouk, U. (1997). *PROBE—developing education policy issues.* Washington, DC: National Education Knowledge Industry Association Communications.

Rowand, C. (1999). How old are America's public schools? (Issue Brief NCES-1999-048). Washington, DC: National Center for Education Statistics.

Ruck, N. C. (1989). *Building design and human performance*. New York: Van Nostrand Reinhold.

Rydeen, J. E. (2003). Environmental design: Focusing on human factors. *American School and University, 75*(12), 158-161.

Sack, J. L. (2002). Razing objections. *Education Week, 21*(22), 38-43.

Sandham, J. L. (2001). Doling out facilities aid proves tricky. *Education Week, 20*(41), 21-24.

Sanoff, H. (1996). Designing a responsive school: The benefits of a participatory process. *School Administrator, 53*(6), 18-22.

Sanoff, H. (1997). *School design.* New York: Van Nostrand Reinhold.

Sanoff, H. (2001). *School building assessment methods.* Washington, DC: National Clearinghouse for Educational Facilities.

Sapp, M. J. (2001). Public/private libraries. *School Planning and Management, 40*(7), 40-41.

Schneider, J. W. (2001). Welcome to the neighborhood. *School Construction News, 4*(1), 15-16.

Schneider, M. (2003). *Linking school facility conditions to teacher satisfaction and success.* Washington, DC: National Clearinghouse for Educational Facilities.

Siegel, J. M. (1995). *Patterns for effective school environments.* Milwaukee, WI: University of Wisconsin-Milwaukee, Architecture and Urban Planning Research.

Sinofsky, E.R., & Knirk, F.G. (1981). Choose the right color for your learning style. *Instructional Innovator, 26*(3), 17-19.

Smolkin, R. (2003). Breathing easier. *School Administrator, 60*(1), 6-14.

Stanard, M. (1996). Visions: Involving teachers as process partners for facility planning. *Educational Facility Planner, 33*(3), 14-17.

Stenzler, Y. (1988). Interface concepts and special education/handicapped facilities. *CEFP Journal, 28*(4), 29-32.

Stevenson, K. R. (2001). School facilities for the 21st century: 12 trends that school facility planners need to know about. *School Business Affairs, 67*(12), 4-7.

Stevenson, L., & Pellicer, K. (1998). Is bigger really better? *School Business Affairs, 64*(1), 18-23.

Stiefel, L. (1998). *The effects of size of student body on school costs and performance in New York City high schools*. New York: New York University, Institute for Education and Social Policy. (ERIC Document Reproduction Service No. ED 420 464)

Stockard, J., & Mayberry, M. (1992). *Effective educational environments.* Newbury Park, CA: Corwin Press.

Stokes, P. (2000). How e-learning will transform education. *Education Week, 20*(2), 44-56.

Strange, J. (2001). Teacher workspaces. *School Planning and Management, 40*(10), 54-55.

Stricherz, M. (2000). Bricks and mortarboards. *Education Week, 20*(14), 30-31.

Sullivan, K. J. (2002). Planning and designing schools with senior citizens in mind. *School Business Affairs, 68*(11), 48-56.

Swanquist, B., & Garza, J. (2003). Going wireless. *American School and University, 76*(2), 40-44.

Syvertsen, K. (2002). Integrating technology into K-12 school design. *School Construction News, 5*(7), 33.

Szczerba, P. (2000). Advances in protection. *American School and University, 73*(1), 24-28.

U.S. Department of Education. (2003). *Closing the achievement gap in America's public schools.* Retrieved November 16, 2003, from http://www.ed.gov/nclb/overview/importance.

U.S. General Accounting Office. (1995). *School facilities: Condition of America's schools. Report to congressional requesters.* Washington, DC: General Accounting Office, Health, Education and Human Services Division.

Valiant, B. (1996). *Turn on the lights! Using what we know about the brain and learning to design learning environments.* Retrieved January 14, 2004, from http://www.cefpi.org/issue5.html.

Viadero, D. (1990). *Task force begins campaign to highlight role of school design on student learning.* Retrieved January 3, 2004, from http://www.edweek.org/ew/ew_printstory.cfm?slug=09270010.h09.

Viadero, D. (2001). The dropout dilemma. *Education Week, 20*(21), 26-29.

Vigue, B. (2002). Setting priorities. *American School and University, 75*(2), 29-31.

White, E. K. (1990). Psychological aspects of classroom planning. *CEFP Journal, 28*(5), 3-8.

White, K. A. (1998). States boost construction investment. *Education Week, 17*(32), 56-60.

Witzling, L., Childress, H., & Lackney, J. A. (1994). *The nature of environmental quality in the workplace*. Milwaukee, WI: University of Wisconsin-Milwaukee, Architecture and Urban Planning.

Wright, P. (1997). Universal service fund provides impetus for both telecommunications and technology planning. *School Planning and Management, 36*(10), 10.

Yan, A. L. (1999). Wiring for the future. *American School and University, 72*(3), 331-333.

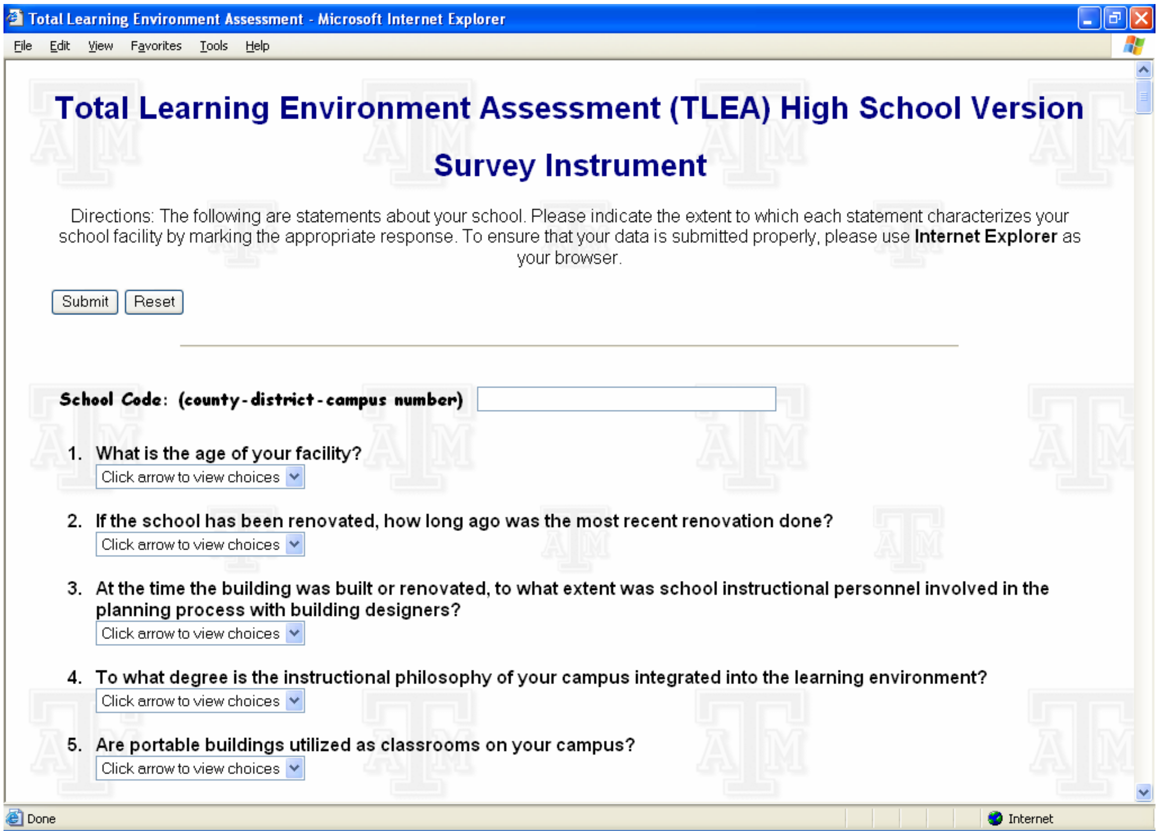
Yaunches, A. (2002). Small works: Schools in three states showcase virtues of small size. *Rural Roots, 3*(2), 1-2.

Yeater, R. (2003). Renovation vs. replacement: Beyond arbitrary rules in the 21st century. *Educational Facility Planner, 38*(2), 18-21.

APPENDIX A

TOTAL LEARNING ENVIRONMENT ASSESSMENT

TLEA – ONLINE VERSION



Total Learning Environment Assessment - Microsoft Internet Explorer

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Total Learning Environment Assessment (TLEA) High School Version

Survey Instrument

Directions: The following are statements about your school. Please indicate the extent to which each statement characterizes your school facility by marking the appropriate response. To ensure that your data is submitted properly, please use **Internet Explorer** as your browser.

Submit Reset

School Code: (county-district-campus number)

1. **What is the age of your facility?**
   Click arrow to view choices
2. **If the school has been renovated, how long ago was the most recent renovation done?**
   Click arrow to view choices
3. **At the time the building was built or renovated, to what extent was school instructional personnel involved in the planning process with building designers?**
   Click arrow to view choices
4. **To what degree is the instructional philosophy of your campus integrated into the learning environment?**
   Click arrow to view choices
5. **Are portable buildings utilized as classrooms on your campus?**
   Click arrow to view choices

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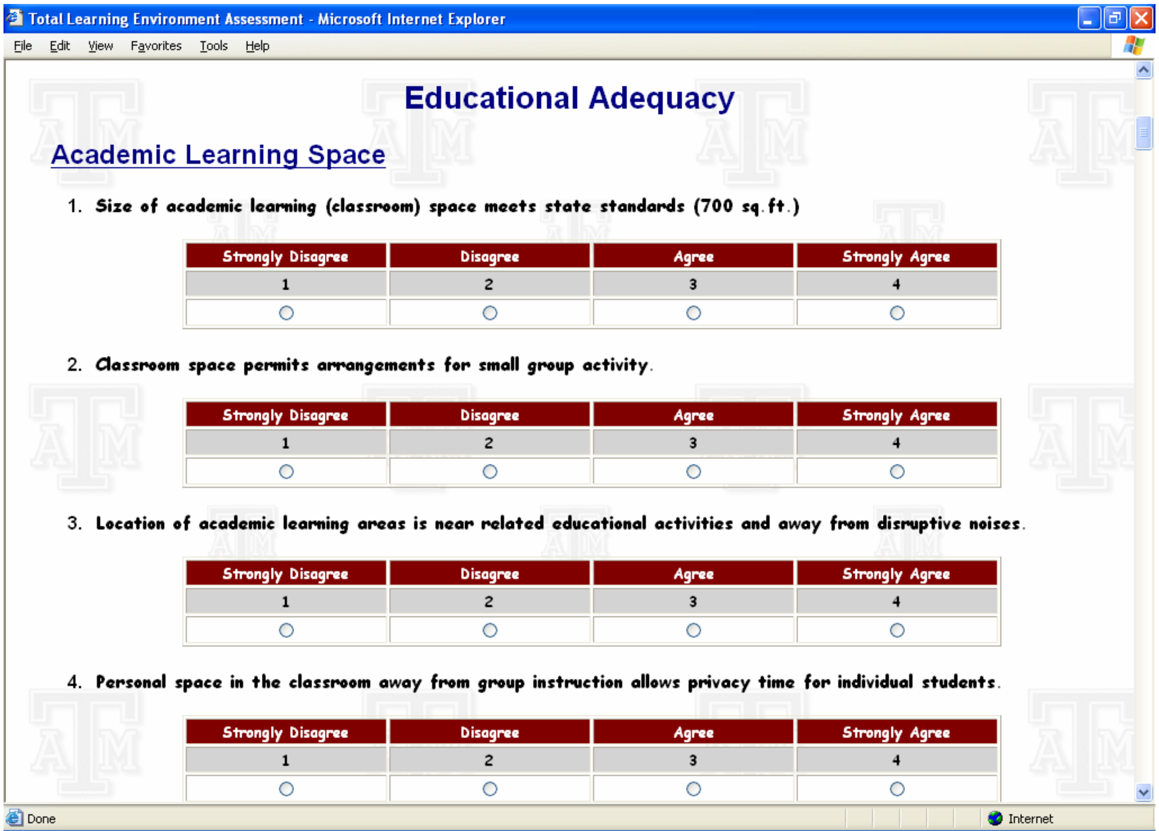

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Educational Adequacy

Academic Learning Space

1. Size of academic learning (classroom) space meets state standards (700 sq.ft.)

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

2. Classroom space permits arrangements for small group activity.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

3. Location of academic learning areas is near related educational activities and away from disruptive noises.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

4. Personal space in the classroom away from group instruction allows privacy time for individual students.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

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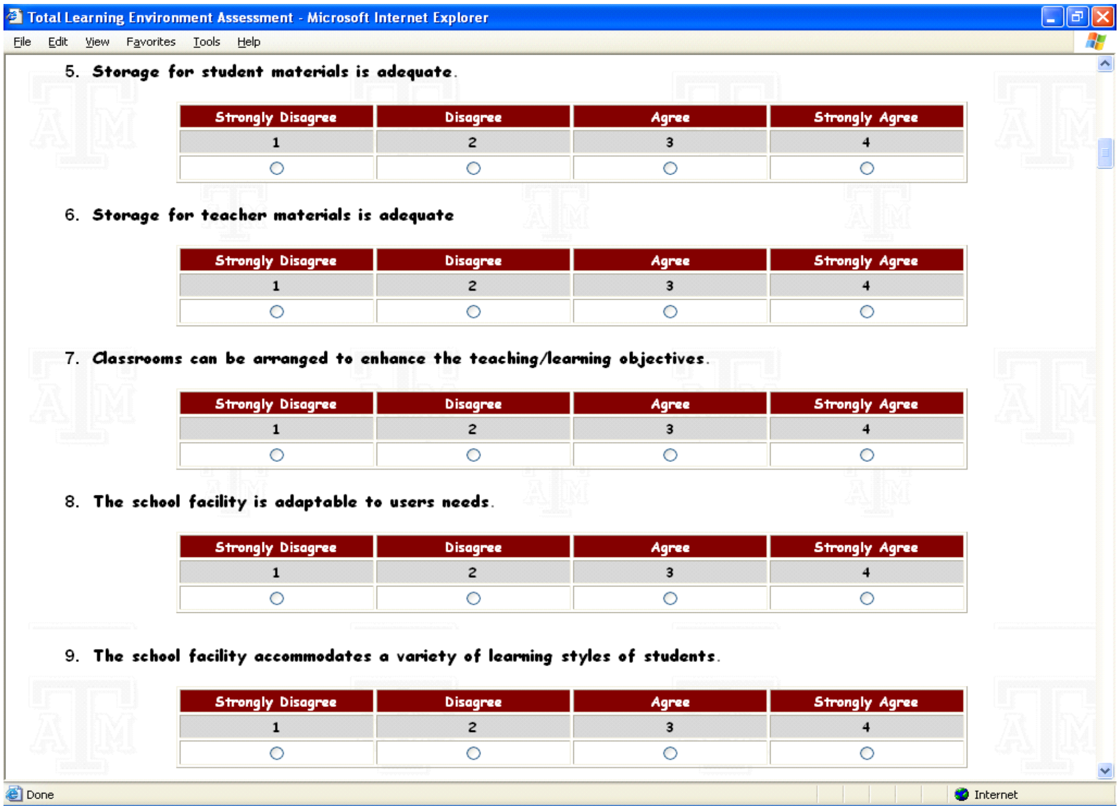
Total Learning Environment Assessment - Microsoft Internet Explorer

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5. **Storage for student materials is adequate.**

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

6. **Storage for teacher materials is adequate**

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

7. **Classrooms can be arranged to enhance the teaching/learning objectives.**

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

8. **The school facility is adaptable to users needs.**

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

9. **The school facility accommodates a variety of learning styles of students.**

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

Done Internet

Total Learning Environment Assessment - Microsoft Internet Explorer

File Edit View Favorites Tools Help

10. Large flexible space and/or workstations are available to accommodate student projects.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

11. Computers in classrooms and computer labs have functional furniture designed for their use.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

12. Classrooms have telephones for communicating both within and outside the facility.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

13. Classrooms have logical, well designed, integrated technology systems.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

14. School has technology plan that includes development of environment for interdisciplinary teaming.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

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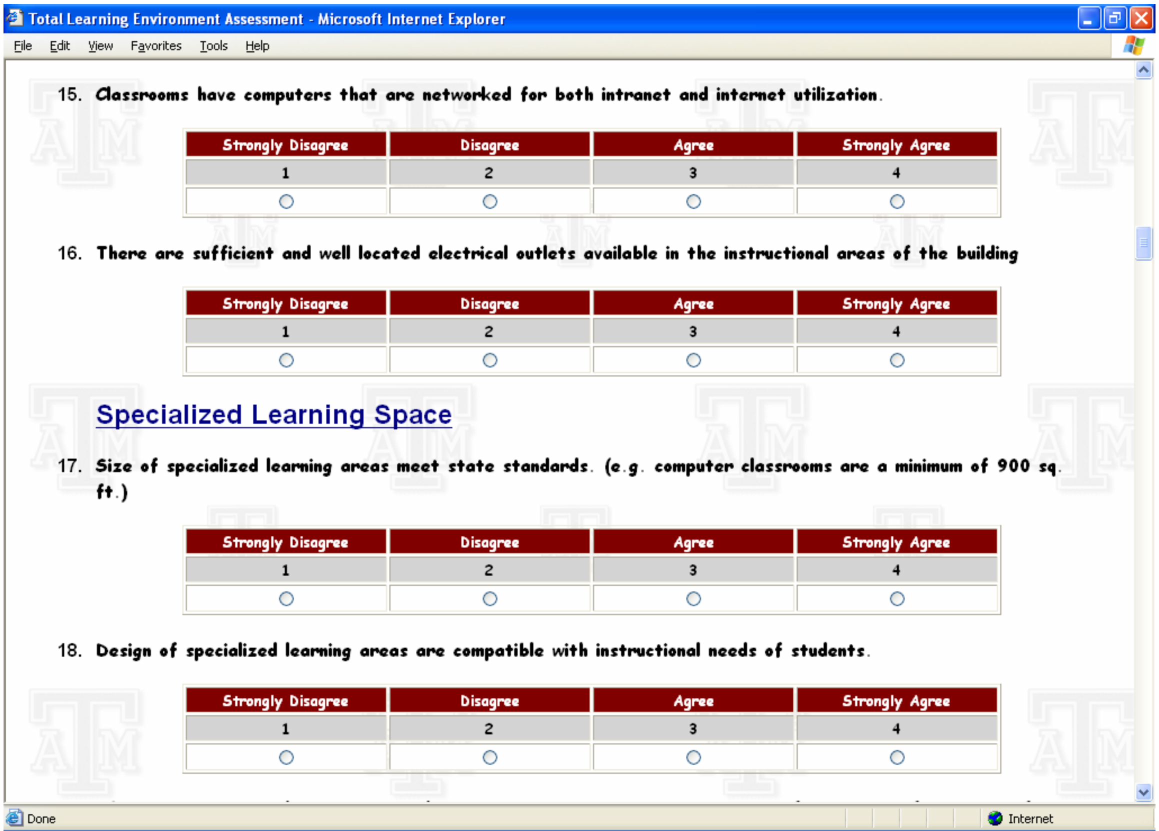

Total Learning Environment Assessment - Microsoft Internet Explorer

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15. Classrooms have computers that are networked for both intranet and internet utilization.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

16. There are sufficient and well located electrical outlets available in the instructional areas of the building

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

Specialized Learning Space

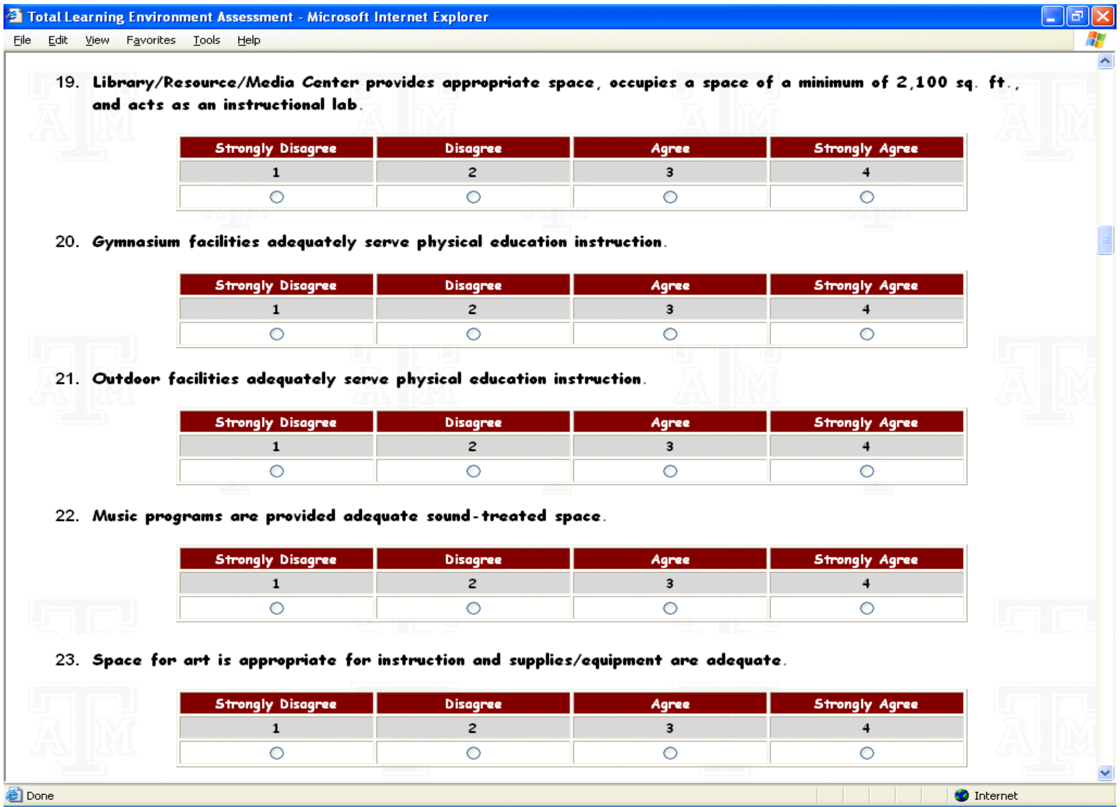
17. Size of specialized learning areas meet state standards. (e.g. computer classrooms are a minimum of 900 sq. ft.)

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

18. Design of specialized learning areas are compatible with instructional needs of students.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

Done Internet



Total Learning Environment Assessment - Microsoft Internet Explorer

19. Library/Resource/Media Center provides appropriate space, occupies a space of a minimum of 2,100 sq. ft., and acts as an instructional lab.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

20. Gymnasium facilities adequately serve physical education instruction.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

21. Outdoor facilities adequately serve physical education instruction.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

22. Music programs are provided adequate sound-treated space.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

23. Space for art is appropriate for instruction and supplies/equipment are adequate.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

Total Learning Environment Assessment - Microsoft Internet Explorer

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24. Science program is provided sufficient space and equipment with science lecture-lab rooms a minimum of 1,000 sq. ft.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

25. Science lab equipment has been updated less than five years ago to meet current standards.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

26. Utilities such as gas, water and electricity are available and are in usable condition in science labs.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

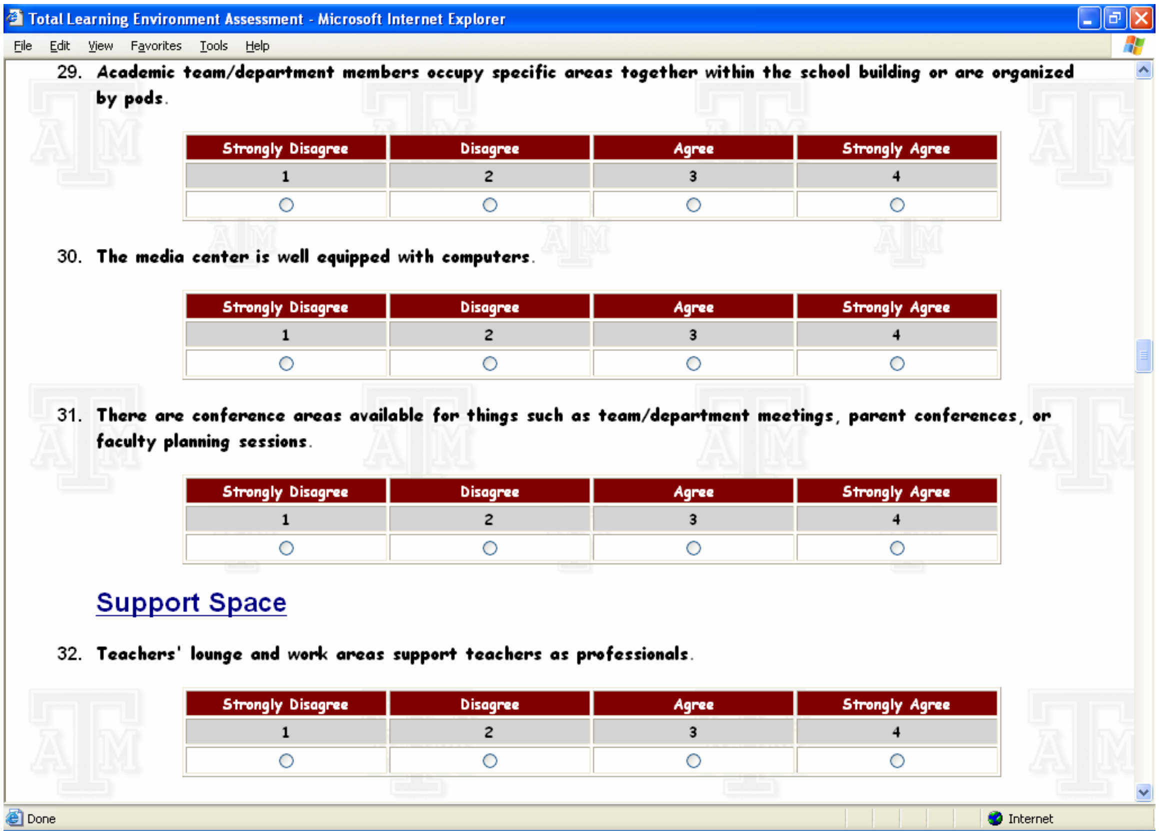
27. Room design for technology education maximizes the use of state-of-the-art equipment.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

28. Space for small groups and remedial instruction is provided adjacent to the classrooms.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

Done Internet



Total Learning Environment Assessment - Microsoft Internet Explorer

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29. **Academic team/department members occupy specific areas together within the school building or are organized by pods.**

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

30. **The media center is well equipped with computers.**

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

31. **There are conference areas available for things such as team/department meetings, parent conferences, or faculty planning sessions.**

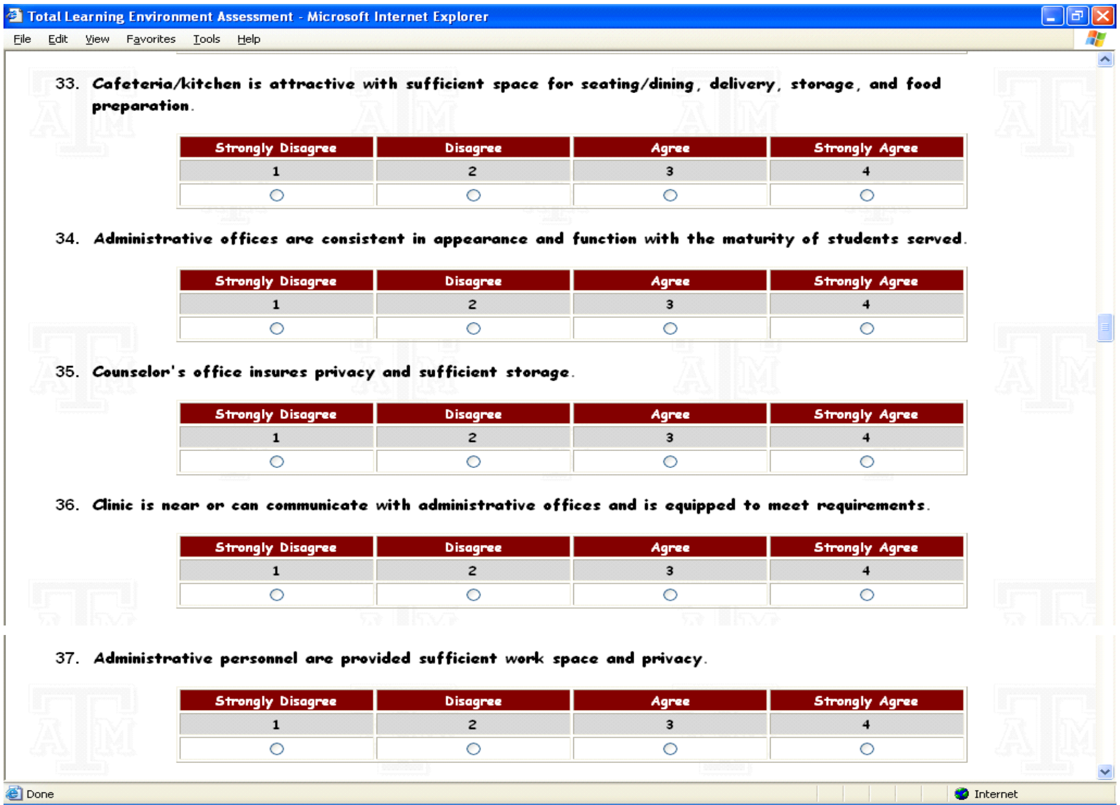
Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

Support Space

32. **Teachers' lounge and work areas support teachers as professionals.**

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

Done Internet



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33. Cafeteria/kitchen is attractive with sufficient space for seating/dining, delivery, storage, and food preparation.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

34. Administrative offices are consistent in appearance and function with the maturity of students served.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

35. Counselor's office insures privacy and sufficient storage.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

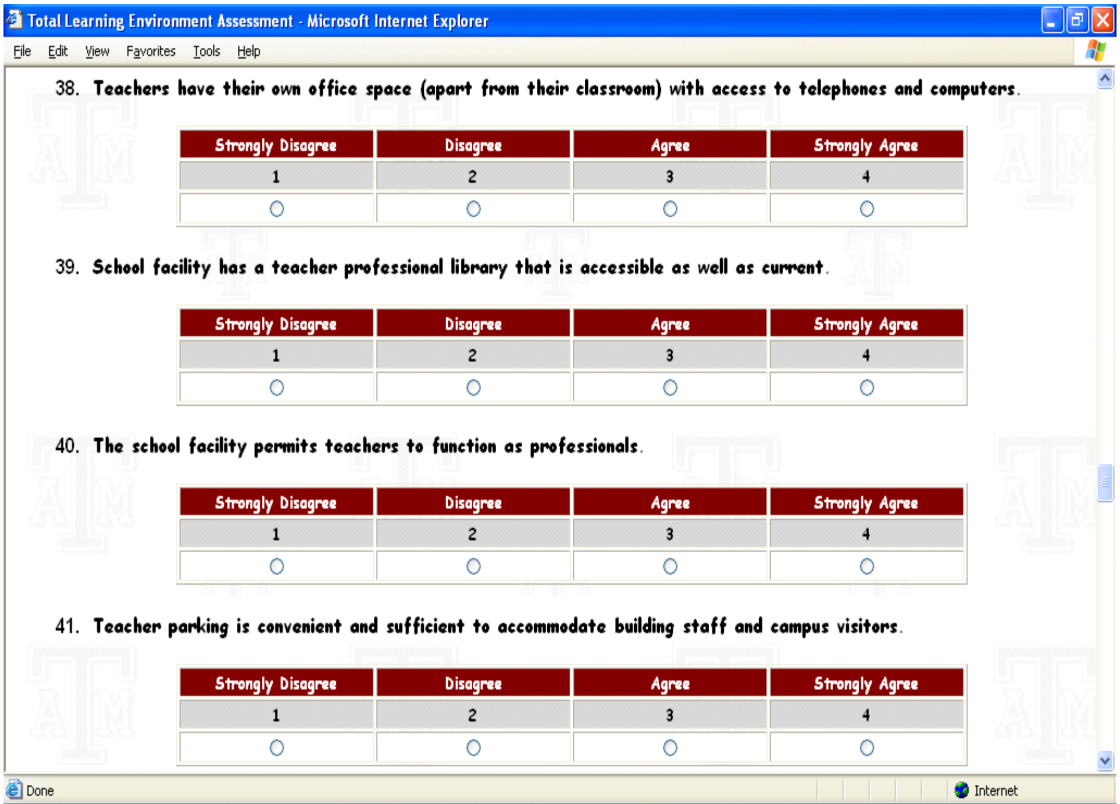
36. Clinic is near or can communicate with administrative offices and is equipped to meet requirements.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

37. Administrative personnel are provided sufficient work space and privacy.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

Done Internet



Total Learning Environment Assessment - Microsoft Internet Explorer

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38. Teachers have their own office space (apart from their classroom) with access to telephones and computers.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

39. School facility has a teacher professional library that is accessible as well as current.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

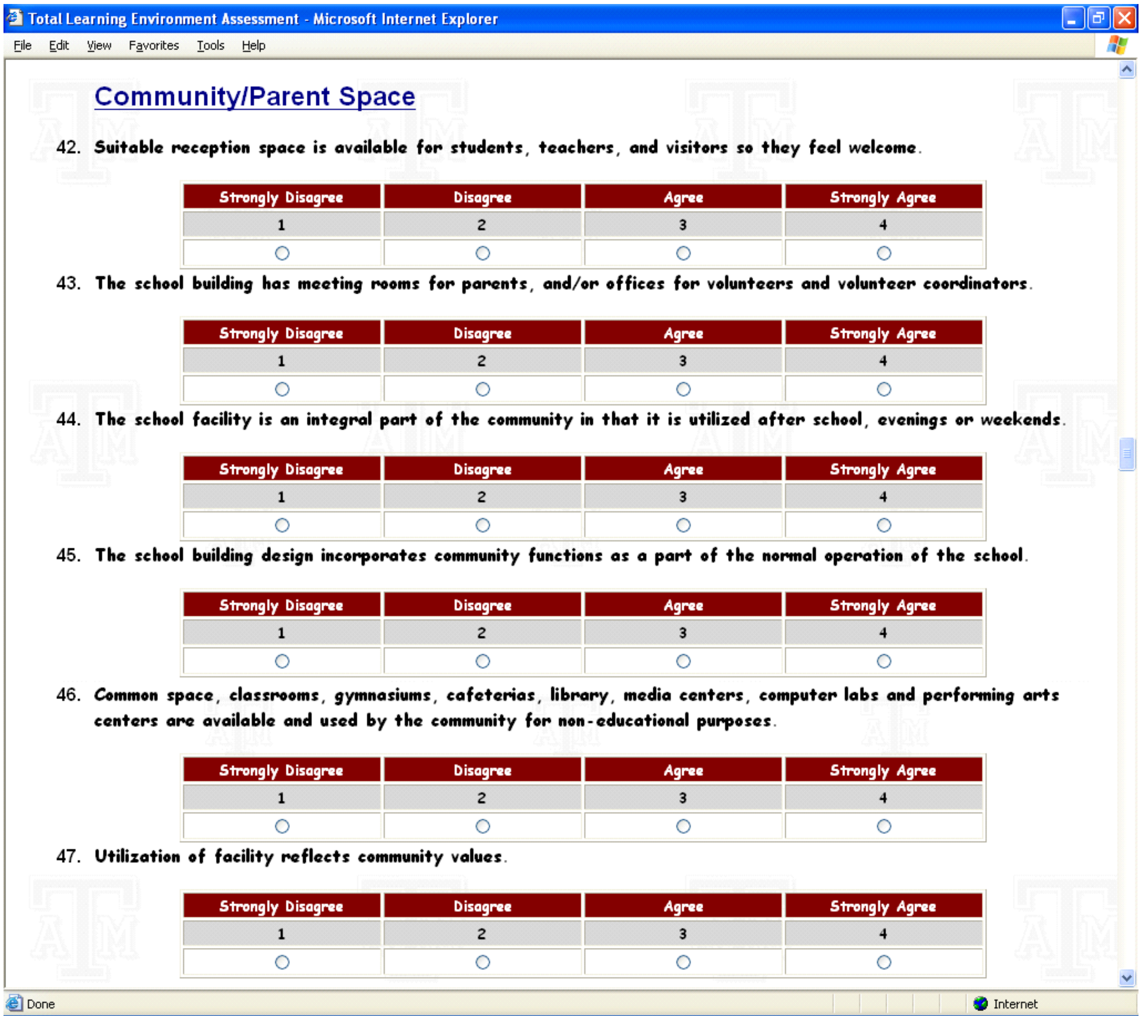
40. The school facility permits teachers to function as professionals.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

41. Teacher parking is convenient and sufficient to accommodate building staff and campus visitors.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

Done Internet



Total Learning Environment Assessment - Microsoft Internet Explorer

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Community/Parent Space

42. Suitable reception space is available for students, teachers, and visitors so they feel welcome.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

43. The school building has meeting rooms for parents, and/or offices for volunteers and volunteer coordinators.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

44. The school facility is an integral part of the community in that it is utilized after school, evenings or weekends.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

45. The school building design incorporates community functions as a part of the normal operation of the school.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

46. Common space, classrooms, gymnasiums, cafeterias, library, media centers, computer labs and performing arts centers are available and used by the community for non-educational purposes.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

47. Utilization of facility reflects community values.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

Done Internet

Total Learning Environment Assessment - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Environment for Education

Exterior Environment

48. Overall design is aesthetically pleasing and appropriate for the age of the students.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

49. Exterior noise and surrounding environment do not disrupt learning.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

50. Entrances and walkways are sheltered from sun and inclement weather.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

51. Building materials provide attractive color and texture.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

52. Proper maintenance (exterior) of the school facility is a priority and vandalism and/or graffiti are repaired/removed quickly.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

53. Site and building are well landscaped.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

54. Exterior walls, or windows and trim were painted less than 5 years ago or are in excellent condition.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

55. Location of facility enhances the learning climate of the school.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

Interior Environment

56. Color schemes, building materials, and décor provide an impetus to learning.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

57. Year around comfortable temperature and humidity are provided throughout the building.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

58. The floor plan of the building helps direct student movement and minimizes student disruptions.

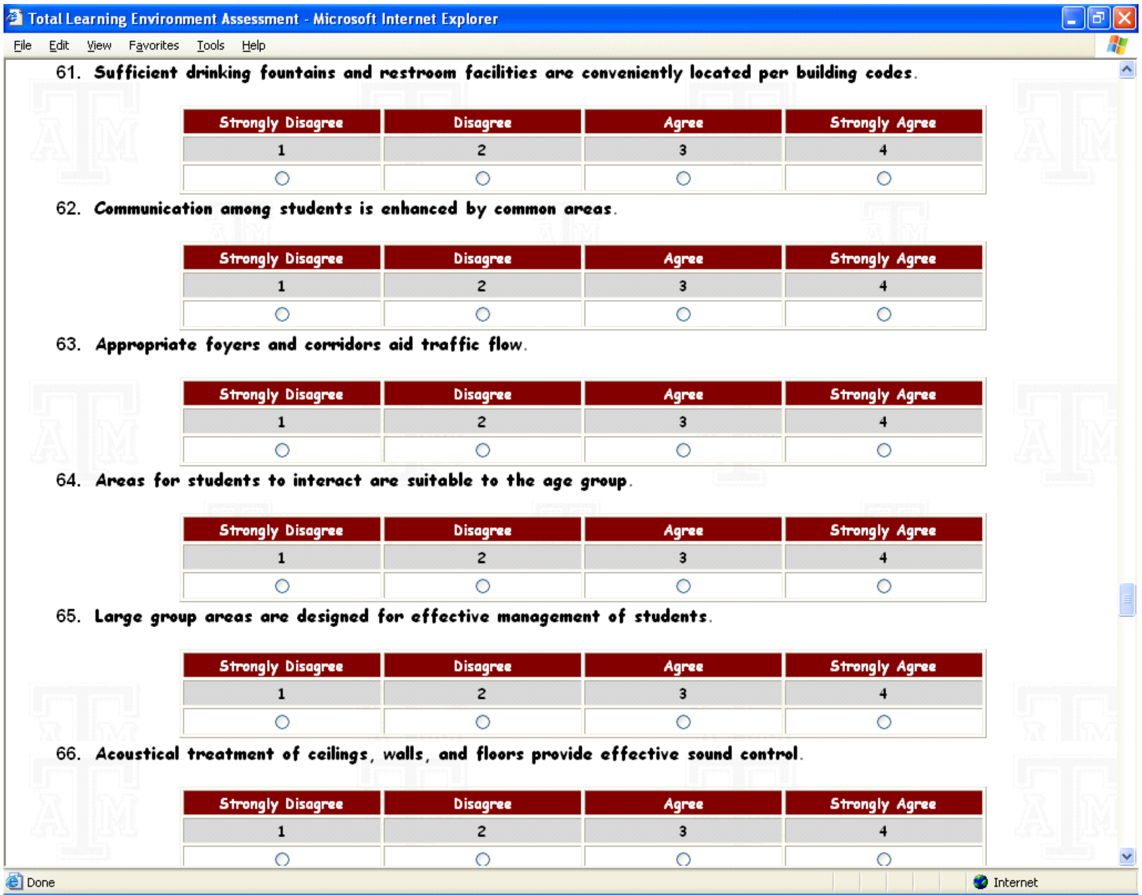
Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

59. Ventilating system provides adequate quiet circulation of clean air and meets Indoor Air Quality (IAQ) standard requirements.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

60. Lighting systems provide proper intensity, diffusion, and distribution of illumination.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4



Total Learning Environment Assessment - Microsoft Internet Explorer

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61. Sufficient drinking fountains and restroom facilities are conveniently located per building codes.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

62. Communication among students is enhanced by common areas.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

63. Appropriate foyers and corridors aid traffic flow.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

64. Areas for students to interact are suitable to the age group.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

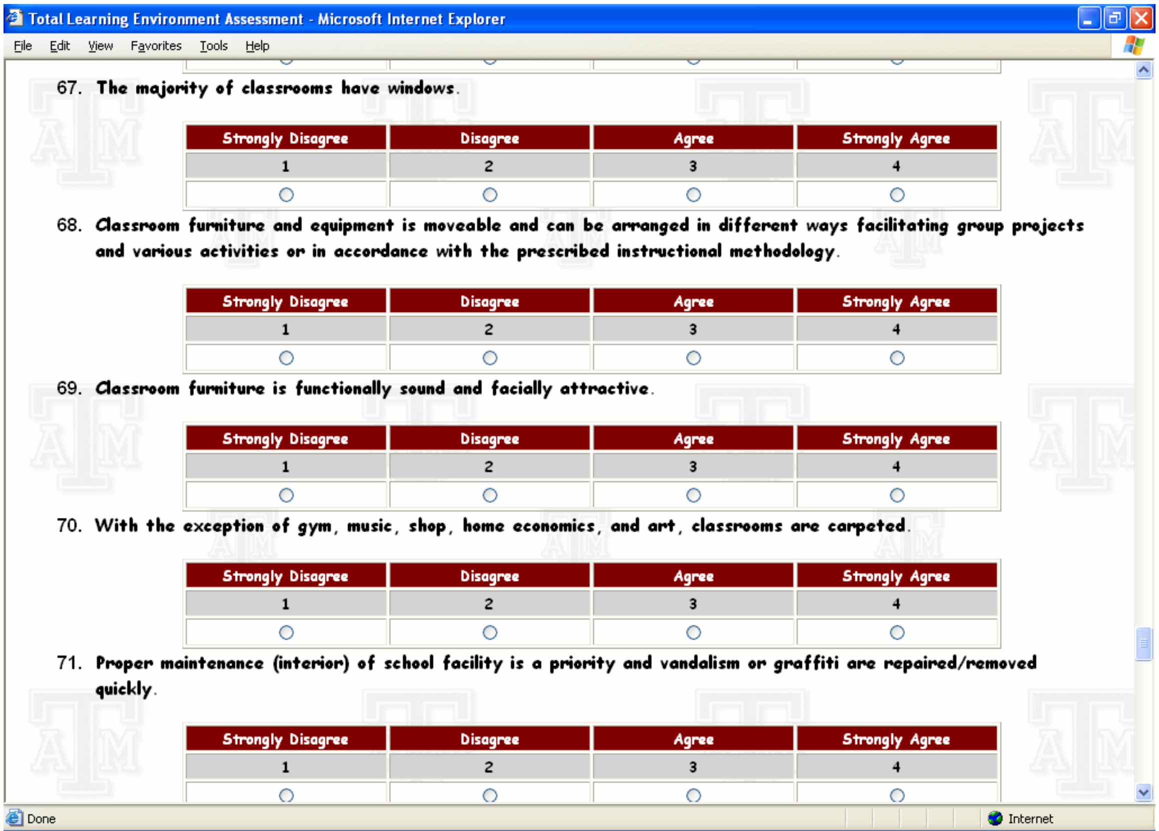
65. Large group areas are designed for effective management of students.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

66. Acoustical treatment of ceilings, walls, and floors provide effective sound control.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

Done Internet



Total Learning Environment Assessment - Microsoft Internet Explorer

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67. The majority of classrooms have windows.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

68. Classroom furniture and equipment is moveable and can be arranged in different ways facilitating group projects and various activities or in accordance with the prescribed instructional methodology.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

69. Classroom furniture is functionally sound and facially attractive.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

70. With the exception of gym, music, shop, home economics, and art, classrooms are carpeted.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

71. Proper maintenance (interior) of school facility is a priority and vandalism or graffiti are repaired/removed quickly.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

Done Internet

Total Learning Environment Assessment - Microsoft Internet Explorer

File Edit View Favorites Tools Help

72. Custodial daily routines are effective in keeping facility clean and attractive.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

73. The condition of your facility is excellent both cosmetically and structurally.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

74. There are a variety of places, both inside and outside of the school, where students can meet together in both small and large groups.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

75. The school facility fosters communication.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

76. The school facility creates an appropriate behavioral setting.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

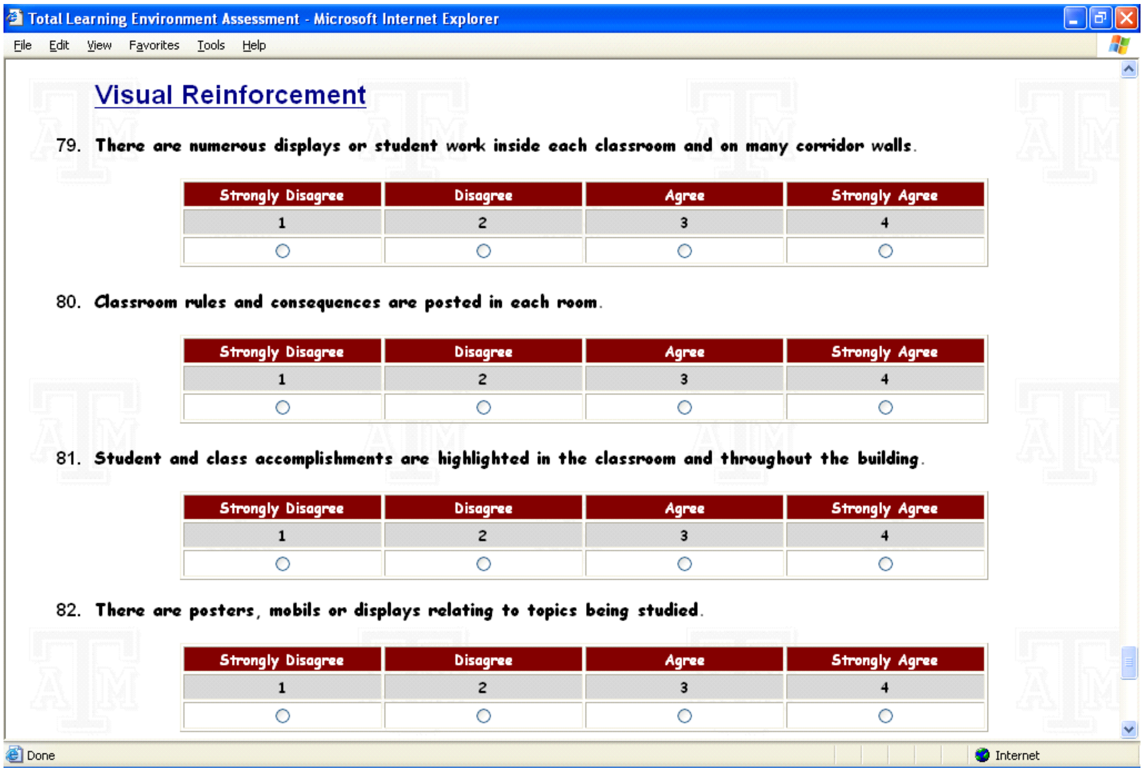
77. There are no visible indications of roof leaks in the school facility.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

78. Interior walls, including classroom spaces, were painted less than 8 years ago or are in excellent condition.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4
○	○	○	○

Done Internet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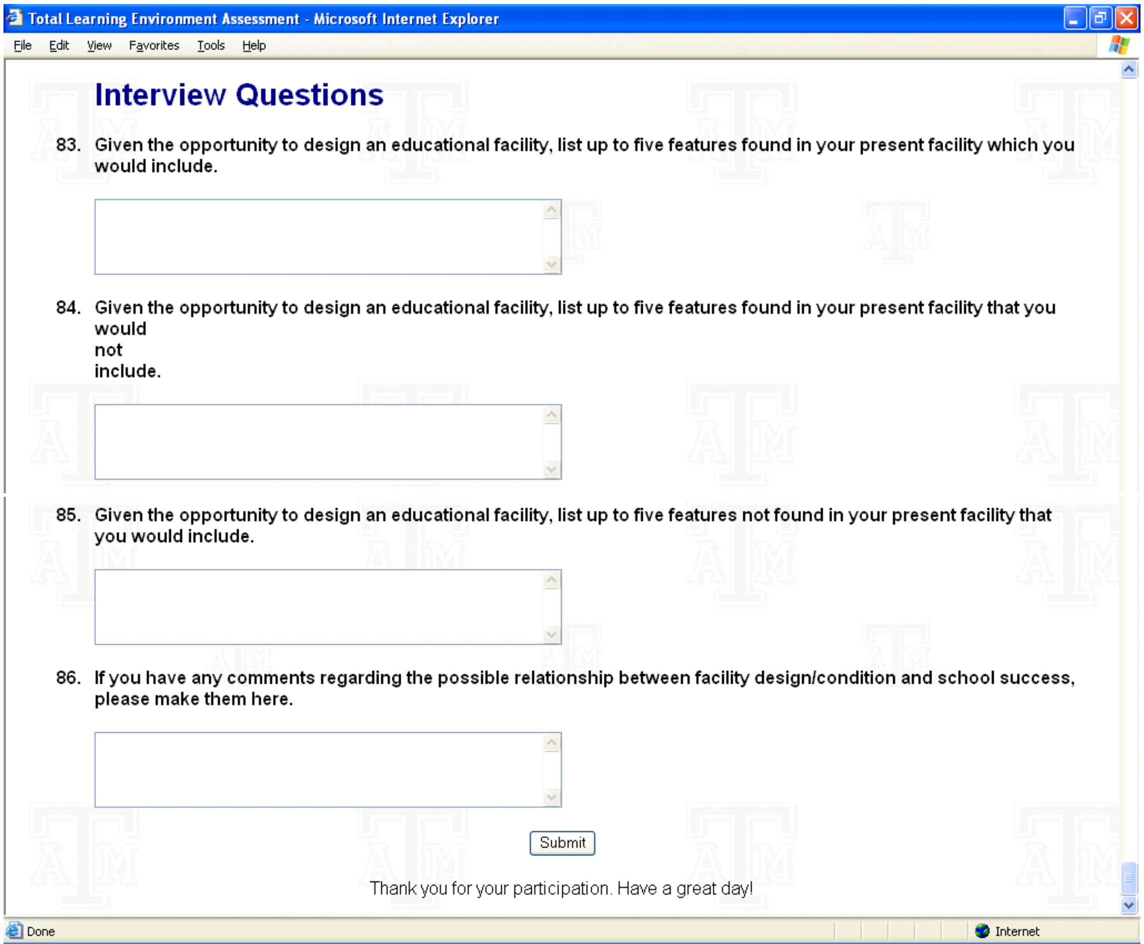
Visual Reinforcement
79. There are numerous displays or student work inside each classroom and on many corridor walls.
Strongly Disagree Disagree Agree Strongly Agree
1 2 3 4
80. Classroom rules and consequences are posted in each room.
Strongly Disagree Disagree Agree Strongly Agree
1 2 3 4
81. Student and class accomplishments are highlighted in the classroom and throughout the building.
Strongly Disagree Disagree Agree Strongly Agree
1 2 3 4
82. There are posters, mobils or displays relating to topics being studied.
Strongly Disagree Disagree Agree Strongly Agree
1 2 3 4
Done
Internet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Interview Questions

83. Given the opportunity to design an educational facility, list up to five features found in your present facility which you would include.

84. Given the opportunity to design an educational facility, list up to five features found in your present facility that you would
not
include.

85. Given the opportunity to design an educational facility, list up to five features not found in your present facility that you would include.

86. If you have any comments regarding the possible relationship between facility design/condition and school success, please make them here.

Submit

Thank you for your participation. Have a great day!

Done Internet

VITA

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EDUCATION

- Doctor of Philosophy, Texas A&M University, College Station, Texas, 2007
  Educational Administration
- Master of Science, University of Houston-Clear Lake, Houston, Texas, 1995
  Educational Management
- Bachelor of Science, Texas A&M University, College Station, Texas, 1990
  Agricultural Science

PROFESSIONAL EXPERIENCE

- 2005-present Assistant Superintendent of Support Services, Goose Creek CISD
  Baytown, Texas
- 2002-2005 Assistant Superintendent of Administration, Friendswood ISD
  Friendswood, Texas
- 1999-2002 High School Principal, Bryan ISD
  Bryan, Texas
- 1996-1999 Director of Career & Technology Education, Alvin ISD
  Alvin, Texas
- 1994-1996 Assistant Principal, Friendswood ISD
  Friendswood, Texas
- 1990-1994 High School Teacher, Alvin ISD and Aldine ISD

PROFESSIONAL AFFILIATIONS

- Council of Educational Facility Planners, International (CEFPI)
- Texas Association of School Administrators (TASA)
- Texas Association of School Business Officials (TASBO)