A Case Study on Facility Design: The Impact of New High School Facilities in Virginia on Student Achievement and Staff Attitudes and Behaviors

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Dedication

To my wife Mary Catherine: Without your support and willingness to sacrifice, none of this would have been possible. I love you. Your support in this project has been unending! You are my biggest cheerleader, greatest fan, and the one person that understands how difficult all of this was. I love you more than you will ever know!

To Nathan and Matthew: Please remember that I will always love you and have high hopes for your futures! Both of you make my life exciting, worthwhile, and wonderful every single day! Know how proud I am to be your dad, and please don't ever forget how much I love you both. Daddy is finally done with his "schoolwork!"

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Abstract of Dissertation

A Case Study on Facility Design: The Impact of New High School Facilities in Virginia on Student Achievement and Staff Attitudes and Behaviors

This case study involved the examination of three new high schools that opened in the Commonwealth of Virginia between 2006 and 2007. Principal interviews and focus group interviews were conducted between April and June 2008. Document analysis of architectural information was conducted by the researcher for each site location; that analysis yielded shared characteristics of the sites such as floor plans, common professional work areas, use of safety features, and the use of natural lighting throughout instructional and professional spaces.

The study determined that the perceptions of the principals and the staff of these new buildings were shared and sufficiently common for identification. The data collected from both groups of participants indicated the existence of three shared themes particular to this case study: improved student behaviors, improved staff and student morale, and a lack of belief that the new buildings had more positively impacted student achievement than had the old buildings.

Additionally, data collected from participants in this study seemed to represent acknowledgement of a relationship between sustainable design elements and student achievement as well as student and staff behaviors. All respondents in both interview groups agreed that the amount of natural light incorporated into the design of the building had a positive impact on both student and staff behaviors, indicating that it may have positively impacted student achievement.

At all three locations, participants expressed a shared belief that natural light had affected their overall performance, their individual moods, and, in some cases, their ability to maintain their levels of performance as the year progressed. Other factors mentioned by all participants as having had a positive impact included the following: open space in classrooms and hallways, the high ceilings and sense of openness in all the buildings, and enhanced safety and security features present in the buildings.

All of the data collected from the participants in this research study led to the conclusion of the researcher that design elements such as natural lighting and climate controlled HVAC systems, as well as wide, open hallways and shared student spaces, do positively impact student behaviors and student and staff attitudes and behaviors.

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CHAPTER 1: INTRODUCTION

Overview

"We shape our buildings: thereafter, they shape us." - Sir Winston Churchill

Every educator has experiences that shape his or her personal and professional opinions about the profession of teaching: the ways in which students learn as well as the optimal conditions that enhance student achievement. As an educator that has worked in both older and brand new facilities, the author has noted a perceptible difference in feeling among students and staff in a new building compared to that noted in an older building. Having worked in three brand new high schools in the Commonwealth of Virginia since 1993, as well as two older high schools, the author observed that people working in a new building seemed to be happier, students in a new school seemed to be better behaved, and achievement in a new building seemed to be markedly improved. The author's first visit to a new high school (1993) in which he would be employed as an educator resulted in a sense of awe and wonderment at the facility and its design and layout. Similar experiences followed in 2003 and 2006, first as an educator at a new school, and then as a member of the administrative team that opened a new high school. As a doctoral student, the author's curiosity was piqued by personal perceptions and interactions with both students and staff at a new high school facility, and that interest became a part of his own professional development. A need to explore this phenomenon emerged throughout the doctoral coursework; the phenomenon experienced by the author warranted further research. Site visits to new school facilities in the Commonwealth of Virginia, which were a part of the research procedures for this dissertation, elicited

feelings similar to those of previous professional experiences. The need to explain personal perceptions and to determine whether or not such perceptions were noted in other new high school facilities drove this research and exploration into the concept of high school facility design and the potential impact of a new high school on students, staff, and their observable behaviors.

The proposed construction of a new high school facility is sometimes met with skepticism, by both the public as well as the political policymakers responsible for its creation. One might expect that all parties involved desire an accurate answer regarding the cost associated with the new building. Once a project has been approved by the local school board, a sense of anticipation begins to build in the surrounding community. Questions associated with cost eventually lead to questions about building leadership, teaching staff, course offerings, and the actual physical layout of the building. Structural plans and architectural renderings do not adequately convey the actual experience of walking through the doors of a new high school on the 1st day of the 1st school year the building is open. The excitement that permeates the air courses through not only the students but also the teachers and staff of that building.

Most people believe that new school buildings contain the most advanced architectural design elements with state-of-the-art technological advancements. They also expect to find inside a new building a learning environment designed to maximize student achievement. Across the nation, as well as in the Commonwealth of Virginia, new high schools are built to reflect specific cognitive learning design elements and to promote a positive educational experience for both students and staff. Most of the architectural designs being implemented in new high schools are based on research that

has defined the most beneficial elements that should be incorporated into the physical layout of the building (Lackney, 1998; Tanner, 2000, 2003, 2007). The expected costs associated with new construction or renovation projects have increased exponentially across the nation; the phenomenon of astronomical cost must be a primary concern for school divisions that are planning future projects when the associated cost of new school facilities is compared to their expected long-term benefits.

Research has indicated that the physical conditions of America's public schools impact student achievement. Scholars have attempted to make a connection between student achievement and teacher quality (Monsour, 2006), student achievement and teacher experience (Huth, 2004), and student achievement and teacher education (Darling-Hammond, 1999). Research conducted in the Commonwealth of Virginia and in other states has identified significant correlations between school facilities and student outcomes (Cash, 1993; Crook, 2006; Hines, 1996; Lemasters, 1997). Previous research regarding school facilities has indicated that the physical condition of the facilities impacts not only student achievement and student behavior (Cash) but also staff attitude and behavior (Hickman, 2002; Lee, 2006). Recent research has also found a correlation between the condition of the school facility and teacher satisfaction (Ruszala, 2008).

School district personnel, contractors, and architects are interested in the most effective design features, as well as the design elements that positively impact student achievement. Just within the past 3 years, school construction and renovation costs have skyrocketed in the Commonwealth of Virginia, from an estimated total of $355 million spent in 2004 (Virginia Department of Education [VDOE], 2004) to an estimated $608 million spent in 2006 (VDOE, 2006) and $611 million spent in 2008 (VDOE, 2008a).

There has also been a steady increase in the number of new elementary, middle, and high schools constructed by divisions across the state within the last decade. According to the Virginia Department of Education, the cost of new high school construction increased from $157.60 per square foot (2004) to $176.81 per square foot (2008) while the cost per pupil increased from $19,230 to $26,776 dollars in the same time period (VDOE, 2008a). In 2006, the Commonwealth of Virginia had 1.2 million students housed in 1,878 public school buildings, with 300 of them serving as high schools (VDOE, 2006). In the past, traditional school construction followed a "bells and cells" concept (Abramson, 2005), in which districts requested a specific number of identical classrooms, with an adjoining hallway and a centrally located office. This layout allowed students to move efficiently from place to place with the least amount of disruption. The quality of the learning environment more often that not was substandard. Today, public school buildings not only are designed for multiple purposes (e.g., community functions and meeting spaces), but they also contain the most current design elements believed to positively impact student achievement.

According to the *Report from the National Summit on School Design* (NSSD, 2005), poorly designed school buildings or those that are poorly maintained provide an undesirable environment for student learning and achievement. Hanson reported in 1992 that 31% of the schools in the United States at that time had been built before World War II. To accommodate the baby boom that followed World War II, an additional 43% of those buildings had been built quickly, often with shoddy materials, resulting in their lasting an average of about 30 years. According to the United States Department of Education (USDOE), about one fourth of all schools in existence in the United States at

the end of the 20th century were built before 1950, and 45% of all schools were built between 1950 and 1969 (USDOE, 1999). A report on school facilities released in the year 2000 concluded that poor environmental conditions in schools, such as poor lighting, inadequate ventilation, and inoperative heating, can affect the learning, health, and morale of students and staff ("Public School Facilities," 2004).

There is an abundance of quantitative research that documents the relationship between existing school conditions and student achievement. The impact of new school buildings on students and staff has been documented in at least two previous research studies. Hickman (2002), whose research focused exclusively on new high schools built in Ohio, concluded that new high schools seem to positively influence student behavior as well as student and staff attitude and behavior. Hickman further concluded that new building conditions reduced the incidents of vandalism within the school and improved student and staff attendance rates, in addition to fostering more positive attitudes in both students and staff. Lee (2006), whose research was conducted in one New Jersey school district, extended the Hickman research by comparing staff attitude and behavior 2 years prior and 2 years after a move to a new school. His research was guided by the belief that improved staff morale, attitude, and behavior created for students a learning environment conducive to positive academic achievement. He suggested a need for qualitative examination of the physical environment in both old and new school facilities.

Crook (2006) examined the relationship between the condition of the physical environment and the number of students who passed the Virginia Standards of Learning (SOL) exams. Crook recommended that further research be conducted in the Commonwealth to assess teachers' perceptions of the learning environment. He

suggested that a qualitative analysis of teachers' perceptions of teaching strategies used in newer buildings versus older buildings was warranted because there had been a statewide emphasis on teaching strategies to encourage demonstrated competence on the state SOL examinations.

Studies in the business world have indicated that employee performance and productivity are influenced by the physical condition of the facility (Eilers, 1991; Glassman, Burkhart, Grant, & Vallery, 1978). Poor indoor air quality, acoustics, lighting, and use of the physical space within the building have been found to negatively impact employee morale, production, and attendance (Hickman, 2002). In the business world, a facility that is deemed unusable is often replaced or renovated to improve production as well as profit margins (Lexington, 1989). In the world of public education, however, dilapidated and unusable buildings continue to be in use across the nation.

Quantitative comparison of the physical conditions of the school building with student achievement and standardized test data does not define what is different about a new building for the students or staff members. Quantitative research simply relates to the reader that there is a statistical implication or connection, but no reason or explanation is given as to what may be the cause of that statistical discrepancy. Statistical information alone does not relate to the reader a reason that may explain the perceptions or described phenomenon. A qualitative assessment of the perceived impact of design elements in new high schools on student achievement, as well as student, teacher, and staff attitudes and behaviors, was warranted because previous quantitative research had indicated a relationship between the condition of the school facility and student achievement (Cash, 1993; Crook, 2006; Hines, 1996; Lemasters, 1997).

Statement of the Problem

There was a need to explore the perceptions held by teachers, staff, and administrators working in new high schools with regard to student behaviors, attitudes, and academic achievement in those new high schools for the purpose of gaining insight into and explaining the effect documented in previous quantitative research. The perceptions of the principals and the teachers working in new high school facilities could provide information regarding the contribution of specific factors to an improved learning environment.

Research Question

What is the impact of the design of new high school facilities in the Commonwealth of Virginia on student achievement and student, teacher, and staff attitudes and behaviors?

Research Subquestions

1. Has the design of new high school facilities in the Commonwealth of Virginia improved student achievement as reported by principals, teachers and staff of the new high schools?

2. Has the design of new high school facilities in the Commonwealth of Virginia improved the attitudes and behaviors of staff members that work in those new school facilities as reported by principals, teachers and staff of the new high schools?

3. Has the design of new school facilities in the Commonwealth of Virginia improved the attitudes and behaviors of students who attend the new high schools as reported by principals, teachers and staff of the new high schools?

4. Is there a relationship between sustainable design elements and student achievement as perceived by principals, teachers and staff of the new high schools?

Purpose of the Study

The purpose of this study was to explore the potential impact of design elements present in new high schools in the Commonwealth of Virginia on student achievement as well as the attitudes and behaviors of students, teachers, and staff. This qualitative case study was designed to examine both the principals' perceptions and the perceptions of the teachers and staff at new high schools regarding the impact of design elements on the aforementioned factors. The primary goal of this qualitative case study was to formulate a clear theory, based on the data collected from the research participants, to explain (a) why students who attend new high schools appear to have higher rates of student achievement and (b) why teachers and staff of new high schools report information either supporting or refuting that phenomenon. Because this study has potentially identified specific design elements that are more important than others, that information can be used by architects to influence what is included in future design models for high schools as school leaders plan for growth, school construction, and renovation projects across the state. Because the cost of construction has significantly increased in the past 5 years, it is important for school divisions planning future school construction or renovation projects to be able to choose design elements that are not only cost effective but also the most beneficial to their student populations.

Significance of the Study

The role that the physical environment plays in the learning process has been well documented in Virginia (Cash, 1993; Crook, 2006; Hines, 1996; Lemasters, 1997). The impact of a new school facility on school personnel, students, and staff has also been documented in other states (Hickman, 2002; Lee, 2006). Despite the use of differing research models, previous researchers have reached the same conclusions: A relationship exists between the condition of the school facility and student achievement. Most of the researchers suggested further examination of the issue.

In 1993, Cash recommended replication of her methodology using urban high schools. Earthman, Cash, and Van Berkum (1995) suggested that further study of the relationship between the physical condition of school facilities and student achievement was warranted; however, they warned of the potential inadequacy of the Cash model for that purpose. Earthman and Lemasters (1996) suggested that the degree to which the building influences student achievement, attitude, and behavior should be explored in greater detail. Lemasters (1997) recommended that further research be conducted to adequately explore the relationship between student achievement and school facilities. Earthman (1998) stated, "People want to know if the built environment has an effect upon user performance, especially upon students in school buildings" (p. 4). Hickman (2002) suggested that a qualitative approach to assessing the relationships that exist within new school buildings would provide valuable information. After examining staff perceptions of learning and student achievement before and after a move to a new school,

Lee (2006) contended that research was needed to explain why the staff members perceived a change in student achievement and behavior.

Hickman (2002) asserted that one possible explanation for improved student and staff behaviors could, in fact, be the newness of the facility itself. Both Hickman and Lee (2006) suggested the need for a qualitative explanation of the impact of the physical environment on student achievement, attitude, and behavior (Hickman), as well as staff attitude and behavior (Lee). Crook (2006) suggested the need not only for a longitudinal study to compare the effects of facility conditions on student achievement but also for a qualitative examination of the specific physical factors that may impact student achievement. This research study will provide information about school personnel perceptions of the relationship between design elements and student achievement, as well as student, teacher, and staff attitudes and behaviors.

The budget process in the Commonwealth of Virginia is a lengthy, drawn-out activity that often consumes several months of the year. The amount of money needed to enable wholesale changes in the conditions of schools statewide is not always available. As a result, alternative funding sources have been utilized in different parts of the state, including private-public partnerships (VDOE, 2006; PPEA, 2002), to provide construction capital and to lessen the construction time for new school facilities. Many school districts are now faced with the task of planning, designing, and constructing new schools to accommodate burgeoning enrollments. Construction costs have skyrocketed within the past 10 years; those high costs coupled with the current financial conditions facing school divisions that choose to build new or renovate existing facilities will have an impact on future educational expenses for decades. The results of this study, combined

with the findings from studies by Cash (1993), Hines (1996), and Crook (2006), provide Virginia legislators and school district personnel with additional information to determine the most effective use of state funds for necessary school construction projects.

Personal Significance of the Study

The researcher who designed and conducted this study became interested in the relationship between new school facilities and the perceived impact on student achievement as well as student, teacher, and staff attitudes and behaviors after having worked in a new high school as a teacher from 2003 to 2006. The principal of the new school, Dr. Carol Cash (1993), had previously conducted research regarding the impact of existing school facilities on student achievement and student behavior. The school to which the researcher refers was located in a suburban area just outside Richmond, Virginia; it was specifically designed to incorporate all previously identified architectural elements that had been linked with positive student achievement (daylighting, acoustics, paint and color schemes, traffic patterns, and technological advancements). During the 1st year in the new building, the researcher was witness to a marked improvement in student achievement on state-mandated SOL testing compared to previous professional experience in an older building. During the 2nd and 3rd years in the building, improvement on state-mandated SOL testing was again noted. Was that improvement due to the condition of the facility? Were there other determinants that might be at the root of this phenomenon? In the mind of the researcher, an explanation for these and other questions was warranted.

Theoretical Model and Foundation

The researcher based the theoretical model on the premise that design elements present in new high schools in the Commonwealth of Virginia have a positive impact on the attitudes, behaviors, and opinions of students and staff in those schools. The relationship between the built environment and the cognitive process of learning, also known as social learning theory (Bandura, 1976) or social cognitive theory (Bandura, 1989), is the primary basis for this assumption. The secondary basis for the assumption presented in this model is manifested in Maslow's (1954) hierarchy of needs theory.

Social learning theory (Bandura, 1976) explains human behavior in terms of continuous reciprocal interactions among cognitive, behavioral, and environmental influences: An individual's behaviors are primarily learned either through modeling or observation. Social cognitive theory (Bandura, 1989) distinguished the influences in the imposed, selected, and constructed environment (Bandura, 1997). This research study was designed to explore the relationship between the physical design elements (the constructed environment) and the perceived impact of the constructed environment on student achievement as well as student, teacher, and staff attitudes and behaviors. Previous research concluded that poor physical condition of the learning environment results in a reciprocal effect on student achievement (Cash, 1993; Crook, 2006; Hickman; 2002; Hines, 1996; Lemasters, 1997), as well as staff attitude and behavior (Crook; Hickman; Lee, 2006).

Maslow's hierarchy of needs (1954) also served as a basis for the theoretical model for this research study. Maslow explained that basic human needs (food, shelter, security, and physical safety) must first be satisfied before the intellectual and social

needs of individuals can be met. It stands to reason that if the physical environment of the school addresses the basic needs of human beings, the learning environment is improved considerably. Consequently, because of the connections between the work of Bandura and Maslow, a combination of Bandura's social learning theory (1976) or social cognitive theory (1989) and Maslow's hierarchy of needs formed the foundation for this research study. Specific details regarding the relationship of Bandura's social learning theory and Maslow's hierarchy of needs to this research study are explained in further detail in the methodology section of chapter 3.

Conceptual Framework

The conceptual framework for this research study was based on previous research conducted in the Commonwealth of Virginia, which supported the theory that school buildings determined to be in standard or substandard condition have an impact on both student achievement and behavior (Cash, 1993; Crook, 2006; Hines, 1996). The framework also was based on previous research (Hickman, 2002; Lee, 2006) conducted outside the Commonwealth of Virginia, in Ohio and New Jersey, which indicated that design elements of new high schools do influence student achievement and behavior, as well as staff attitude and behavior. That influence, however, has not been clearly defined.

Cash Model

The study's conceptual framework was based contextually on the model created by Cash (1993) to examine the relationship between school building condition and student achievement and behavior in Virginia's rural high schools (See Figure 1).

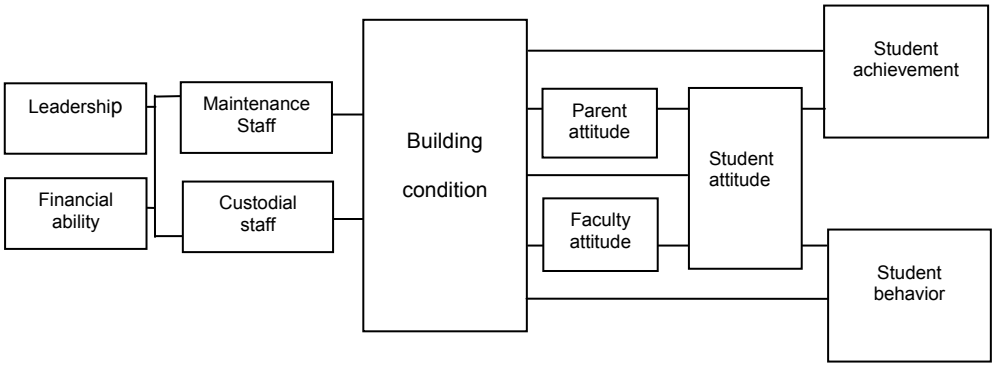

Figure 1. Cash's theoretical model (1993) illustrates the relationship between physical environment and structural as well as cosmetic items and their combined impact on student achievement.
From *Building Condition and Student Achievement and Behavior*, by C.S. Cash, 1993. (UMI No. 9319761), Copyright 1993 by the American Psychological Association.

After the Cash (1993) research was completed, subsequent attempts were made to replicate the theoretical model used in her research study in other states (Earthman et al., 1995) as well as within the Commonwealth of Virginia (Crook, 2006; Hines, 1996). Other researchers utilized different theoretical models and had similar findings that Cash found concerning the relationship between school facilities and student achievement and behavior.

Cash (1993) studied rural high schools in southwest Virginia and determined that buildings in poor physical condition have an impact on both the academic achievement and behavior of students. The researcher used a 27-question survey instrument called the Commonwealth Assessment of Physical Environment (CAPE) to establish the physical condition of each structure. She then evaluated the relationship between the physical building condition and student achievement using standardized test results as the measurement instrument. Cash also analyzed the relationship between student behavior and the condition of the school facilities, reporting that student suspensions and expulsions appeared to be reported more frequently in above-standard or standard school facilities.

Hines (1996) used the Cash model to study urban high schools in the Commonwealth of Virginia and concluded that building conditions do impact both student achievement and student behavior. Earthman et al. (1995) used the Cash model to study rural high schools in North Dakota and reached the same conclusion: Physical conditions of school buildings do impact student achievement and student behavior.

Hickman (2002) used the work of Cash (1993) and Hines (1996) as the basis for his examination of student and staff behaviors in new high schools in Ohio. Hickman

assessed student and staff behaviors and attitudes, as well as student achievement, 2 years before and 2 years after a move to a new high school for 13 new high schools constructed in the State of Ohio between 1997 and 1999. He compared that data to statistical information on student achievement from the schools in the research study. His research concluded that new high schools contain design elements that positively impact student achievement and behavior as well as staff attitude and behavior.

The conceptual framework for this study also was based on the work of Tanner (2007), who concluded through several research studies (1998-2007) utilizing a different theoretical model, that the design patterns of the school's physical environment positively impact and influence student achievement. He asserted that the school itself should be viewed as a comprehensive learning environment. The research conducted by Tanner employed an assessment instrument called the Design Appraisal Scale for Elementary Schools (DASE), which assessed how the physical design of the school impacted cognitive learning of students. The 39-item survey instrument measured school design using a 10-point Likert scale for each question to assess the presence of design factors (Tanner & Langford, 1998). Ayers (1999) modified the Tanner instrument to collect statistical information about 27 high schools in Georgia. Her research focused on the impact of design elements on 11th-grade student achievement as measured by performance on the Georgia High School Graduation Test (GHSGT).

Tanner (2000) also studied 44 rural and urban elementary schools in Georgia using a design appraisal scale that assessed not only the physical elements of the school design but also the technological capacity of the classrooms, the layout and design of the facility, and the design elements incorporated into each school (lighting, thermal

components, and student access to other parts of the building). He then analyzed the impact of the elements on student achievement using a one-way analysis of variance (ANOVA). Tanner used that same basic design model in 2003 to assess the perceptions of elementary school principals regarding the design elements that were found in their buildings and the impact of those elements on student achievement and staff behaviors. In both of those research studies, Tanner concluded that design elements positively impact student achievement.

There are many similarities in the aforementioned models as they were based on the most relevant research available at the time. Cash (1993) surveyed rural high schools in Virginia and established a relationship between student achievement and the physical condition of the facility using the CAPE. Hickman (2002) based his assessment instrument on the Cash model. Tanner (2007) evaluated the physical environment of 24 rural elementary schools in Georgia using the DASE, an assessment instrument that assessed four specific areas of the physical learning environment.

The increase in school building construction in Virginia, as well as across the nation, was considered to be a valid reason to consider using a combination of the Cash (1993) model and the Tanner (2007) model. The Cash model illustrated the possible influence that building and classroom conditions may have on student achievement. The Tanner model quantified the design elements that are incorporated into new school buildings and provided statistical data to support their effectiveness. School design and construction has become a focus for national organizations, as well as federal, state, and local government officials. With the increase in construction costs to build new facilities,

it is imperative that all stakeholders in the process of school design, construction, and project completion have an adequate understanding of the importance of this topic.

Propositions

The propositions for this study were based on the concept that students perform better in new high schools that are tailored to promote academic achievement. This belief was based on the work of Cash (1993), Hickman (2002), and Tanner (2007). People's opinions, beliefs, ideas, and reasons for behaviors and attitudes were examined and interpreted by the researcher through a social constructivism paradigm. A conceptual assumption was made by the researcher that students who attend a new high school are much happier with the learning environment; that assumption supports the contention that the new building facilitates students' learning to a greater degree than did the old building they previously attended. Subsequently, the researcher contended that students who feel safe in a new learning environment perform at a higher level of competence than demonstrated in their previous school buildings.

Methodology

This research study was conducted using a descriptive, holistic, multiple-case design that involved three research sites and three streams of data collection. According to Yin (2003), "the evidence from multiple cases is often considered more compelling [than from a single case], and the overall study is therefore regarded as being more robust" (p. 46). Triangulation of research sources was used to gather information for this study. According to Maxwell (2005), triangulation reduces the "risk of chance

associations and of systematic biases due to a specific method, and allows a better assessment of the generality of the explanation that one develops" (p. 112).

Data collection procedures included face-to-face interviews, focus group interviews, and document analysis of architectural information for each research site. Interview participants included the building principal, other administrators, and teachers who worked at each of the new high schools involved in the case study. At each research site, a focus group was created; the group consisted of veteran teachers (those with at least 8 years of experience), who had taught in a previous building prior to working in one of the high schools participating in the case study.

Focus group participants were purposefully selected to accurately represent the ideas, opinions, and beliefs of the persons working in those high schools. Maxwell (2005) stated that purposeful sampling typically represents the setting, individuals, and activities that occur in that particular setting. According to Maxwell, "deliberately selecting cases, individuals, or situations that are known to be typical provides far more confidence that the conclusions adequately [represent the population]" (p. 8). Document analysis of construction information and architectural information was utilized, and other pertinent information associated with the design process to build the school was evaluated by the researcher.

This case study involved three high schools that opened in the Commonwealth of Virginia between 2006 and 2007. Three different locations were selected for this case study, with each representing a different type of setting: urban, rural, and suburban. The primary research methodology utilized by the researcher was based on techniques advocated by Maxwell (2005) and Yin (2003). According to Yin, a multiple case study

design that allows the researcher to arrive at common conclusions will have "immediately expanded the external generalizability of [the] findings" (p. 53) when compared to a single case study design.

The goal of the researcher was to determine whether or not there was a perceivable impact on student achievement and behaviors as witnessed by the principals, teachers, and staff members of new high schools. Further, if certain behaviors were observed, the researcher attempted to discern the beliefs of the principal as well as the teaching and support staffs regarding the cause.

This research study attempted to determine whether or not the design of new high school facilities in the Commonwealth of Virginia improved (a) student achievement, as reported by the principals, teachers, and staff members of the new high schools; (b) the attitudes and behaviors of staff members working in those new school facilities, as reported by the principals, teachers, and staff members of the new high schools; and (c) the attitudes and behaviors of students attending the new high schools, as reported by the principals, teachers, and staff members of the new high schools. Finally, this qualitative research study was designed to determine whether or not the principals, teachers, and staff members of the new high schools under study perceived a relationship between design elements and student achievement.

Data for this research study were collected through interviews with each building principal as well as focus groups that consisted of teachers and staff members. Based upon those interviews and descriptive information gathered for each of the schools, a qualitative description of each high school was created. The interviews conducted with the participants were based in part on the CAPE survey instrument, created by Cash

(1993) and replicated by Hines (1996) and Ayers (1999), as well as the research subquestions created for this research study. The questions used in all interviews were closely tied, to the extent possible, to the literature review that follows in chapter 2. All interviews were recorded and transferred to a digital audio file, which was transcribed by a third party. Transcribed documents without identifiers, names, or other information that could be used to identify participants were returned to the researcher via electronic file transfer in July 2008. Transcripts were coded for data analysis by the researcher in July and August 2008, and specific themes were developed from the coded data. More specific details about the methodology, data collection procedures, validity assurances, and other information specific to this case study are provided in chapter 3.

Limitations

The limitations of this particular study include the fact that the research data collected represent the opinions, beliefs, and ideology of the principals, teachers, and staff members of three new high schools that opened in the Commonwealth of Virginia between 2006 and 2007. Most of the research collected for this literature review indicated that new high schools are usually built in suburban areas that are growing at a rapid rate. Because of that factor, a significant number of the students in these high schools could reflect the high range of the socioeconomic (SES) distribution in each of the communities served by these schools. Some of the data collected for this study could be reflective of that phenomenon and thus cause some of the collected data to be misinterpreted. Because the researcher's line of inquiry did not specify questions about student characteristics (SES, race, ethnicity, and transitory status), demographic information, or other variables,

it is unclear how much student characteristics could have influenced the participants' perceptions of student achievement or behaviors.

Additionally, some of the participants in this research study could have been biased toward the data presented because they worked in the school and wanted to present the best possible picture of the school. This possibility presented some threat to the internal validity of this study; to control for the potential threat, therefore, a transcription service was used to transcribe interviews, and the data were not coded until after all interviews were completed and had been transcribed. Qualitative research cannot control for threats to internal and external validity (Maxwell, 2005). The focus group questions were field tested in a building in which the researcher was employed as an administrator. To control for this possible bias or influence, the field test focus group was conducted by an outside researcher not associated with the school building.

The researcher, because he had worked in new facilities as both a teacher and an administrator, was well aware of the possible bias created by that factor alone. According to Maxwell (2005), it is impossible to eliminate the researcher's theories, beliefs and ideologies in a qualitative case study. The researcher was exposed to a multitude of information during the collection of research for the literature review; therefore, a potential for bias in explaining documented effects during the research process existed.

Case Study Descriptions

This case study involved the examination of three new high schools that opened in the Commonwealth of Virginia between 2006 and 2007. All three high schools were

constructed to meet expanded student populations within the districts they served. The potential school divisions were contacted in February and March 2008. Once each division consented to participate in the research study, interviews with building principals were arranged. After building principal interviews were completed, a focus group interview was conducted between April and June 2008 at each research site with staff members working in the building. Information has been included to describe the communities served by the schools, the population demographics, and construction information and timelines, as well as other pertinent facts to enhance the data collected through the interview process. Additional information about each school participating in the case study appears in chapter 3.

Definition of Terms

For the purposes of this study, the following operational definitions are provided:

School design. School design includes the structural elements that are incorporated into the architectural design of a high school building used for Grades 9-12 in the Commonwealth of Virginia.

School facility. A school facility is defined as any building, public or private, used in an educational setting as a K-12 school.

Student achievement. Cash (1993) defined student achievement as the measurement of academic proficiency on a standardized test. For the purpose of this literature review, student achievement is defined as overall student academic performance.

Staff. For the purposes of this study, staff refers to teachers and other employees

who work in a public K-12 school environment in the Commonwealth of Virginia.

Staff attitude and morale. Hickman (2002) defined staff attitude and morale as staff pride, staff feelings (as they relate to the school), and staff attendance. For the purpose of this literature review, the same definition is used.

Student attitude and behavior. Hickman (2002) defined student attitude as student pride, student discipline, and student morale. The same definition is utilized for this study.

Focus groups. Teachers with at least 8 years of contractual teaching experience in a public, K-12 setting prior to working in their current setting were selected for participation in these group interviews in order to standardize to some degree the make up of each of the focus groups.

Organization of the Study

This study focused on the relationship between the design elements incorporated into new high schools constructed in the Commonwealth of Virginia and perceptions of the building principals, other school administrators, and teachers regarding student achievement following a move into a new facility. The researcher used qualitative research methods in a descriptive, holistic, multiple-case design to ascertain the opinions, beliefs, and attitudes of building principals as well as purposefully selected staff members working in new high schools in the Commonwealth of Virginia regarding the building's impact on student achievement and on student, teacher, and staff attitudes and behaviors.

The primary means for data collection included both structured and unstructured interviews and focus group interviews conducted between April 2008 and June 2008 in the Commonwealth of Virginia as well as document analysis of architectural information.

All of the participants in this research study were school system employees who worked in the new buildings. The researcher attempted to base the interview questions on the work of previous research regarding the relationship between school facility conditions and student achievement, attitude, and behavior, as well as staff attitude and behavior (Cash, 1993; Crook, 2006; Hickman, 2002; Hines, 1996; Lee, 2006).

Chapter 1 has presented the introduction, statement of the problem, research questions, purpose of the study, significance of the study, theoretical model and conceptual framework, limitations, assumptions, definitions, and organization of the study.

Chapter 2 includes a review of literature related to school facilities design, including the following topics: background and history, current conditions of the nation's schools, a synthesis of research on facility conditions and the relationship to student achievement and behavior, as well as a summary of the current research regarding school design.

Chapter 3 provides information related to the methodology used in the study. Additionally, the theoretical foundation and conceptual framework for this research study are presented in chapter 3.

Chapter 4 presents findings and information culled from the data sets derived from the information collected.

Chapter 5 presents a summary of the findings, including themes developed from the research study, discussion, conclusions, and implications for further study.

CHAPTER 2: REVIEW OF THE LITERATURE

Introduction

The purpose of this literature review was to investigate research studies that focused on the relationship between building conditions and student achievement. A specific attempt was made to find research studies that examined the impact of new school design elements on student achievement, as well as student, teacher, and staff attitudes and behaviors. To accomplish this, a review of previous as well as current literature was necessary to identify areas of concern and to explain previous attempts to define the relationship between school facilities and student achievement and student and staff attitude and behavior.

In some cases, there was limited research available that described the impact of new school facilities on student achievement or student, teacher, and staff attitudes and behaviors. Much of the research available that explored the relationship between school facility conditions and student achievement, as well as student, teacher, and staff attitudes and behaviors, focused on existing buildings. The literature review is divided into five main sections.

The first section of the literature review examines the history of school design in the United States. An attempt was made to explain the how, why, when, and where of school design, as well as the problems associated with previous design models. The second section investigates the state of the nation's schools and their relationship to current conditions, student achievement, student behaviors, employee performance, and school climate. The third section synthesizes previous research regarding the relationship between the condition of school facilities and student achievement, student behavior, and

staff attitude and behavior. The fourth section summarizes school facility design recommendations supported by school facilities organizations, researchers, and professional associations. The fifth section synthesizes the recommendations for future design models developed by school facilities designers, professional design associations, and government agencies that support school facilities design concerns.

Because of the limited availability of valid, rich qualitative data that adequately explained the perceptions of principals, teachers, and staff members working in new high schools, a qualitative research study needed to be completed. There was an abundance of quantitative research that had identified a significant statistical difference between student achievement in a school building in substandard condition and student achievement in a building identified as being in above-standard condition (Cash, 1993; Crook, 2006; Hines, 1996). The CAPE instrument created by Cash provided a measurement instrument to gauge the condition of the school; however, it did not provide an explanation as to why a building deemed to be in above-standard condition had an influence on student achievement. The gap existing in the scholarly research resulted from a lack of adequate and detailed explanation to support the differences reported by research participants.

The collection of research for this literature review was completed primarily through the use of online electronic databases available through the Gelman Library at The George Washington University. The process of reviewing the literature began with the use of electronic databases such as EBSCO, PROQUEST, and JSTOR. In addition, Web sites available via the Internet, as well as government databases such as ERIC, NCEF, and NEPIS were searched between January 1, 2006 and November 1, 2008.

Statistical information was retrieved from the United States Department of Education Web site (www.ed.gov), as well as the Virginia Department of Education (VDOE) Web site (www.doe.virginia.gov), to complement the research collected through this literature review.

For this literature review, the researcher focused on studies conducted within the past 30 years that explored topics such as school facilities, academic achievement, and structural, as well as environmental, conditions of school buildings and facilities. Electronic databases of scholarly dissertations and journal articles also were utilized as resources. Searches were conducted using key terms such as "new school facilities," "student achievement and school facilities," "school facilities and academic achievement," and "school facilities and behaviors." The research collected represented a primary focus for the content of the literature review. State facilities reports, professional school facilities associations, and facilities research and design Web sites also were consulted and utilized as resources for the remaining research that appears in this literature review.

History of School Design

The early days of school design were elemental and basic: A school was built quickly, efficiently, and cheaply to serve the needs of the community (Agron, 1998). A basic box shape or "H" pattern was common in most elementary schools, whereas junior high and high schools utilized multiple layouts and designs; however, few or none met the educational needs of students (Agron, Spoor, Cox, & Brown, 1998). Early school designs were based on efficiency: The school was built quickly, cheaply, and with the

least amount of input from the community. In an attempt to improve the functionality of the school building, many different ideas were incorporated into the design process.

Multiple design styles and plans have been utilized since World War II. *American School & University* magazine reported that, in 1949 alone, an astonishing 61% of school systems built new buildings (Agron et al., 1998). School designers experimented with open-plan models, campus-style designs, open-plan classrooms, and many other school design models in the 1950s (Agron et al.). School design in the ensuing decades resulted in a significant number of buildings that were poorly planned and constructed with inferior materials and poor workmanship, thereby experiencing a short lifespan. The impact of these poorly designed schools continues to plague American students. In the decade that witnessed America's venture into outer space, students across the nation were spending their days in portable classrooms, carpeted classrooms, and spaces that were supposed to be more energy efficient. Those spaces, at once thought to be adequate and cost efficient, were found to be filled with a multitude of environmental as well as health and safety issues that were ultimately addressed through renovation or overhaul of the original designs.

Questions about a possible relationship between these newly identified problems and the learning environment emerged in the late 1960s and early 1970s. The nation's schools, however, were overflowing with students. In 1971, school-age enrollment in the United States hit 51.4 million students (Agron et al., 1998), and school systems across the country became aware of environmental problems within their schools, such as asbestos, pollutants, and chemicals that impacted the health and safety of America's school population. The design models of the late 1970s, especially the open-space school or

open-plan systems, were still having an impact on the achievement of students in the year 2007. Because many of those schools have undergone some form of cosmetic renovation, most of them are still used today and contain many of the design inadequacies previously identified. George reported that "50% of all schools built from 1967 to 1970 were open space; in some States, nearly all of the newly constructed schools had open plan designs" (as cited in Weinstein, 1979, p. 594). Many of the school buildings from that period that are still in use are found to be in relatively the same condition as nearly 40 years earlier. Thus, the design elements contained within those buildings continue to impact student achievement.

Schools have evolved from small, one-room schoolhouses built in the 19th century to mammoth mega-high schools. There were 250,000 schools in the United States just 70 years ago; that number had shrunk to about 91,000 by the beginning of the 21st century (Lyons, 2001). Research has suggested that secondary schools of no more than 600-800 students maximize student potential (Lackney, 2000). In addition, smaller schools allow students to feel connected to the community within their school and provide them with more opportunities to participate in school activities and exercise leadership within the school environment (Lackney, 1999). Much of the school design research in the past 30 years focused on the impact of the physical structure or layout of the building on student achievement and behavior as well as staff attitude and behavior. Historically, school divisions have attempted to maximize their investment return for dollar expenditures. This principle has applied to costs associated with school construction as well.

Historical Construction Costs

In 1945, Whitehead reported estimates as high as $5 billion needed to build new

or renovate existing structures across the country. A recent report indicated that public school districts spent more than $304 billion on “hard costs” for public school construction (Filardo, Vincent, Sung, & Stein, 2006). In the past decade, over 12,000 new schools have been built and more than 130,000 renovations and other improvement projects have been undertaken (Filardo et al.). School system expenditures increased from a national average of $106 per pupil in 1928 (Agron et al., 1998) to almost $9,724 per pupil in Virginia in 2005 (VDOE, 2006). As the cost of education per student has increased, so has the number of students enrolled in public schools.

In the past decade, the average enrollment of public schools in the United States reached about 47 million students (Filardo et al., 2006). Based on those numbers, statistics reflected a 10-year national average of $6,519 spent per pupil for school construction costs (Filardo et al.). Alaska ($12,482), Connecticut ($11,345), and Massachusetts ($10,735) spent the most money per pupil on school construction in the past decade, whereas Montana ($2,004), West Virginia ($2,774), and Louisiana ($3,008) spent the least (Filardo et al.). With the escalating costs associated with school construction, an examination of the current conditions of the nation’s schools was needed to accurately gauge the situation regarding judicious use of the funds available.

Current Conditions of the Nation’s Schools

The literature has suggested that the nation’s schools are crumbling. Peeling paint, inadequate classroom space, noise from both outside and inside the school environment, structural problems, and design flaws contribute to a major problem in the United States: the conditions of the nation’s schools are deplorable, and it has been established that

school facilities affect learning (Cash, 1993; Crook, 2006; Hines, 1996). Spatial configurations, noise, heat, cold, light, and air quality affect teachers' and students' ability to perform. In some cases, buildings constructed as civic monuments in the 1920s and 1930s still provide a suitable learning environment, but buildings erected in the cost-conscious, cost-cutting 1960s and 1970s do not (Agron et al., 1998).

Across the nation, increased accountability for public education has become a central theme for both politicians and education reformers. Many politicians have demanded increased accountability through legislation such as the No Child Left Behind (NCLB) Act (2001), and some have focused their attention on the deteriorating conditions of the nation's public school buildings. In response to some of these demands, public-private partnerships at the local, state, and national levels have been developed with the purpose of improving the conditions of the nation's public schools. Recently, in some areas of the country, corporate partnerships have been developed to promote the most efficient and beneficial school design models at not only the state but also the national level. These efforts to improve the condition of the nation's schools are much needed, as is evidenced by the literature.

In 1995, two thirds of America's schools reported that all buildings were in adequate condition, with most needing preventative or corrective repair (United States General Accounting Office [USGAO], 2000). The remainder reported the need for extensive repair or replacement of buildings. Additionally, over half of America's schools more recently reported at least one major building feature in need of repair or replacement (Gillespie, Epps, Griesdorn, & Butin, 1999). In 2003, it was reported that about one third of all American public schools, serving 14 million students, needed

extensive repair or replacement; 28,100 schools had less-than-adequate heating, ventilation, and air-conditioning systems; 23,100 schools had less-than-adequate plumbing; and, 21,000 schools had less-than-adequate roofs (Brooks-Lair, 2003). The statistical information reported by Brooks-Lair has been included in national research studies reported by the federal government, and similar statistical information has been reported by other researchers. Additionally, similar academic results believed to have been caused by the condition of school facilities have been found in multiple research studies conducted since 1979.

According to the Educational Longitudinal Study of 2002 conducted by the National Center for Education Statistics (NCES), disrepair and inadequate cleanliness, safety, and security measures were some of the major concerns of 10th-grade students in the United States (Planty & DeVoe, 2005). The NCES report stated that 66% of the schools involved in that study had at least one unacceptable structural condition. Additionally, of the students surveyed, 16% reported trash on the floors, 10% reported graffiti somewhere in the school, 33% reported unclean floors or walls, 30% reported no stalls on the bathroom doors, and 8% reported chipped paint on the walls (Planty & DeVoe). Other statistical information gathered about the conditions of the nation's schools has included similar findings.

Everyday an estimated 14 million school children attend deteriorating public schools (Schools in Need, n.d.). Estimates to repair these conditions and bring educational facilities up to a minimum standard nationwide range from $112 billion (USDOE, 1999) to $322 billion (Schools in Need). In 2000, the USGAO estimated that it would cost an additional $60 billion to build new schools simply to keep up with

expanding enrollment figures. The skyrocketing cost of construction has forced district-level personnel to justify huge expenditures on building facilities and the construction of new schools. With the added pressure of the federal NCLB, school districts are likely to struggle with the debate over the expenditures associated with school construction. Because of the cost associated with school renovation or construction, it becomes imperative that school facilities are designed to exert a positive impact upon student achievement, according to the research gathered for this literature review.

Impact on Student Achievement

Researchers have suggested that the conditions of the physical environment are just as likely to impact student achievement as is the teacher in the classroom. Bowers and Burkett (1988) found that students in new buildings outperformed students in older ones and reflected better records for health, attendance, and discipline. In addition, Jago and Tanner (n.d.) reported a connection between building age and student achievement and behavior. Research has indicated that better school buildings lead to improved achievement scores on standardized tests (Cash, 1993; Earthman & Lemasters, 1998; Edwards, 1992; Hines, 1996). Cash concluded that achievement was found to be higher in buildings with higher quality ratings, better science lab facilities, structured maintenance plans, and functional heating ventilation and air conditioning (HVAC) systems. In a 1994 report, Moore and Lackney theorized that as the physical setting of the school improves, teacher and student behavior improve; thus, student achievement is improved dramatically, as well. They further theorized that "physical environment factors affect educational outcomes by affecting teaching practices" (p. 16), which in turn impact student achievement.

Researchers have examined children's cognitive development and the relationship that may exist between the learning environment and student achievement. Cognitive learning theories developed from that research have concluded that children learn best when the learning environment is stimulating and the physical environment is varied. Attention to design elements that address multiple intelligences (Gardner, 1983) within the classroom, as well as brain-based research into how students learn, has allowed new classroom environments to reach students of all ability levels. Sanoff (1994) cited the need for greater variety in physical facilities to accommodate various teaching and learning styles. Earthman (1998) concluded that "spending funds to improve the built environment might produce greater student performance results than funds spent on instructional materials, textbooks, and even teachers" (p. 21). A report prepared for the Tennessee Department of Education (Young, Green, & Roehrich-Patrick, 2003) also indicated that higher student achievement is associated with well-maintained buildings.

Earthman and Lemasters (1998) reported that students attained higher achievement scores in new school facilities, indicating that as the age of the building decreased, a corresponding increase was seen in math, reading, and composition scores. Previous research on this topic conducted by Earthman et al. (1995) found that student achievement scores varied between 1 and 11 percentile points on the Comprehensive Tests of Basic Skills (CTBS), administered in North Dakota public schools, when the variable of school facilities condition was a part of the research. Edwards' (1992) research in Washington, DC public schools found that student achievement scores increased by 4.55% in buildings that were ranked as being of better quality. Multiple research studies focusing on this topic have reached similar conclusions. The extent of

improvement, however, depends upon the study conducted, the place it was completed, and the context within which the research data were analyzed.

Studies on the conditions of the nation's school facilities have been conducted in Washington, DC; Milwaukee, WI; Saginaw, MI; rural and urban Virginia; and the State of Tennessee. The results of these studies were reported in a 2003 report for the Tennessee Governmental Advisory Commission on Intergovernmental Relations. Young et al. (2003) also reported that a Milwaukee study measured the condition of 139 schools and compared physical conditions to math and reading scores for the years 1996-1998 in 130 school buildings. After controlling for SES, the researchers discovered that the physical building conditions actually had as much of an impact as any other variable. A Tennessee study that investigated the differences between two groups of students in different physical environments in the same county compared "students in the new building with those who went to school in a building constructed in 1939" (Young et al.). Students in the new building significantly outperformed students in the old one. Cash (1993) studied rural schools in Virginia, whereas Hines (1996) chose to study urban Virginia schools. Their combined research revealed that cosmetic aspects such as the condition of floors, ceilings, and walls had more of an impact than any other identified variables on student achievement. Much of the research conducted regarding physical conditions of schools has explored the measurable impact on student behavior as well as achievement.

Student Behavior and School Climate

Quantitative research has indicated the existence of a relationship between the condition of the physical environment and student behavior. Cash's 1993 study of rural

high schools in Virginia found that suspensions and expulsions actually were higher in facilities that were ranked as higher in quality based upon the survey instrument. Her explanation for that phenomenon was that perhaps staff and administrative expectations for student behavior were much higher because the school was maintained and in such good condition. Hines' 1996 study also found that incidents of suspension were more likely to be reported in buildings that were in better condition. Hickman's 2002 study of new high school facilities, however, produced the opposite result. His research found that suspensions and expulsions had, in fact, decreased in new facilities when compared to instances in the previous facilities. Hickman theorized that "student behavior [was] positively improved [thereby resulting] in fewer major student incidents" (p. 117). Quantitative research has been mixed in regards to the relationship between suspensions or expulsions and the quality or age of the facility. Further study is needed to explore this aspect of research. The documented results regarding the relationship between physical conditions of schools and student achievement and behavior have been extended to explore the effects that building environments may have on teachers and staff as well.

Employee Performance

Hickman (2002) reported that staff were more likely to come to work and be productive in a new facility for the simple reason that "pleasant working conditions tend to positively support the notion of better staff pride and morale and thus better attendance results because the conditions support improved teaching and learning" (p. 121). The most vital resources that enable a school to function are those provided by the teachers. The effort, commitment, and involvement from teachers "not only [relate] to student learning; [they are] also the ultimate means through which schools, through greater

teacher effort and involvement, are able to accrue greater parental support for, and assistance in their children's learning" (Rosenholtz, 1989. p. 420). It stands to reason, therefore, that if the teachers in the building are dissatisfied with the physical conditions for learning, the potential exists for an identifiable negative impact on student behavior as well.

According to Leung, Chan, and Wang (2006), teachers reported that building conditions did impact their attitudes and behaviors in new facilities. The researchers also reported that teachers cited a need for working spaces and shared work areas to enable them to carry out their tasks more effectively. Because teachers spend an enormous amount of time in the classroom, the assumption can be made that they want the working environment to be pleasant and genuinely rewarding.

In summary, a significant amount of research has been conducted regarding the impact of a school facility on the attitudes, morale, and behaviors of staff, faculty, and students. Hickman's 2002 study established a positive relationship between staff attitude and morale and new school facilities. Lee (2006) confirmed the research of Hickman and established that not only does the public have high expectations for the success of a new school, but they can realistically expect the climate of the school to improve as well.

Staff Behaviors and Attitudes

Hickman (2002) and Lee (2006) both confirmed that teachers reported a greater sense of pride and staff morale in a new school facility. This topic warranted further exploration, as only a few studies had been completed on this particular subject.

Hickman (2002) found that teacher attendance rates improved, compared to their attendance rates at a previous facility, when they moved into a new facility. He also

found a positive relationship between staff morale and pride and a new facility when compared to morale in previous buildings; there also appeared to be improvement in both student and staff attitudes when a new building was occupied. In summary, a corresponding move to a new school facility was shown to be positively related to student and staff behaviors and attitudes (Hickman).

Lee (2006) found that the perceptions of staff in a new facility had shown improvement, compared to their perceptions of the old facility: A significant relationship was indicated for 28 of 40 school climate indicators used in his research study. Staff members who participated in the research tended to have similar opinions across all variables measured. Lee concluded that the positive changes in staff perception of school climate were not significantly influenced by demographics.

In contrast to the aforementioned studies, Ayers (1999) found that the number of years of teaching experience and the educational background of the teaching staff had little impact on the degrees of variance in her study findings. The goal of Ayers' study was to determine whether or not school facilities impacted children's educational achievement as measured by the Georgia High School Graduation Test (GHSGT). Her study did not examine new school facilities, but instead looked at 27 existing high school facilities in the State of Georgia. Most of the available research regarding the relationship between physical environment and student achievement and behaviors was based on the idea that the physical environment does impact both the learning environment and the working environment.

Theoretical Framework

The theoretical framework for this research study was based on the theory that design elements found in new high schools built in the Commonwealth of Virginia positively impact student achievement as well as student, teacher, and staff attitudes and behaviors. This premise was derived from two distinct educational theories: (a) the social learning theory (Bandura, 1976) or social cognitive theory (Bandura, 1989), which emphasized the importance of behavior modeling and observation of other behaviors, attitudes, and the emotional reactions of others; and (b) the ideology contained within Maslow's hierarchy of needs (1954). For human development to progress, Maslow stated that paramount needs of food, safety, and shelter must be met before other needs such as belonging, affection, achievement, independence, or self-fulfillment can be attained. In essence, both ideas are related to theories of cognitive learning; because the idea of cognitive learning is related to the process by which one learns, the investigation of whether or not the conditions present within the learning environment actually influence the way children learn serves a useful purpose.

Bandura

The social learning theory (Bandura, 1976), in its original form, emphasized the importance of observing and modeling behaviors, attitudes, and emotional reactions of others. The theory explained human behavior in terms of continuous reciprocal interactions among cognitive, behavioral, and environmental influences. Social cognitive theory (Bandura, 1989) entails a detailed explanation of human functioning in terms of reciprocal causation or the interactions among cognitive learning dynamics, biological events, behavioral patterns, and environmental influences. Bandura (1976) identified

contemporary social learning theory as a bridge or transition between traditional behaviorist learning theories and what were then the newly developed cognitive learning theories.

Bandura (1989) stated that the interactions of cognitive, affective, and biological events, as well as behavioral patterns and environmental influences, operate as determinants to influence people's social behaviors. Thus, these factors influence people's learning. People's behaviors are learned primarily through either modeling or observation. Social cognitive theory (Bandura, 1989) identified the influence of and differentiated among three types of environmental structures: the imposed environment, the selected environment, and the constructed environment (Bandura, 1997).

Previous research on this topic had determined that poor physical condition of the learning environment results in a reciprocal effect on student achievement (Cash, 1993; Crook, 2006; Hickman, 2002; Hines, 1996; Lemasters, 1997), as well as staff attitude and behavior (Crook; Hickman; Lee, 2006). The traditional behaviorist theory supports the contention that the student and staff attitudes and behaviors present within a school are learned or observed through interaction with others; therefore, because people's attitudes, behaviors, and social interactions are influenced by the constructed environment, it made sense to attempt to explain how, why, and when this influence actually occurs. Bandura believed that people construct outcomes or expectations for themselves from the observed conditions that surround them as well as the environmental events in which they participate. This research study explored the physical design elements (the constructed environment) with regard to their perceived impact on student achievement as well as student, teacher, and staff attitudes and behaviors. The main ideas presented in this

research study were based on the work of Bandura and grounded in the principles of social learning or social cognitive theory (Bandura, 1976, 1989) described in his research.

Cognitive learning theory is the belief that people learn behaviors through specific repeated actions and that there are specific stages of observation and imitation that can produce learning without performance (Bandura, 1976). Reciprocal causation, according to Bandura, is the idea that behavior can influence the environment and the person. Bandura supported the contention that the person, the behavior, and the environment all have an impact on each other. This ideology served as justification to further explore the identified relationship documented in previous quantitative research studies (Cash, 1993; Crook, 2006; Earthman et al., 1995; Hickman, 2002; Hines, 1996; Lee, 2006; Lemasters, 1997), which supported the contention that the physical environment of the school does, in fact, impact student achievement by as much as 11 percentile points (Earthman et al.) and that student and staff attitudes and behaviors do, in fact, improve in a new school facility (Hickman; Lee).

Cognitive learning research is based on the theory that the learner and a facilitating agent form a joint learning system (Salomon & Perkins, 1998), thereby enabling the learner to achieve critical levels of learning. Based on that ideology, the basic premise of this research study was that the facilitating agent (the school facility itself) helps to create a better learning system. Thus, the critical conditions for optimal learning are achieved through school facilities designed with components that promote the cognitive learning of students, as well as positive social interaction among teachers, students, and staff. This theory is closely related to the ideas of Maslow and the theory that he developed to explain the stages of human development.

Maslow

Maslow's hierarchy of needs (1954) also served as a basis for the theoretical model of this research study. Maslow explained that basic human needs (food, shelter, security, and physical safety) must be satisfied prior to the satisfaction of individuals' intellectual and social needs. It stands to reason that if the physical environment of the school does address the basic needs of human beings, the learning environment is improved considerably. Subsequently, if the learning environment is improved for students, there is a reciprocal effect on the level of student achievement attained.

Maslow's (1954) hierarchy of needs outlined safety as a basic necessity and priority for all mankind. Safety brings stability to human lives, and appropriate safety features are included in current school design without making students feel as though they are imprisoned. Parents, teachers, students, and community members are, therefore, ensured that the school serves as a safe place in which to learn, a feature that is of paramount importance given the recent tragedies that have involved students across the nation. School safety is imperative to the design of the school facilities; however, the implementation of security measures should not create an institutionalized environment. The preponderance of data collected through previous research models (Cash, 1993; Tanner, 2007) indicated that the condition of school facilities has a positive correlation with student achievement and behavior as well as staff attitude and behavior. An explanation of why student achievement improves in a new school building from the perspective of the participants helps to further explain the relationship between school facilities and student achievement from a perspective that is not entirely driven by quantitative data.

The theoretical model for this study was based on research that supports the possibility of a relationship between design elements of new school facilities and student achievement and staff behavior within those facilities. Previous research on school building conditions and student achievement found that a consistent relationship existed between poor facilities and poor performance (Cash, 1993; Filardo et al., 2006; Hines, 1996; Lemasters, 1997; Schneider, 2002). Hickman (2002) used the work of Cash and Hines as the basis for his examination of student and staff behaviors in new high schools in Ohio. The other component of the theoretical model for this research was based on the work of Tanner (2007). Tanner asserted that the design patterns of the school's physical environment impact and influence student achievement and suggested that the school itself should be viewed as a comprehensive learning environment.

Researchers have concluded that the quality of a school's facilities also impacts its ability to support the implementation of education reform (LAB Policy Perspectives, 1997). In addition to presenting tangible, structural impediments to learning, poor school conditions may also affect student performance, thus, sending a negative message to children about their worth and the value of education (LAB Policy Perspectives). Hickman (2002) concluded that new school facilities appear to positively influence pride for students and staff as well as morale and attitude. Poor building conditions greatly increase the likelihood that teachers will leave their schools—a troubling fact given the need for more and better teachers in the most disadvantaged schools (Buckley, as cited in Filardo et al., 2006).

Consequently, the research and literature that addressed this relationship were reviewed and used to facilitate further discussion. This literature review was based on

previous research studies that had attempted to explain the relationship between physical conditions of schools and student achievement.

Previous Research

McGuffey and Brown (1978) examined the relationship between building age and student achievement. That research theorized that building age exerts the most influence on math and reading scores. Weinstein (1979) noted that "the weight of evidence suggests that design factors can have a significant influence on students' general behavior" and on their "attitudes toward the class and others" (p. 584). An additional study by McGuffey (1982) reported two major conclusions: Old, obsolete buildings have a detrimental effect on student achievement, whereas modern buildings facilitate learning; and building conditions have a differing impact across grade levels and subjects. Cash (1993) identified a host of explanations for poor building conditions, including inadequate maintenance, lack of funding, and poor leadership. Other researchers suggested that the initial design of the facility itself may be inappropriate for the needs of the students.

Research Synthesis

In Virginia, there is a distinct disparity between old and new facilities (Gillespie et al., 1999). Older schools, those built prior to 1990, often do not contain safety features, such as telephones in classrooms, shared commons or multipurpose areas, technologically advanced media centers or libraries (Gillespie et al.), or cost-saving features such as fluorescent lighting or motion-controlled lighting systems, which conserve energy.

Research in Virginia identified a correlation between the conditions of the educational environment and student learning and achievement (Cash, 1993; Hines, 1996).

In a 1995 examination of building condition and student achievement in North Dakota, Earthman et al. found that measurable student achievement in above-standard buildings was higher than the achievement in substandard buildings. In 1996, Hines found that student achievement was as much as 11 percentile points lower in substandard buildings compared to achievement in above-standard buildings. Other studies determined that physical conditions have direct positive and negative effects on teachers' morale, sense of personal safety, and feelings of effectiveness in the classroom, as well as the general learning environment (Corcoran, Walker, & White, 1998). Research and experience have suggested that spatial configurations, color, ventilation, acoustics, and other design elements such as dual functionality are just as important to student achievement as the quality of the teacher (NSSD, 2005). The conditions of school buildings in terms of environment are just as important as the feelings of safety the school actually promotes for staff and students.

Cash (1993) found a positive relationship between building condition and student achievement in rural schools in Virginia. Cash assessed the condition of rural high schools (n = 41) using an assessment instrument called the CAPE, a 27-question survey designed to assess the physical environment of Virginia schools. Cash reported that 7 of the 27 assessment categories indicated that a significant relationship existed between the physical plant condition and student achievement and behavior. She found that student achievement scores on the Tests of Academic Proficiency (TAP) varied as much as 2 to 5 percentile points for students in substandard buildings compared to scores for students in

standard buildings. Cash also reported that student behavior was better in school buildings with higher quality ratings as measured by the CAPE assessment instrument.

The Cash (1993) research study targeted small high schools that were classified as rural, each having a senior population of fewer than 100 students. A total of 47 schools from 36 school divisions were targeted for the study. Schools selected for the study served populations that ranged from 10th through 12th graders only to schools serving kindergarten through 12th grade. The primary factors shared by all of the schools identified for the study were the following: (a) the TAP had been taken by all 11th graders at the school during the 1991-1992 school year, and (b) scaled raw scores from the test were provided for use in the study. The CAPE instrument was developed by the researcher to assess the cosmetic and structural condition of each of the school buildings in the study; rankings were developed that evaluated each building on scaled-score criteria.

The assessment instrument results and relevant documentation for Cash's (1993) study were collected from 43 of the 47 schools identified for the study. The CAPE instrument ratings for both structural and cosmetic conditions were compared to student achievement scores on the TAP; analysis of covariance was used to compare building conditions to adjusted achievement mean scores, as well as composite total achievement means, across both the structural and cosmetic rankings. The final statistical test that was performed employed regression analysis to correlate achievement scores with behavior ratings and the age of the building.

Some limitations of the Cash (1993) research include the fact that it was focused on rural high schools with senior populations of fewer than 100 students. Assumptions

include the possibility that these schools were located in poor, rural areas of the state where the schools might not have been in as good condition as schools in an urban area such as Fairfax or Prince William County. Another limitation is the fact that this statistical analysis was performed before the advent of the state-mandated SOL testing and the overhaul of the high school curriculum, which took place in the mid-1990s (VDOE, 2007). One final limitation of the Cash research is related to the fact that it was conducted more than 15 years ago; the conditions of many schools in Virginia and across the nation have been impacted by both federal legislation such as NCLB and state actions such as public-private partnerships. Other research conducted since the Cash research study, however, found similar results, using a variety of theoretical models and statistical procedures.

Earthman et al. (1995) utilized the Cash (1993) model in a study of high schools in North Dakota (n = 120); they reported that student achievement was positively affected by above-standard buildings in 18 of 23 categories measured. The research of Earthman et al. was based on a survey instrument used in the Cash research; the response rate of 60% represented 120 of the 199 high school principals targeted for the study. Earthman et al. compared student performance on the Comprehensive Test of Basic Skills (CTBS), which measured student performance on 13 separate content-related subtests. They measured building condition in three separate subcategories: overall condition, cosmetic condition, and structural condition. In the statistical comparisons for overall building condition, Earthman et al. found that 11 of the 13 subtest scores on the CTBS were between 1 and 9 percentile points higher in buildings that were identified as above standard when compared to the scores of students in buildings that were identified as

substandard.

The research conducted by Hines (1996) replicated the Cash (1993) research model, exploring the relationship between building condition and student achievement and behavior. The Hines research focused, however, on large urban high schools (n = 88) in the Commonwealth of Virginia. The researcher found that higher student achievement was associated with newer buildings, the presence of more windows, and improved HVAC systems (Hines). Student achievement was measured using the TAP scores for 11th-grade students during the 1991-1992 school year. Hines defined student behavior as the number of disciplinary infractions, suspensions, and expulsions reported by the schools included in the study. Analysis of covariance, linear regression, and correlation analysis were conducted to determine the relationship between building condition and student achievement.

Hines (1996) concluded that poor school facilities have an impact on student achievement. Hines' research revealed that scaled scores were higher in every category of the TAP when scores of students in buildings of substandard condition were compared to scores of students in above-standard buildings, as evidenced by the CAPE assessment instrument. Hines found that test scores ranged from 7.16 percentile points higher on the social studies subtest to 11.63 percentile points on the sources of information subtest, which analyzed student research skills. Hines also compared the relationship of the facility condition to student behavior and determined there were more suspensions in the above-standard buildings than in substandard buildings. Expulsions, substance abuse reports, and incidents of violence also were more frequent in the above-standard buildings. According to Hines, the higher numbers of discipline infractions found in the

study could be attributed to staff efforts to report more discipline infractions.

Hines (1996) found a positive correlation between favorable building conditions and student performance. The researcher reported that when the cosmetic conditions were found to be better, increases in scores on each subtest of the TAP were observed. Hines also reported that the structural building conditions influenced every subtest mean score except the sources of information subtest. The researcher attributed this finding to the combination of better physical school conditions and students' having been provided with greater academic opportunity. Hines reported that students attained higher achievement scores in schools that were newer, had more windows, and were carpeted.

Earthman and Lemasters (1998) synthesized previous research that investigated the relationship between building conditions and student achievement; they reported that student achievement was impacted by as much as 11 percentile points when students attended a school building that was in above-standard condition. The researchers further suggested that building personnel could improve facility conditions to positively impact student achievement. The researchers concluded that funds spent on the built environment could have a more substantial impact on student achievement than funds spent on textbooks, instructional materials, or even teachers.

Lemasters' (1997) synthesis of 53 research studies conducted since 1980 established a relationship between the variables of climate, lighting, and noise and student learning and behavior. Lemasters investigated ways in which the building environment affected two student variables, student achievement and student behavior. Her research synthesis found that students attained higher achievement scores in newer facilities. In addition, there were fewer discipline problems, and attendance records were

better in new facilities. Lemasters also found that as the condition of the facility improved, achievement improved. The researcher reported that all factors (age, color, lighting, etc.) influenced student achievement, with building age, lighting, and noise having the most significant effect.

In Lemasters' (1997) synthesis of previous research, student achievement was defined in terms of norm-referenced or standardized testing administered to students in the study. The researcher used total incidents of student discipline as a measure of student behavior. Lemasters reported that a preponderance of the studies reviewed indicated a significant relationship between student performance on selected subtests and the condition of the physical environment; however, some studies revealed very weak relationships. Lemasters reported that the degree to which the school facility was actually the cause of student behavior was difficult to determine because of either flawed methodology or flawed research design. Additionally, the researcher suggested that certain studies in the research synthesis (Cash, 1993; Chan, 1980; Earthman, 1995; Garret, 1981; Hines, 1996, as cited in Lemasters) should be replicated in various climates, locations, and geographical areas to determine if the results could be duplicated. Lemasters noted that important factors influencing student achievement included thermal environment, proper illumination, adequate space, and availability of certain equipment and furnishings, especially in the science classrooms.

In 1999, Ayers examined through regression analysis the relationship between design elements and student achievement for students in Georgia high schools ($n = 27$); the researcher concluded that there was no statistical relevance associated with those variables. Ayers noted the number of first-time test takers (11^{th} grade) who passed the

GHSGT and compared that to data collected using a survey instrument called the Design Appraisal Scale for High Schools (DASH-I), which was a modification of Cash's 1993 CAPE assessment instrument and the DASE assessment created by Tanner (1999).

Variables compared in Ayers' (1999) study included the teachers' average number of years of teaching and their educational background, as well as the size of the student population in each school. Ayers then used the DASH-I to determine the total score for the facilities. Her analysis of the data revealed that approximately 6% of the variance in English and social studies, 3% of the variance in science, and 2% of the variance in mathematics and writing scores was attributed to school design. Ayers equated much of the discrepancy in achievement scores to SES in an examination of the 27 high schools in Georgia and concluded that there are many other variables to consider when examining student achievement and building condition. Other researchers have attempted to explain the variance in student achievement scores through analysis of the teachers who work in the buildings in question.

Similar research using the same type of research model has been conducted in other states. Cervantes (1999) attempted to explain the possible impact of the conditions of schools in Alabama (n = 19) on student achievement in 4^{th}, 7^{th}, and 11^{th} grades. She also examined the relationship of the physical environment to student behavior in 4^{th}, 7^{th}, and 11^{th} grades. The relationship between building conditions and student performance in math and reading as well as suspension rates was analyzed using a Pearson correlation coefficient. Her study identified relationships among overall building conditions, suspensions, and student achievement. Cervantes concluded that the condition of school facilities was directly associated with student suspensions; specifically, as the condition

of the building decreased, student suspensions (representing poor behavior) increased.

Research that documents the relationship between the physical condition of the school facility and student achievement is not confined exclusively to high schools. Lanham (1999) examined the relationship between student achievement and the physical condition of the buildings in specific Virginia elementary classrooms. Lanham surveyed Virginia elementary principals using the CAPE survey instrument to assess the condition of the school building, including the school classrooms, and to gather general information about each school. Statistical data collected from each of a random sample of schools (n = 300) were analyzed. The CAPE data were compared to each school's spring 1998 performance on the SOL tests in English (Grade 3, M = 404.20, SD = 26.57; Grade 5, M = 422.56, SD = 21.87), mathematics (Grade 3, M = 421.35, SD = 42.67; Grade 5, M = 393.63, SD = 33.29), and technology (M = 71.98, SD = 17.33).

Lanham (1999) utilized regression analysis to analyze the data and concluded that there were significant predictor variables related to the performance of elementary school students on the state SOL tests. The researcher found that physical and structural problems within the buildings had a significant impact on English, mathematics, and technology scores of elementary school students. Lanham also reported, however, that the free- or reduced-price-lunch variable was the most statistically significant variable to impact both English and mathematics scores for students in Grades 3 and 5.

All of the aforementioned research studies focused on the conditions found within existing school buildings. At least two previous research studies focused specifically on new high schools. Hickman (2002) examined 13 new high schools built in Ohio between 1997 and 1999; his study was the first designed to specifically evaluate new high schools.

His research was limited to schools constructed in predominantly rural and suburban settings. Hickman used a survey instrument completed by staff members 2 years before the move to a new school facility and 2 years after the move. Those results were then compared to student achievement scores and data collected from a state database for public education in the State of Ohio. Additional data were collected through interviews with staff and administrators from each of the schools involved in the study. Hickman concluded that a significant relationship existed between new school facilities and staff attendance. The researcher reported that significant changes were observed in both student and staff attitudes once they moved into a new school facility; however, he confirmed that staff turnover was not significantly influenced by new school facilities.

Hickman (2002) reported that positive perceptions of staff morale and attitude as well as student behavior were reported by staff of the new high schools. He analyzed student suspension and expulsion rates using a paired-samples *t*-test. He also used a qualitative survey instrument to gain insight into staff perspectives regarding the impact of the new school facility on morale and staff and student perceptions ($n = 51$). The majority of the responses reported by Hickman in the qualitative portion of his research study were positive and revealed that many of the surveyed staff members believed the new school facility had either improved or positively impacted student and staff attitudes and behaviors.

Hickman (2002) reported that more students were suspended for minor infractions ($M = 6.41$, $SD = 4.17$) prior to the move to a new school compared to those receiving similar suspensions after the move ($M = 5.74$, $SD = 3.47$). Hickman also analyzed expulsion rates before and after the move to a new high school, revealing that rates were

significantly greater before the move (M = 18.49, SD = 19.07) than after the move (M = 16.96, SD = 17.52). Overall, he found a significant reduction in the number of reported suspensions and expulsions, as well as a significantly positive overall change in staff perception of student morale and attitude and staff morale and attitude in the new school.

There are some limitations with the Hickman (2002) research. One of the most important is the fact that the 51 participants in the qualitative portion of the survey instrument responded to a free-response questionnaire rather than a face-to-face interview that might have elicited more in-depth perceptions and analyses by the participants in the study. The free-response answers that supported the researcher's premise—that new school facilities positively impact student achievement and student and staff attitudes and behaviors—were reported; however, no responses that indicated a negative connotation or disagreement with the researcher's premise were reported. Additionally, the Hickman research was limited to 13 new high schools constructed in Ohio, including schools in rural, small city, and suburban settings, but no urban schools.

A research study conducted in the Commonwealth of Virginia by Crook (2006) investigated the possible relationship between the physical condition of the school facilities and the percentage of students passing the SOL examinations for each school. Crook surveyed principals (n = 198) of Virginia high schools that served 11th-grade students. Those principals were asked to complete the CAPE assessment instrument to determine the physical condition of each of the buildings; responses were collected via the Internet. A response rate of 75% was attained for this portion of the study (n = 142).

Crook (2006) compared SOL achievement scores for each building in five subjects: English reading, English writing, Algebra I, Algebra II, and Geometry. Crook

found that a positive relationship existed between overall building condition and student achievement. Specifically, a strong difference was found in the percentage of students passing the English reading and writing subtests. The difference between students passing the Algebra II and Geometry SOLs revealed a positive relationship, but not one that was statistically significant. The research conducted by Crook concluded that there was a difference of as much as 17.2 percentage points when comparing SOL pass rates for students in a standard building and students in a substandard building. Crook controlled for SES and determined that the difference was still 11.2 percentage points between the SOL scores of students in standard and substandard facilities. His conclusion was that the variance in achievement scores could significantly impact the school's accreditation status.

The Crook (2006) research, although supportive of the contentions of previous research conducted in Virginia (Cash, 1993; Hines, 1996; Lanham, 1999), does have several limitations. The first of these includes the fact that all of the previous research used three categories to identify building condition (above standard, standard, and substandard) whereas the Crook research simply used two categories (standard and substandard). A second limitation, similar to that of previous research (Cash, 1993), was the use of a self-reported survey, allowing the possibility that some of the information may have been overreported or underreported by the principals. A final limitation of the Crook research is based on the fact that 57 of the 199 participants failed to complete the assessment instrument on time, meaning that more than 25% of the possible participants in the study did not respond. If those responses had been included, the results of the study might have been different.

A qualitative assessment of urban educational settings was completed by Edwards in 2006. The study involved surveys and interviews, as well as observational research conducted during a 6-week period of a summer school session. Although this study was one of the first to attempt to assess the impact of the educational facility on student achievement, it does have several limitations: The study involved 14 middle school- and 25 high school-age students in a summer school setting. Each participant completed a 14-question survey and an interview with the researcher. Observational research was also completed, and coding was developed as the researcher completed each interview. The research methodology process presents some threats to internal as well as construct validity, as the researcher transcribed all of the recorded data and developed all of the coding during the research process. Additionally, it should be noted that the main purpose of a summer school session is usually remediation, and the students who participated in this research study may not well represent the general student population.

The second research study to document and attempt to validate the relationship between new high schools and student and staff attitudes and behaviors was conducted by Lee (2006) in New Jersey. Lee corroborated the findings of Hickman's research regarding the relationship between new school facilities and student attitude and behavior and staff morale and performance. He specifically examined staff (n = 67) perceptions of school climate before and after a move to a new high school. The staff members of four buildings from one school district were surveyed on 40 separate climate topics using the Charles F. Kettering School Climate Profile Assessment prior to their reassignment to a new high school in the same district.

Lee's (2006) research was guided by the belief that improved staff morale,

attitude, and behavior create an environment for students that is conducive to learning, thereby improving student achievement. All of the participants in the study had been relocated from other, considerably older school facilities within the district. His research utilized an ex post facto causal comparative design to compare the independent variable of building age to the dependent variable of staff perceptions of school climate.

Another research study was conducted in Ohio in 2007, using the same basic research principles as the Lee study and combining some of the principles of the Hickman (2002) research as well. Fritz (2007) attempted to determine if student achievement, as demonstrated on the Ohio 6th-grade proficiency subtest, would increase when students moved into a new school building. The researcher used nonrandom, purposeful sampling to study 26 newly constructed school buildings and compare student performance on proficiency tests 2 years prior and 2 years after construction was completed.

Fritz's (2007) research utilized a causal comparative, quantitative methodology: The discrete independent variable, the change in location from an old school building to a new school building was compared to student performance on a state-mandated proficiency assessment for 6th grade. The researcher found that reading and science achievement was significantly improved when students moved into a new building; however, citizenship, writing, and math achievement were not improved. One of the main limitations of this study is that it compared student performance on only one standardized achievement test and used performance over time (4 years) to compare statistical trends. Other factors, such as SES, gender bias, or curriculum changes could have accounted for the changes noted by the researcher in this study.

Ruszala (2008) investigated the condition of high school facilities and the relationship of school conditions to teacher satisfaction. Ruszala used the CAPE instrument created by Cash to measure the physical environment, as well as a new instrument called the Teacher Opinionaire of Physical Environment (TOPE), which measured the teachers' level of satisfaction in relation to specific building conditions. Both surveys measured structural items such as lighting, thermal, acoustics, density, indoor air quality, and age, as well as cosmetic items such as paint and floor cleanliness. Ruszala calculated a Pearson correlation coefficient for the survey results of the CAPE and the TOPE. According to Ruszala, "the Pearson correlation coefficient indicated that moderate positive correlations between the CAPE and TOPE survey instruments existed for age, paint, and light; a low positive correlation was found for thermal conditions between the CAPE and TOPE survey instruments" (p. 132). The research conducted by Ruszala indicated that paint was a significant predictor of teacher satisfaction (2008).

In contrast to that research, Broome (2003) suggested that the variance in academic achievement was not due to school facility conditions, as others have suggested (Cash, 1993; Earthman, 1995; Hines, 1996; Lemasters, 1997; McGuffey, 1982), but actually was related more strongly to the SES of the student population. Broome studied 29 schools serving 8th-grade students in Mississippi and Tennessee; the new schools had been constructed between 1997 and 2001. Broome used a Likert-scale instrument to assess the impact of design elements used in the buildings. Scores on the Iowa Test of Basic Skills (ITBS) and the Tennessee Comprehensive Assessment Program (TCAP) for students in those buildings served as the measures of student achievement. The study also examined student suspension data for students in each of the buildings in the study.

Limitations for the Broome study include the fact that it was conducted in two different states with a student population consisting entirely of 8th-grade students, not high school students.

Broome (2003) found that the correlations between school design and student behavior were not as strong for the 40 predictors measured ($M = 5.502$, $SD = .7618$) as previous research had indicated. Broome concluded that almost all of the variance in both school building design and academic achievement was explained by and associated with SES as measured by free- or reduced-price-lunch status of each school.

All of the research studies identified in this section of the literature review attempted to explain school building design ideology components. Multiple research studies were conducted to explore the most influential design elements found in current construction projects. To fully explain the principles of architectural design and research, it is important to explain how the process of designing schools has evolved. Much of the research collected for this literature review reflects components of cognitive learning theories (Bandura, 1976) as well as brain-based learning research of the past 2 decades.

Design Ideology

Research regarding the effects of design elements on student achievement in the United States increased dramatically over the past 15 years. Classroom environments designed to support best instructional practices have been affected by the research on student learning styles and achievement. The work of Robert J. Marzano suggested that school environments that promote a viable curriculum, involve community members, provide a safe and orderly environment, and at the same time promote collegiality and

professionalism among staff members, have the greatest impact on student achievement (as cited in Myers & Robertson, 2005).

School design should meet two primary objectives: (a) to create buildings that are vibrant and lively and (b) to create academic environments that actively support the learning process by carefully aligning facility design with instructional approaches and the overall academic mission (Fanning, 2005). Research has suggested that certain design elements need to be present in all new school facilities: smaller scale learning environments such as "houses" or "clusters" that create more personalized learning communities, fluid traffic patterns that ensure the smooth transition of students, flexible and multifunction spaces that accommodate day-to-day needs as well as community needs, equal access to school facilities for students with differing physical handicaps, and design elements that reflect community values (LAB Policy Perspectives, 1997). Other suggestions include the creation of centralized "learning streets" where students interact and move past each other in wide, well-lit, and easily navigable hallways (Nair, 2002). School design has become the subject of intense debate and nationwide scrutiny.

Since the advent of NCLB in 2001, the conditions of school facilities have been more closely scrutinized because of the stipulation that parents may choose to move their children to another school if their children's current school has not made adequate yearly progress (AYP) for 2 consecutive years (Healy & Holycross, 2005). This option has made school systems accountable for creating learning environments that promote an increase in student achievement. Schools now are scrutinized with regard to academic proficiency and standards-based achievement. Therefore, if research has connected the physical conditions within the school to student achievement (Cash, 1993; Earthman &

Lemasters, 1995; Hines, 1996; Hickman, 2002; Lemasters, 1997), an improvement in the quality of educational facilities should result in higher student achievement and attainment of standards-based assessment benchmarks.

Structural Design Elements

Much of the existing research in the area of facility conditions and student achievement has attempted to make a connection between the message that poor school facilities send to students about the value of the education they receive and their ultimate achievement. Uline (2000) stated, "Educators should view the building of a new school or the renovation of an older one as an opportunity to advance reforms" (p. 457). There has been an unprecedented opportunity with the advent of NCLB (2001) to improve, replace, and build new, better, and more efficient school facilities. The relationship between the physical conditions of school buildings and the interactions among students and staff (Hickman, 2002) as well as student achievement (Cash, 1993; Earthman, 1991; Hines, 1996; Lemasters, 1997) has been well documented.

The ability of the school to become a teaching tool allows instruction and curriculum to expand and offers educators the opportunity to create expectations for high performance. Madsen (2005) asserted, "Students thrive in buildings that are safe, healthy, and designed for learning" (p. 61). Some of the design elements that influence the school environment include (a) space for teachers to confer with colleagues and engage in professional development activities (LAB Policy Perspectives, 1997); (b) the incorporation of daylighting into the classroom environment (Benya, 2001); (c) the incorporation of acoustics into the learning environment (Lubman & Sutherland, 2001; Sundersingh & Bearg, 2003); (d) indoor air quality management systems (United Stated

Environmental Protection Agency [EPA], 2006; Madsen); (e) classroom design that supports differentiated instructional practices; and (f) facilities that can serve multiple purposes (NSSD, 2005; Council of Educational Facilities Planners International [CEFPI], 2001). In addition to the research that suggested optimum situations to improve student performance, much of the research collected for this literature review highlighted improvements and design components that specifically address the working environment for employees.

Professional Working Spaces

Professional teacher workrooms allow teachers to complete their daily tasks in the most efficient manner. Leung et al. (2006) wrote, "Enlarged working spaces, seating areas, and commons rooms improve the cooperation, interaction, and affability among teachers. A good outside view and indoor plants can release stress, encourage clear-headed thinking"; further, they stated, "Sufficient teaching facilities help teachers to prepare teaching materials" (p. 82). The curriculum will change in the future as will instructional methods that teachers use within the classroom; therefore, it is important to prevent the school environment from becoming obsolete. By providing teachers with a professional environment in which to interact with their peers and allowing the space within the school to adapt to change when necessary, a climate for learning can be created that will allow for student success (CEFPI, 2001; Kennedy, 2005).

In summary, treating teachers as professionals has long been identified as a strategy that helps to create a sense of collegiality, professionalism, and commitment among staff members. Multiple researchers (Fielding, 2005; Hickman, 2002; Lee, 2006; Leung et al., 2005; Nair, 2002; Schneider, 2003) indicated that the design of the building

should incorporate professional spaces specifically designated for teachers. The spaces provided for the staff and faculty of a new facility reflect the importance and value placed on those persons by the community. A professional working environment that allows teachers to focus on the process of classroom instruction benefits all students.

Acoustics

The quality of acoustics within the building and classroom environment is an important element to consider when evaluating learning and achievement. The classroom serves as a communication channel for teaching all students essential academic, social, and cultural skills (Lubman & Sutherland, 2001). The learning environment is equally as important as the physical appearance. Situations that distract students from the task at hand, such as background noise, annoying equipment sounds, or excessive noise from outside the classroom have been shown to have a negative impact on student achievement (Shield & Dockrell, n.d.).

Hearing in children does not fully develop until the age of 15, and younger students tend to tune out instruction if they cannot hear well (Sack, 2005). A 4-year research study in Utah revealed that student scores on state assessments were 10% to 15% higher for children whose classrooms had auditory enhancements (Sack). Ideal conditions for learning are created when acoustics are considered as part of the school's integrated design (Madsen, 2005). Research has concluded that internal classroom noise is related to children's academic performance on standardized assessments (Shield & Dockrell, n.d.) as well as their cognitive development.

A 1996 synthesis of research regarding building conditions completed by Earthman and Lemasters concluded that less external noise was related to higher student

achievement. Further, they noted that outside noise and distractions led to student dissatisfaction and that the combination of excessive noise and temperature caused stress in students. In 2002, Earthman cited numerous research studies (Duffy, 1992; Hyatt, 1982; Laird, 1930; McGuffey, 1982) indicating that noise had some effect on educational outcomes. Acoustics within the classroom environment, specifically their effect upon the ability of students to hear instruction from the teacher without extraneous noise and distraction, represents a key component for future research in this area. Also related to classroom acoustics is the position that the teacher occupies within the room during instruction. Teachers may maintain a right-side or left-side instructional presence, thereby putting students on the opposite side at a distinct disadvantage in terms of hearing what is being said (Hill & Cohen 2005).

Madsen (2005) stated, "Excess noise can distract students and make students' ability to process speech patterns difficult" (p. 62). Madsen reported that listeners with normal hearing can understand only about 75% of the words they hear in the classroom. In summary, the acoustical environment has been shown to impact student achievement (Heschong-Mahone, 1999; Lubman & Sutherland, 2001; Sundersingh & Bearg, 2003). Classroom noise generated by HVAC systems or other mechanical systems, as well as other background noise, has been shown to impact the ability of students to concentrate (Shield & Dockrell, n.d.).

Use of Daylighting

Classroom design elements have changed a great deal over time. Until about 1950, classroom design incorporated the use of windows and natural light as the predominant means of illuminating most school spaces (Benya, 2001). With the emphasis on energy

conservation in the post-World War II era, many school designs actually eliminated the use of natural lighting. Today, researchers believe just the opposite; in fact, the incorporation of natural lighting into the school design process has become a standard design concept.

A school's design should provide views of the outdoors, eliminate direct sunlight penetration and glare, and provide uniform illumination. The use of full-spectrum lighting within classrooms is believed to have an impact on student learning and achievement (Benya, 2001; Fielding, 2006; Kennedy, 2005). Student achievement and behavior have been linked to the use of natural lighting (Fielding), fluorescent lighting (Sleeman & Rockwell, 1981), and full-spectrum lighting (Nair & Fielding, 2005). Cool daylighting or the use of daylight through controlled glazing systems, shading systems, and architectural design (Benya) is a modern concept incorporated into school facility design as well.

Daylighting or the use of natural light within the classroom environment has been analyzed; reported results of individual studies are not in agreement. Dependent upon the type of research conducted, there is a strong correlation between the use of daylighting and student performance (Conway, Epps, & Plympton, 2000). The research conducted by Conway et al. indicated that the use of daylighting in classrooms had led to the downsizing of heating and air conditioning systems, which in turn led to less noise and distraction, thereby creating a better learning environment. The research also suggested that as much as a 20% increase in math scores and a 26% increase in reading scores had been observed for students in classrooms with daylighting. Benya (2001) reported an actual side benefit to daylighting: Turning off the electric lights when they are not needed

prolongs the life of the electric lighting system and ultimately decreases maintenance costs.

Significant findings have indicated a relationship between lighting and color and learning environments. A study conducted from 1981 to 1985 in Alberta, Canada found that the amount of light required is directly proportional to the work being completed. The results revealed that noise levels were significantly lower in rooms painted in cool, relaxing colors. Full-spectrum lighting seemed to promote positive moods in students, whereas students exposed to warm colors exhibited slight increases in blood pressure (Hathaway, 1987). Additionally, Hathaway's study reported that 5th-grade students exposed to supplemental ultraviolet lighting were absent from school less often than others. Although conclusions regarding the effect of lighting on human behavior vary, it is significant to note that several studies have been completed that provide evidence in support of its effect.

A 1999 report funded through the California Public Utilities Commission examined the effect of daylighting on human performance (Heschong-Mahone, 1999). The primary focus of the study was the impact of the use of sky lighting as an illumination source as well as the connection of daylighting use with improved student performance. The study was conducted in three different school districts—California, Washington, and Colorado (n = 21,000)—and utilized standardized test scores as the unit of analysis for measuring student achievement. A sample of classrooms from each of the three school districts was visited by the researchers; architectural plans, aerial photographs, and maintenance records were analyzed along with student demographic information about each school.

The researchers used regression analysis to control for influences on student performance and analyzed data from two separate tests, math and reading. After controlling for all other variables, the researchers found that students with the most daylighting in their classrooms demonstrated 20% greater progress on math tests and 26% greater on reading tests in 1 year as compared to those with the least daylighting. Students in classrooms with the largest window areas demonstrated 15% greater progress in math and 23% greater in reading than those with the least daylighting. The results were not the same in all three districts; however, overall, students in the classrooms with the most daylighting were found to have scores between 7% and 18% higher than those with the least daylighting (Heschong-Mahone, 1999).

The limitations of the Heschong-Mahone (1999) study include the fact that the results were reported for only two student achievement categories: math and reading. Additionally, the researchers examined primarily elementary school buildings within each of the three districts. Thus, the results of this study can be generalized to the whole population of elementary schools that utilize daylighting as a source of illumination; however, they cannot be generalized to secondary or high schools. Also, the scores were self-reported by the districts themselves; they did not result from an independent assessment instrument or state-mandated testing service. One final limitation of this particular study is the fact that the data sets were from three different school districts in three distinct geographical regions of the United States. The variances in student achievement scores can possibly be explained by variances in climate or temperature, or the age, condition, or physical design of the buildings themselves. This possibility does not mean that all of the results of this study should be discounted; however, it is

important to note the limitations of the study.

Classroom lighting may play a particularly critical role because of the direct relationship between good lighting and student's performance (Tanner & Langford, 1998). Lemasters' synthesis of 53 research studies in 1997 found that daylighting does foster higher student achievement. A report commissioned by the California Energy Commission (Heschong-Mahone Group, 2003) suggested several ways in which the visual environment is extremely important for learning: an ample view through a window that includes vegetation or human objects in the distance supports student achievement; sources of glare negatively impact student achievement in a classroom, especially in mathematics; the use of white boards instead of chalkboards significantly diminishes glare and enables students to perform better; direct sun penetration into classrooms, especially through unshaded windows, is negatively associated with higher levels of student achievement; and blinds allow teachers to control the visual environment, glare, and visual distractions that permeate their windows (Heschong-Mahone Group). One study found that students with the most classroom daylight demonstrated 26% greater progress on reading tests than did the students in natural light environments (Schneider, 2002). Research has shown that the amount of light within the learning environment positively impacts student achievement.

In summary, daylighting has been shown to be not only beneficial to student learning but also pleasant for the students. In addition to promoting student achievement, correctly implemented lighting can reduce electrical systems maintenance, prolong the life of electrical systems, and cut energy costs and associated maintenance costs (Benya, 2001). In addition to research regarding the amount of light in the classroom, studies also

have been conducted to determine whether or not the learning environment can be impacted by variances in classroom temperature and indoor air quality

Thermal Environment and Indoor Air Quality

In numerous studies, thermal environment was shown to affect student achievement. In a report prepared for the Los Angeles Unified School District, Earthman (2002) synthesized several studies that relate to thermal environment. He cited the work of Mayo (1955), Chan (1980), McGuffey (1982), and Lemasters (1987) regarding the importance of controlling the thermal environment to facilitate or enhance student performance. Inadequate heating, ventilation, and air conditioning (HVAC) systems can create unnecessary distraction for students, who may spend more time sweating or shivering than learning. Schneider (2002) reported that moderate temperatures (between 68 and 74 degrees) and moderate humidity levels (40% to 70%) allowed students to perform mental tasks most successfully. Poor thermal environment can affect the health, productivity, and general wellbeing of students, faculty, and staff. Mold and indoor air quality problems in both new and existing facilities have led to illnesses, school closings, and costly repairs in all regions of the country (Environmental Law Institute, 2002).

It is estimated that children spend as much as 85% of their time indoors, including about 7 hours per day in school (Wakefield, 2002). Schools must maintain adequate heating and ventilation systems to promote a healthy and safe environment. Research has indicated that children are exposed to hundreds of chemicals, bacteria, biological organisms, and other threats everyday in classrooms across the country, including "exposure to molds and toxic fungi, pesticides, and volatile organic chemicals emitted from cleaning products, photocopiers, and classroom furnishings" (Wakefield, p. A300).

Many school districts have been forced to deal with employee health issues believed to be caused by a condition called “sick building syndrome,” the symptoms of which can include headaches, nervous disorders, and respiratory problems caused by inadequate or faulty heating and air conditioning systems (EPA, 2003). Indoor chemical pollutants have been suspected as the cause of health problems for decades; chemicals such as formaldehyde, nitrogen dioxide, and others are suspected causes of pulmonary and respiratory problems (Mendell & Heath, 2004). For example, in a classroom of 30 children, it is estimated that about 3 are likely to have asthma (EPA, 2004). According to the U.S. Centers for Disease Control and Prevention, asthma causes students in the United States to miss 14 million school days per year collectively. Many of those missed days are likely attributable to poor indoor air quality (Johnson, 2005).

Schneider (2002) reported that 15,000 schools suffer from poor indoor air quality (IAQ) in the United States, affecting 8 million children or 1 of every 5 that are of school age. He theorized that public school buildings built in the post-oil-embargo world had poor HVAC systems installed as a means to cut energy usage in the 1970s, and as a result, those schools now experience the highest number of IAQ issues. He further reported that a positive relationship had been established between poor ventilation and the amount of airborne bacteria and mold in the air and, ultimately, asthma in children in public schools. Schneider also indicated that ailments such as asthma were likely contributors to high absentee rates. Mendell and Heath (2004) reported that absentee rates increase in schools with poor HVAC systems or IAQ issues and indicated that those same conditions lead to higher teacher absenteeism and diminished teacher performance. They reported a relationship between conditions of the school environment and concentrations of air, dust,

fungi, or bacteria that result in respiratory conditions such as asthma and allergic immunological problems. The indoor air quality of public school buildings impacts the learning environment not only for students but also for teachers who work in the building.

Poor indoor air quality, airborne allergens, and airborne fungi are the likely causes of allergic diseases such as rhinitis and asthma, irritation of the nasal membrane, infections, and in some cases headaches (Chao, Schwartz, Milton, & Burge, 1997). Schools have high concentrations of people within them, thereby making the task of maintaining acceptable indoor air quality more difficult in those buildings than in other types of buildings (Bayer, Hendry, Crow, & Fischer, 2002). Schools are just as likely to experience symptoms of sick building syndrome as are other building types. Poor indoor air quality affects student performance of mental tasks involving concentration, calculations, and memory, in turn, impacting student achievement (Wakefield, 2002).

A study conducted in the United States from 1998 to 2002 (Moglia, Smith, MacIntosh, & Somers, 2006) determined that school systems are aware of the increasing evidence that researchers have identified with regard to indoor air quality. Moglia et al. sought to determine the quality and effectiveness of IAQ programs across the United States. The researchers concluded that IAQ programs led to improved health status of students, as indicated by fewer asthma episodes, fewer visits to the school nurse, and lower absenteeism. Cost, lack of resources, lack of knowledge, and competing priorities were the most frequently reported barriers to implementation of an IAQ program among school systems without such programs. This information confirmed earlier research (Chao et al., 1997; Bayer et al., 2002) regarding the effects of airborne allergens, fungi, and bacteria on the learning environment of the nation's schools.

In summary, the amount of school construction activity that will occur across the country in the coming years creates an opportunity to change the way schools are built. A school should promote a healthy environment for all who enter, create places of inspiration for all students, and be able to adequately address IAQ concerns first from the design perspective and then from the construction perspective. The creation of a school environment that promotes student achievement, addresses health and environmental concerns, and is an active, engaging learning environment is a challenge that current educational facilities design has attempted to address.

Classroom Environment

Research has suggested that the environment within the classroom is the most significant aspect of the school facility that impacts student perception, attitude and behavior, and academic achievement. Weinstein (1979) reported considerable evidence that the classroom environment affected nonachievement behaviors and attitudes in students. Her synthesis of research studies indicated that high levels of density in "hard classroom environments" resulted in dissatisfaction, decreased social interaction, and increased aggression among students, whereas classrooms that were associated with a more humane learning environment or "soft classroom environments" were associated with better attendance, greater levels of student participation, and more positive attitudes toward the class, the instructor, and classmates (Weinstein). Research has indicated that classroom spaces should be easily accessible and flexible (Butin, 2000) and should be designed to support a variety of learning styles (NSSD, 2005). Butin stated, "Children learn best when learning is active and student-centered rather than passive and teacher centered" (p. 1). Ultimately, classrooms should be designed to accommodate a wide

range of activities and learning styles: one-on-one instruction, individual study, small group work, and teacher-directed instruction and lecture (Butin).

According to research, color and paint schemes incorporated into the design process have an impact on student achievement. Classroom walls that incorporate a scheme of color that utilizes a medium hue on the end wall with the remaining walls off white or neutral has been shown to maximize student achievement (Engelbrecht, 2003). A 1976 study by Kuller "demonstrated how color and visual patterning affects not only the cortex but also the entire central nervous system" (as cited in Engelbrecht, p. 2). Studies have suggested that one of the classroom walls (preferably the focal point of the room) should be painted in a medium hue of blue, brown, or green, indicating that the end-wall treatment can help to relieve eyestrain, help students' eyes to relax, and stimulate the brain for learning (Engelbrecht). According to Engelbrecht, color within the classroom has been shown not only to affect student achievement but also to influence people's moods, minds, and emotions.

Multiple-Use Facilities

The traditional classroom model is one that has changed and evolved over time, as has the purpose of the school building itself. A major focus of recent school design within the past 2 decades has been a return to the focus on the school as the center of the community. An NSSD (2005) report indicated that multiple-use facilities designs have been incorporated across the country and have included partnerships with corporate sponsors and state and local government affiliates as well as collaborations with community colleges and institutions of higher learning to offer dual enrollment courses. School design models now include multiple-use aspects such as shared library facilities,

partnerships with recreation and extracurricular groups, and the ability to transform certain places within the school environment into multipurpose facilities. According to the American Architectural Foundation (AAF) (2005), many schools across the country share their facilities with parks and recreation departments, adult education programs, and community-based organizations such as the YMCA.

Flexibility is a term used by design professionals to indicate the likelihood that the building can be adapted to the changing educational needs of its population. Flexibility can enhance personalization for students; research has suggested that buildings that contain flexible classroom space can be adapted to a variety of learning styles (NSSD, 2005). The ability to incorporate multipurpose lab space designed to accommodate a variety of instructional activities has also been a key component of flexible classroom design models (Knowledge Works Foundation, 2005). Multipurpose lab space allows for science experiments, art projects, and group projects to be conducted, sometimes in the same space on the same day. This concept allows for maximum usage of all classroom space, as well as expanded curricular offerings that allow for more student choice. Another consideration that designers have taken into consideration is an emphasis on school safety that does not create an institutionalized feeling for students and staff.

The focus on flexible design is not entirely centered on the classroom; therefore, the total building has been incorporated into this concept in the past several years. Elementary, middle, and high school design models all contain components of flexible design, which allow them to adapt to changing needs throughout the school day and the school year. One example of this concept found in the literature includes cafeterias or commons areas with sound systems that can support after-school, weekend, or nighttime

community activities (Planty & DeVoe, 2002). Many modern school designs have incorporated some form of circular campus design that creates traffic patterns in which students flow throughout the building in a circular pattern rather than the traditional "H" pattern. The flexible design pattern allows for future expansion if needed, and it promotes a feeling of safety and security.

School Safety and Security

Recent events in American history have forced school facilities designers, school district personnel, and the American public to look closely at security of the nation's schools. Incidents in Columbine, CO, Paducah, KY, Jonesboro, AK, Red Lake, MN, and most recently Lancaster, PA have made the reduction and prevention of violence in the nation's schools a concern for all involved. The implementation of safety and security-oriented designs, a closer relationship with local law enforcement, and a heightened level of awareness of school personnel across the nation have led to many key design implementations for the nation's schools.

An important idea with regard to safety is the combination of multiple safety features into school design. The ability to control movement throughout the facility, as well as having one single-entry point for the public, has made designers more keenly aware of the flaws of previous school designs (Collins, 2006). Closed-circuit digital monitors and electronic identification badges for entry have made recently constructed school facilities much safer than previous designs. School systems have also put into place increased school-based security and safety monitors to protect students and staff from potential harm. Each of these design recommendations for school safety and security is the direct result of an identified problem with previous design models.

Unfortunately, as evidenced through media accounts, those problems were brought to focus after tragedies had occurred on school campuses across the nation. Within the past 10 years, many recommendations have been made for school facilities designed to prevent some of the problems previously identified in this literature review.

School Facilities Design Recommendations

Researchers have made recommendations regarding design element principles for future construction. National organizations whose focus is on the improvement of educational facilities have released guidelines and suggestions as well as results of studies that document all the elements of school design that should be included in the next generation of school buildings. This section of the literature review briefly examines the recommendations offered regarding school facilities design.

The planning process for the school facility is just as important for the success of that building as the bricks, mortar, and concrete supporting the physical structure. To be successful in the creation of new facilities, school officials must make an active effort to engage the community members who will be served by the new facility. To reduce the costs of design and construction, varied new methods are being implemented to pay for these multimillion-dollar facilities. School and business partnerships, alternative funding models, and development of the school as the center of the community are all examples of innovative strategies to promote new school design and construction.

In 1998, Lackney recommended that school design elements include aspects of brain-based learning research to promote student achievement. He recommended that school design incorporate small-group learning environments; views of the outside;

interior design that utilizes different colors, shapes, and spaces; an abundance of professional and student resources areas; flexible academic spaces; semiprivate places for individual instruction; and personalized space for students and teachers that allow them to develop a sense of identity and common purpose. More recently, design recommendations have been made at the national level for future school design models.

National Summit on School Design Recommendations

The National Summit on School Design (2005), held in Washington, DC in October 2005, produced eight recommendations regarding school design, indicating that school design should do the following:

1. Support a variety of learning styles. School designers need to conduct an examination of the traditional classroom model to determine its relevance in 21st century learning, thus evaluating the instructional needs of both students and teachers.

2. Enhance learning and achievement through technology. School designers need to incorporate technology that both supports and enhances the learning environment, thus allowing students access to a wealth of information, tools, and skills that were unavailable just 10 years earlier.

3. Foster a "small-school" culture. School designers need to consider the needs of the community and balance those against the needs of the students and staff that will spend the majority of the time in the new school building, thus ensuring student academic success by creating a small-school culture through house or cluster designs.

4. Support neighborhood schools. School designers need to attempt to preserve the neighborhood school culture and ideology associated with neighborhood schools, thus nurturing the link between school and community.

5. Create schools as centers of community. School designers need to encourage the formation of partnerships between schools and community interest groups, thus benefiting not only students and staff of that school but also the libraries, university groups, museums, and businesses who join the partnerships.

6. Engage the public in the planning process. School designers need to improve the communication process with regard to the development of the need for a new school, thus communicating legitimate and realistic expectations to both district personnel and community members.

7. Provide healthy, comfortable, and flexible learning spaces. School designers must commit to improving the quality, health, and attractiveness of the nation's schools, thus ensuring a focus on the quality of the built environment as well as the teachers and students that inhabit that environment.

8. Consider nontraditional options for school facilities. School designers need to incorporate Internet and video-conferencing ability into the design of school facilities, thus ensuring a focus on experiential learning as well as standards-based learning.

In summary, school design should create adequate learning spaces for all students, provide opportunities for expansion of the physical environment if needed, and incorporate brain-friendly design elements into the school's physical structure to maximize student achievement.

Sustainable and Green Design Elements

The next generation of school buildings in the United States should incorporate sustainable design or green design. Sustainable design provides optimal environmental and economic performance, increased economic and energy efficiency, and productive

and high quality indoor working spaces, as well as the utilization of a specific percentage of environmentally friendly building materials in the construction process (Olson & Kellum, 2003). Green design incorporates a conscious idea of the potential impact of the construction and operation of the school building on the local ecosystem and ultimately the environment. This section of the literature review focuses briefly on sustainable and green design elements that are currently being incorporated into new school facilities design. Worth noting is that there is a significant gap in this literature as green design is a relatively new concept incorporated into school facility design.

Madsen (2005) defined high-performing schools as those that incorporate IAQ systems into the design of the building and maximize the amount of fresh air brought into the building. Because children's immune systems are not fully developed, they are more susceptible to problems created in the school. Yoders (2006) stated that sustainable design is crucial to the health and well-being of students. Children need fresh air, daylight, and a healthy environment in which to learn (Yoders). Kats (2003) reported that green buildings use key resources such as "energy, water, materials, and land more efficiently than buildings that are just built to code" (p. 2). The incorporation of natural light and air quality systems allows green buildings to contribute to improvements in employee and student health. Many school design models focus not only on the educational impact of the facility but also the environmental impact that a particular school facility will have in the future.

Future of Educational Facilities Design

Facilities design factors that have been identified through research include, but are not limited to, the following: human comfort, indoor air quality, lighting and acoustical

control, placement of lockers and shared student resource areas, science lab locations, and vocational areas within the building itself as well as the outside areas that surround the building (Myers & Robertson, 2005). Additionally, the integration of technology within classrooms and curricular offerings has been identified as beneficial to future facilities design models. Through the collection of research for this literature review, all of the aforementioned elements were identified as having an impact on student achievement.

Summary of the Research

The research literature reviewed and presented in this chapter focused on the impact of the school's physical environment on student achievement (Cash, 1993; Crook, 2006; Earthman, 1998; Hines, 1996; Lemasters, 1997) in the Commonwealth of Virginia. Additionally, research studies that documented similar results from other states were presented (Cervantes, 1999; Hickman, 2002; Lee, 2006). The literature review identified design elements that were reported as having a positive impact on student achievement, as well as student, teacher, and staff attitudes and behaviors. The literature suggested the importance of structural design elements in the actual design and construction process for new school facilities: the physical layout of the building, the incorporation of acoustics, daylighting, thermal air environmental and IAQ systems, and sustainable and green design elements.

The focus on physical conditions of the learning environment by the academic community has increased substantially over the past 30 years. Recent scholarly articles have focused on the *21st-century school*. The 21st-century school is a term found in the

more recent research and reflects an ideology regarding the contents of schools of the future. One of the key areas of focus for today's educational facilities is the design of learning environments that do not simply address what students should learn but address how students learn. Richmond (2006) wrote, "A 21st century school has the opportunity—and the responsibility—to be a resource for learning, recreating, and entertaining for all ages" (p. 39). The current focus on school design and construction by national organizations, federal, state, and local governments, and school design associations has brought much needed attention to the relationship between the physical conditions of the school and the academic achievement of students.

Conclusion

Previous research findings regarding the impact of school facilities design and the built environment on student achievement have been substantiated through research models (Cash, 1993; Hickman, 2002; Hines, 1996; Lee, 2006; Lemasters, 1997). Much can be learned from that research regarding the physical environment for learning, the behaviors of students and staff as they relate to the physical environment, and the overall condition of school facilities.

Previous research into school facilities condition and the relationship of the condition of the facilities to student achievement, as well as student, staff, and teacher behaviors and attitudes, identified a clear pattern that was repeated in several quantitative research studies (Cash, 1993; Crook, 2006; Hickman, 2002; Hines, 1996; Lee, 2006). The pattern revealed in previous research suggested that student achievement improves by as much as 11% in a new school building (Cash; Lemasters, 1997) and that student behaviors also improve in a new school building (Hines; Hickman). Further, previous

research indicated that staff attitude and morale improve in new school facilities compared to those factors in a building considered to be in poor physical condition (Hickman; Lee).

In all of the previous research studies, the condition of the building was measured using either the CAPE or a variation of the CAPE survey instrument created by Cash in 1993. Some of the previous research (Hickman, 2002; Lee, 2006) attempted to explain the statistical data that were presented. In the case of the Hickman research, an attempt was made to collect information from building level principals of new schools; however, the information was collected through a paper-and-pencil format and respondents were asked to respond to either open-ended questions or to complete a Likert-style questionnaire that ranked and prioritized the information about the building itself. The Hickman research validated the previous studies conducted in Virginia and established a premise for this research study. A detailed explanation from principals who had opened a new school, as well as the teachers and staff members who had worked in a new school building, was needed to further clarify the statistical implications of previous research.

That which had not been completed prior to the current study was a detailed explanation of whether or not the principal, teachers, and staff members believed that student achievement had improved in the new environment when compared to achievement in the environment in which they had previously worked. There also had been no in-depth analysis to determine the factors that actually contribute to the phenomenon identified in previous quantitative research studies. The goal of this study was to fill the gap in the literature with a rich, detailed description to understand the reasons behind the statistical evidence presented by others on this topic. The data

collected were used to generate a possible theory to explain this potential phenomenon.

This qualitative case study provides a more detailed explanation than has previous research on the topic by examining whether or not a relationship exists between new school facilities and student achievement and staff behavior and attitude in the Commonwealth of Virginia. All of the previous research had established, to varying degrees, the impact of an excellent-rated school facility on students, faculty, and staff. Abundant quantitative research had been conducted on the impact of the physical condition of the facilities on student achievement and student, teacher, and staff attitudes and behaviors. The literature review revealed a lack of information regarding the perceived impact of design elements of new high schools on student achievement, as well as student, teacher, and staff attitudes and behaviors.

This literature review contained five sections. Section one defined school design within a historical context. Section two investigated the current environmental conditions of the nation's schools. The third section explained previous research regarding the condition of school facilities as related to student achievement and behavior, as well as staff attitude and behavior. Section four summarized the school facility design recommendations supported by school facilities organizations, researchers, and professional associations. The final section of the literature review synthesized the recommendations for future design models.

CHAPTER 3: METHODOLOGY

Overview

The purpose of this qualitative case study was to describe school personnel perceptions of the influence of new high school facilities in the Commonwealth of Virginia on student achievement as well as student, teacher, and staff attitudes and behaviors. Three high schools that opened in the Commonwealth of Virginia between 2006 and 2007 were used in a case-study research model. According to Yin (2003), case study research "investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (p. 13). Quantitative research conducted to investigate the relationship between the condition of school facilities and student achievement as well as student and staff behaviors had indicated the existence of a relationship (Cash, 1993; Crook, 2006; Hickman, 2002; Lemasters, 1997). There had been no qualitative explanation as to how or why this relationship exists.

The findings presented in this case study are intended to provide a thick, rich description of school personnel perceptions of the relationship between the condition of school facilities and student achievement and behaviors that had been previously investigated using quantitative methods in the Commonwealth of Virginia by Cash, Hines, (1996), and Crook. It was also the intention of this case study to provide an in-depth and detailed explanation of the phenomenon that had been identified through previous quantitative studies: the perceived academic impact that school facilities conditions have on student achievement and student, staff, and teacher attitudes and behaviors (Cash,

1993; Hines, 1996, Crook, 2006). The findings of this case study are also intended to further previous research conducted in other states, which has investigated the relationship between new school facilities and student achievement (Hickman) as well as staff attitude and behavior (Lee, 2006). Additionally, the findings of this study enrich the current information available about the perceptions of school personnel of design elements found in new high schools on student achievement and student, teacher, and staff attitudes and behaviors. This study reflects the data collected and analyzed from three high schools in the Commonwealth of Virginia, each of which opened between 2006 and 2007.

A qualitative case-study design that utilized triangulation of research sources was used to investigate and explain the perceived relationship, if any, between the design elements incorporated into new high school facilities and the possible reciprocal effect on student achievement as well as student, teacher, and staff attitudes and behaviors. Additionally, document analysis of pertinent architectural data that related to the construction of the building, architectural designs or modifications, as well as descriptive data specific to each building was included as a part of the data collection process.

The data for this research study were collected primarily through face-to-face interviews conducted with the building principals who oversaw the opening of the new buildings as well as focus groups of purposefully selected teachers, staff members, and other faculty who worked in the three high schools involved in this case study during the first 1 or 2 years of operation. Focus group interviews were conducted with purposefully selected staff members who had at least 8 years of classroom experience and who previously had taught in other buildings prior to their current positions.

All of the participants in this portion of the research study were adults. The data derived from those focus group interviews were coded and analyzed for general themes presented in the interviews (open coding). Once the general themes had been developed, the collected data were coded again for specific identifiers and grouped accordingly under each of the major themes developed during the initial data analysis stage (axial coding). Primary data collection was completed through personal interviews, focus group interviews, and document analysis of architectural plans or drawings; all interviews were transcribed by a third party to maintain internal validity throughout the interview process.

Research Question

What is the impact of the design of new high school facilities in the Commonwealth of Virginia on student achievement and student, teacher, and staff attitudes and behaviors?

Research Subquestions

1. Has the design of new high school facilities in the Commonwealth of Virginia improved student achievement as reported by principals, teachers and staff of the new high schools?

2. Has the design of new high school facilities in the Commonwealth of Virginia improved the attitudes and behaviors of staff members that work in those new school facilities as reported by principals, teachers and staff of the new high schools?

3. Has the design of new school facilities in the Commonwealth of Virginia improved the attitudes and behaviors of students who attend the new high school as reported by principals, teachers and staff of the new high schools?

4. Is there a relationship between sustainable design elements and student achievement as perceived by principals, teachers and staff of the new high schools?

Through this case study the researcher attempted to determine school personnel perceptions regarding the impact of the design of new high school facilities in the Commonwealth of Virginia on student achievement and student, teacher, and staff attitudes and behaviors. Additionally, the researcher attempted to ascertain whether or not the design of new high school facilities in the Commonwealth of Virginia improved student achievement as reported by the principals of the new high schools. The researcher also attempted to determine whether or not the design of new high school facilities in the Commonwealth of Virginia appeared to improve the attitudes and behaviors of staff members working in those new school facilities, as reported by the principals of the new high schools. Further, the researcher attempted to examine whether or not the design of new school facilities in the Commonwealth of Virginia improved the attitudes and behaviors of students attending the new high school, as reported by the principals, teachers, and staff members of the new high schools. Finally, the relationship between sustainable design elements and student achievement, as perceived by the principals of the new high schools in the Commonwealth of Virginia, was explored through the opinions, observations, and perceptions of those principals, teachers, and staff members.

Research Procedures

The research conducted for this study was grounded in the premise that design elements found in new high schools in the Commonwealth of Virginia have a positive impact on the attitudes, behaviors, and opinions of students and staff in those schools.

This theory was based upon previous quantitative research conducted in Virginia by Cash (1993), which explored the relationship between the school's physical condition as measured by the CAPE and student performance as measured by the TAP. The schools used in the Cash research model were all rural high schools in southwest Virginia. Hines (1996) and Crook (2006) both used the CAPE survey instrument, as well, and their research produced results similar to those of the original research upon which their work was based.

Additionally, the research conducted for this study was based on the work of Tanner (2007), who concluded that the design patterns created by the school's physical environment ultimately influence student achievement. Thus, the school building itself should be viewed as a comprehensive learning environment, not just a building constructed of bricks and mortar. Tanner utilized an assessment instrument called the School Design Appraisal Scale, which analyzed the design components identified by building principals as being present in the schools that participated in the Tanner research studies.

Both of these models had been used in previous research studies investigating the relationship between the physical environment of the school and student achievement. The majority of the previous research studies on this topic, even when different theoretical models were utilized, reached the same conclusion: The physical condition and design of the school facility itself positively impact student achievement and student, teacher, and staff attitudes and behaviors.

Research Methodology

Because case study research in general focuses on a particular event or phenomenon, the methodology employed for this research study followed established procedures and methods outlined by Creswell (1998) and utilized the principles of grounded theory development (Strauss & Corbin, 1998). The researcher employed a descriptive, holistic, multiple case design, based on the work of Yin (2003), who asserted that multiple case study design can produce analytic conclusions independently; thus the results generated from such a study are "more powerful that those coming from a single case alone" (p. 53). Data collection was accomplished in this case study using triangulation of sources: interviews with the building principals of the research sites, focus group interviews with teachers who worked at each research site, and document analysis of architectural and construction information for each research site. According to Maxwell (2005), triangulation of data collection methods "reduces the risk that…conclusions will reflect only the systematic biases or limitations of a specific source or method" (p. 53) and allows for a more secure understanding of the issues involved in the research study.

The researcher conducted face-to-face interviews with the building principals and focus group interviews with purposefully selected teachers and staff members who had opened the new buildings under study. Focus groups consisting of teachers with 8 or more years of contractual teaching experience, each of whom had worked in a previous public K-12 setting prior to working in one of the case study high schools, were created to gather data about the impact of design elements on students, teachers, and staff. The interviews were based on structured questions created in advance of the interviews.

During the interview process the researcher asked for clarification of responses and elaboration by the participants when needed. The interviews were conducted from April to June 2008 at each of the designated research sites. Each of the interviews was recorded using digital audio and video recording equipment, and the interviews were transcribed by a third party and returned to the researcher in July 2008. A research journal containing field notes, memoranda, and observations was kept by the researcher along with an electronic file of interview dates, locations, times, and contacts. Releases were obtained from all school divisions that participated. All participants signed The George Washington University Institutional Review Board (IRB) paperwork for human subject participants in qualitative research studies. All questions used for interviews are presented as appendices to this doctoral dissertation.

In addition, each principal was asked to purposefully select for participation in a focus group interview at least 8 but no more than 10 teachers, each with a minimum of 8 years of teaching experience: one teacher from each content area (math, social studies, science, English, fine arts, physical education, world languages, career and technical education, special education) and a representative from either the guidance department or administration.

Once group members were identified, a focus group interview was scheduled within a 2-week window based upon the date of the original interview with the building principal. Focus group interviews were conducted between April and June 2008. Building principals were asked to purposefully select focus group participants from each of the academic disciplines. The researcher did not meet any of the focus group members until the day of the focus group interview. The researcher returned to each site about 2 weeks

after the initial interview with the principal to conduct the focus group interview with teachers at the location.

A separate set of questions based on the research subquestions was developed for each of the building principal interviews (Appendix B). A second set of interview questions was developed for the focus group interviews (Appendix C); those questions were field tested in March 2008, then revised and used for the focus group interviews conducted at the research sites. In some cases, based upon responses from research participants, follow-up questions or clarification questions were asked in addition to those included in the original research questions. Each building principal interview lasted approximately 30-35 minutes and was followed by a tour of the facility and explanation of specific architectural features and design elements that lasted approximately 45-60 minutes. Each focus group interview lasted between 45 and 60 minutes and was held in a conference room provided by the principal at the research site.

Each focus group interview was recorded using audio and video recording equipment so that it could be transcribed at a later date. An interview with central office personnel was conducted within a few days of the principal interview (High School #1) or on the same day that the interview with the principal was completed (High School #2). The interviews with the central office personnel were designed to gather descriptive data and information about school design, construction, and financing procedures that were utilized in each of the research locations. The data collection process involved 30 people from three different locations: 3 building principals, all of whom opened their respective buildings, 2 central office personnel, and a total of 25 teachers from the designated high schools.

Once the interviews were completed, the data were analyzed using the principles of data analysis as outlined by Creswell (1998) for conducting qualitative research through a phenomenological perspective. The outline of the research procedures is based on *Qualitative Research Design*: *An Interactive Approach* by Maxwell (2005). General themes or ideas were formulated from the collected data, and open coding of the data was completed so that the researcher could identify themes and meaningful units of information contained in the data. Once the initial coding was completed, an analysis (axial coding) was completed in July and August 2008 and fact checking with building principals was conducted by the researcher to verify and validate the data collected. Once the themes emerged from the collected data, axial coding was used to rank, classify, and categorize the data to interpret and develop a textural description of what the data indicated. A contextual description of the overall experience of data collection was created once the research study had been completed (Maxwell).

Document analysis of information gathered from the architectural firm responsible for the design of the building was completed, and available construction information was gathered for each of the schools involved in this case study. The use of personal interviews, focus group discussions, and document analysis provided a triangulation of data collection procedures as well as a clear picture of the schools involved in the case studies. It also provided, according to Maxwell (2005), particular information about the participants, settings, and persons or activities within each of the buildings that could not have been obtained from other data collection procedures.

Validity and Data Interpretation

Triangulation of data collection techniques was employed for this research study: data were collected not only from the principals of the new high schools, but also from the teachers, staff members, and other school personnel who worked in those buildings (Yin, 2003: Maxwell, 2005). According to Maxwell (2005), triangulation, "reduces the risk of chance associations and of systematic biases due to a specific method" (p.112). Yin (2002) stated that triangulation provides the researcher with "converging lines of inquiry" (p. 98) which would allow for a finding or conclusion to be much more convincing and accurate. Construct validity, according to Yin, (2003) is attained when multiple sources of evidence are analyzed, and the data collection methods employed in this case established "correct operational measures for the concepts being studied" (p. 34).

Once the data were collected, all interviews were transcribed by a third party to ensure accuracy and maintain stability of the data collection procedures. Additional information was gathered through the examination of architectural renderings, construction information provided by school district officials, and interviews conducted with school division personnel responsible for the oversight of each project, except in the case of High School #3.

During the data collection process, the researcher maintained a field note journal from each set of interviews with principals, as well as focus group interviews. A case study database in electronic form was created that detailed dates and times of interviews, as well as specific topics of discussions. These sources of information were utilized in the data analysis process to reference specific points made by participants, or to validate specific information about construction costs or information that related to the overall

design ideology of each research site. According to Maxwell (2005), a case study database "increase[s] the reliability of the entire case study" (p. 102). Additionally, the researcher kept detailed case study notes and case study materials such as construction information profiles, architectural design layouts, and other pertinent information collected by the researcher were maintained based on the principles for case study design outlined by Maxwell (2005).

Case Study Descriptions

Case study descriptions were developed for each of the three schools involved in the study; the descriptions include construction information, as well as information about student body makeup and previous school attendance rates. Architectural information from each of the schools is included in the respective case studies, as well as any pertinent information gathered from the architectural firm itself about the design process used to create the building. A description of each school's physical location, demographic information about the surrounding community, and pertinent information about the socioeconomic status of the school's students has been included. A general description of the staff employed at each school is included in each of the case descriptions. All participants in the study shall remain anonymous; names of schools, as well as names of participants, were changed to maintain confidentiality.

High School #1

High School #1 was located in the central portion of the Commonwealth of Virginia, in a metropolitan region of about 21,000 people (U.S. Census Bureau, 2006);

the original building had been constructed in 1952. The original building had been renovated and several additions completed before the school board made the decision to build a new school adjacent to the old school on the existing site. Construction on the new building began in the spring of 2004 with the footer for the new building's being exactly 6 feet from the old building.

High School #1 was designed by Moseley Architects of Richmond, VA and was modeled after a previous design model used in 2003 in the suburban Richmond area. High School #1 was built through the Public-Private Public Education Facilities and Infrastructure Act (PPEA) of 2002. It was constructed to hold about 1,000 students but at the time of this research housed about 800 students. The design and construction cost for the entire project was $51.4 million (which included the construction of an elementary 3-5 school) on a separate site (Principal Interview 1, April 8, 2008). Four change orders made during the construction process increased the cost of the project, but not significantly. During the construction process, it was discovered that a 19th-century pit existed on the site, thereby necessitating the completion of additional excavation and site work assessments before the project could proceed. High School #1 had 65 teaching staff as well as 35 clerical and support staff; it was situated on a 27.4 acre campus.

Input Into the Design Process

High School #1 was intended to be a collaborative effort in terms of the design process, as the district leadership made an effort to involve the teachers in that process as much as possible. Additionally, the principal of High School #1 intentionally involved the staff of the existing school in the process of furniture selection, classroom layout, and other areas of input regarding the design. Not all of the suggestions made by those

teacher committees were incorporated into the design of High School #1, but many ideas were included, such as the science lab layouts, the location of locker room storage areas, and the types of desks and furniture used in the classrooms. Additionally, the teachers served on committees to select paint and color schemes for classrooms, hallways, and commons areas.

The principal worked closely with the director of operations for the school division, who provided the financial oversight, and a construction foreman, who supervised the technical aspects of the construction process. The principal indicated that the actual process of construction necessitated consideration of aspects that had not been previously taken into account, such as door locations, lighting, heating and air conditioning (HVAC) systems, and grounds and maintenance (Principal Interview 1, April, 8, 2008).

Architectural Design Features of High School #1

The building layout was designed to be separated into academic and extracurricular or elective courses, with the technology or computer lab courses interspersed within the academic houses or "wings" (See Appendix E). According to both the director of operations and the building principal, the construction of High School #1 was the biggest and boldest construction project in the city's history (Principal Interview 1, April 8, 2008; Central Office Interview 1, April 15, 2008). High School #1 had very few exterior keys for the principal and administrative staff, whereas the rest of the teaching and support staff accessed the building through the use of electronic swipe cards. Times for access were set so that all staff had access to the building during the evenings and weekends (Principal Interview 1).

High School #1 contained 234,000 square feet of space. The building itself incorporated architectural modifications and design elements recommended by both CEFPI as well as the NSSD (2005). Hallways were wide and tall, with a great deal of open space incorporated into the design of the building, as well as the use of natural lighting in all of the classrooms, hallways, and commons areas. All administrative offices were located in the main office with the counseling department located on the second floor of the school. No administrative offices or counseling offices were contained in the academic wings of the building. Academic wings at High School #1 are not completely interdisciplinary as there are designated areas for core courses; however, all of the science classrooms are centralized on both floors in the center of the building. Technology classrooms for business and marketing are integrated within each of the academic wings.

Each of the academic wings of the building included a professional workroom for teachers that contained a copier, individual workspaces, and a kitchen area with bathrooms for staff use. The classrooms contained oversized student desks, each large enough to support not only a laptop computer but also the textbook and other necessary materials students might need. Furniture was selected for classrooms based on portability and ease of movement; the desks needed to be adaptable for a variety of learning styles and instructional activities, such as group work and collaborative learning. Every classroom contained a technology package consisting of a multimedia computer system, speakers strategically placed within the classroom, and an LCD projector and white board.

Additionally, teacher computers were integrated with the communications network in the building so that when teachers wanted to print copies of documents from

their classroom computers, they were able to select that option and then simply walk to the workroom to retrieve their materials. Professional workrooms were available in each academic wing to allow teachers their own private spaces for planning purposes, as well as privacy to make telephone calls and communicate with parents or conduct other personal business. The gymnasium contained three full basketball courts, locker and team room facilities for boys and girls, as well as storage, laundry, and athletic training areas. The auditorium and performing arts wing of the building were situated adjacent to each other, and the auditorium was built to hold 1000 people. Many community functions and events were held there throughout the year.

Summary of High School #1

High School #1 opened in the fall of 2006, with the old building still standing next to the new one. It was situated on a campus of 27.4 acres and contained 234,000 square feet of space, with 69 teaching staff, 35 support staff, and 3 administrators. Each building principal was asked to provide a breakdown of experience for the staff in the building at the time of this research study. In High School #1, the breakdown for years of experience was as follows: 0-7 years – 43 staff members, 8-14 years of experience – 4 staff members, 15 or more years of experience – 13 staff members, and 30+ years of experience – 9 staff members.

Additionally, the majority of the athletic fields and most of the school grounds were still in various stages of construction or demolition, thereby necessitating modifications to most of the extracurricular activities as well as the curriculum for health and physical education classes. No outdoor activities were held at High School #1 for almost 18 months, from the time construction began in 2004 until the building was

complete; outdoor site work was completed in the late fall of 2006. The principal of High School #1 was hired in the summer of 2004 and not only served as the principal of the existing building, but also, along with the director of operations and the construction foreman, supervised many aspects of the planning and construction process of the new school. The construction foreman post was a short-term contractual position that expired once all of the punch-list items had been completed.

High School #2

High School #2 was located in southeastern Virginia, in a rapidly growing suburban locality of about 221,000 people (U.S. Census Bureau, 2006). There had been about a 10% increase in the population of this region of Virginia since the year 2000 (U.S. Census Bureau, 2008), and the need for a new high school in this area had been expressed for several years. The total cost of construction for High School #2 was $63 million; construction began in 2004, and the building opened for the first time in the fall of 2007 (Central Office Interview 2, April 17, 2008). High School #2 housed almost 1750 students when it opened in the fall of 2007; it was scheduled to serve about 2100 students for the 2008-2009 school year.

Input Into the Design Process

To gain an adequate perspective regarding what was needed to make High School #2 a 21st-century school, the school division had sought input from a variety of stakeholders. The school division collected information through surveys of the staff of existing buildings and community members whose children would attend the new school. Almost 2 years prior to the beginning of construction on High School #2, site visits to

other schools currently under construction in the Commonwealth of Virginia had been utilized as a means to determine what was available and what the possibilities were for the design of the building and grounds. There was a conscious effort on the part of the director of construction and the entire division to include as much technology infrastructure as possible into the design of the new school (Central Office Interview 2, April 17, 2008). Several items that were ultimately included in the final product, such as smart boards, were not in the original plans for the building; as the technology was developed and costs decreased during the design process, the division made modifications and adjustments to the original plans to accommodate changes.

From the beginning of the process, the division as a whole made an effort not only to include the most recent and cost-effective technological advancements available but also to purposefully design a building that was eco friendly and energy efficient. Information was gathered that documented the academic benefits of the use of daylighting, thermal environmental controls, and sound and acoustical enhancements to the classrooms. One of the driving forces behind the design of High School #2 was the fact that the school division incorporated some of the enhancements at other existing high schools and, therefore, had a model school plan to utilize again, if they needed to build another high school in the future. The division attempted to learn from the mistakes that had been made in a previous construction project: That school had opened without availability of the full capacity, parts of the building were still under construction for several months after school began, and there was no teacher or administrator input into the design process. With High School #2, the division made a specific and conscious effort to include as many teachers in the design input process as possible.

Architectural Design Features of High School #2

High School #2 contained specific security design features such as automated access points for teachers and staff and a main entrance monitored by video surveillance as well as a school security checkpoint for all visitors. The doors of the building automatically unlocked or locked at a certain time of the day; therefore, the number of keys needed for staff was decreased, and the number of people entering the building at certain times of the day was limited to those with access. One problem attributed to that design was encountered early in the winter of 2007, when the division was closed because of a snow day. Because of the automatic lock mechanisms, the building opened promptly at the designated time, and no one was aware of it until late in the day. The building itself was constructed so that if the need arose to add space or classrooms, there was a specific place where that could be accomplished (See Appendix H).

High School #2 was designed to replicate the concept of academic houses or quads, a concept that helps to keep students of the same grade level in a specific part of the building for the majority of their academic classes, with shared spaces in between for science, elective courses, and computer labs. Each of the academic quads included an administrator's office and a counselor's office to facilitate not only supervision but also communication for the teachers with the grade level administrator in that quad (See Appendix H). Each quad contained a professional workroom for teachers with desks, computer access, and telephones for professional duties, as well as a small social gathering area for teachers' use during their planning periods. Each of the academic quads or wings was interdisciplinary with all grade-level classes occupying the same

wing or space, instead of its having a traditional format in which classrooms for one subject were found in a specific area or hallway of the building.

The science labs, as in High School #1, were located toward the center of the building in a cluster so that the natural gas lines entered only one area of the building. Each of the classrooms contained a highly integrated technology package that included a computer, an LCD projector, an integrated sound system that operated through speakers in the ceiling, and an audio enhancement system for the teacher that allowed the teacher's voice to be projected anywhere in the classroom during the lesson. The majority of the classrooms were designed to take advantage of the natural lighting, with many of the classrooms' having windows positioned high on the wall; all of the glass windows contained beveled blinds between the panes of glass that were angled to optimize the amount of light in the room at specific times of the day. The overall design of the building was somewhat circular in nature, with the auditorium, gymnasium, and commons areas in the center and the academic wings or houses located off the main central area. Student lockers were in a centralized location, as with High School #1; however, they were more closely aligned with the center of the building. Separate facilities for performing arts, drama, and specialty courses also were located in the central portion of the building. The building contained a gymnasium with three separate courts, as well as an auxiliary gym, training room, locker and team rooms, storage facilities, and athletic training rooms.

Summary of High School #2

High School #2 opened in the fall of 2007 with about 1750 students in Grades 9-12. There were 108 professional teaching staff, 24 support staff, and 6 administrators

assigned to this building. High School #2 was situated on a campus of 97.8 acres, contained 353,000 square feet of space, and was built to hold about 2200 students (Central Office Interview #1, April 15, 2008). The building principal provided a breakdown of experience for the staff in the building at the time of this research study. In High School #2, the breakdown for years of experience was as follows: 0-7 years – 57 staff members, 8-14 years of experience – 45 staff members, 15 or more years of experience – 19 staff members, and 30 or more years of experience – 7 staff members. The student body populating High School #2 was drawn from three communities with existing rival high schools, as well as two middle schools. The principal of the school was provided with 2 years of time to plan for the opening of the school and was able to provide input into the design modifications as the building progressed and change orders were issued with the construction company.

High School #3

High School #3 was located in a suburban area of about 71,000 people (U.S. Census Bureau, 2008) in southeastern Virginia. There had been a 24% population increase in the combined city and county locality since the year 2000; consequently, a new high school was needed to relieve overcrowding at the other two high schools. The school division served the citizens of both the county and the city, and High School #3 was the third high school in the division, the second one built in the previous 25 years. It was designed to be a technology pathways high school to serve the needs of the career and technical education (CTE) curriculum offered by the school division, thereby providing students at the other two high schools with another curricular option.

Certifications were to be offered in the fields of emergency medical technician and technology systems information or networking.

High School #3 had a planning principal in place when construction began in the spring of 2006; however, that person left in early July of that year and there was no planning principal until the current principal, who was the director of CTE and high school guidance for the division, volunteered to serve as the planning principal in October of 2006. Once the planning principal had been named, a new CTE director was hired. The planning principal worked in a dual capacity, as both the director of guidance and the planning principal, for a total of 4.5 months (Principal Interview 3, June 11, 2008). The researcher could not determine what effect if any the lapse of time between the departure of the original planning principal and the appointment of the new one might have had.

Input Into the Design Process

The division assigned the director of operations to oversee the construction of High School #3, the design of which had already been selected. The plans for the new high school did have input from teachers who worked within the division; the design was selected by the school division before construction began or the planning principal was hired. There was very little input into the design process on the part of the principal or any of the teachers after construction was underway. The color schemes and layout of the classrooms and buildings had been completed, and there was a conscious effort on the part of the district to bring the project in under budget. Many concerns were expressed, especially with regard to the classrooms that were designated as career and technical classrooms, which had specific instructional needs; the principal oftentimes was unable to

attain recommended changes. According to the principal, an adversarial relationship existed between the central office and the planning office. The planning principal stated that she often felt frustrated, overwhelmed, and out of the loop on many of the decisions (Principal Interview 3, May 13, 2008). The color scheme, classroom design, and even the tile on the floor were specified in the construction contract with the builder and were to be used in the building no matter what problems were encountered.

Architectural Design Features of High School #3

High School #3 contained 243,000 square feet of space and is situated on a campus of 54.6 acres; it was designed according to the concept of a "main street" that contained, in this case, all of the career pathways courses and classrooms for AutoCad, pre-engineering, EMT, graphic arts, computer networking, and business and marketing classrooms, as well as the guidance office, main office, and commons area; the gymnasium and performing arts area were located at the end of the main street. The arms of the building branched off the main street, with academic wings that housed elective classes in one area and core classes in another. The arms were not interdisciplinary; they were separated into a math wing, English wing, social studies wing, and so forth. The science labs were situated in the middle of the building, just as they were in the other two high schools involved in this research (See Appendix K).

The locker areas were situated in the same manner as was the case in the other two high schools, with a centralized location away from the academic wings, which served as the main location on both floors. The classrooms each contained a technology package, with a computer and LCD projector in every room, as well as software for each teacher to allow access to specific Web sites for students. All of the classrooms, as well

as the hallways and commons areas, incorporated the use of natural light into the design process. The performing arts wing, as was the case with the other high schools in this study, was located next to the auditorium; there were separate facilities for band, strings, and chorus, as well as individual practice rooms for drama and theatre classes. The gymnasium contained three full courts, as well as space for locker rooms, team rooms, and storage and athletic training facilities.

Summary of High School #3

High School #3 opened in the fall of 2007; it was designed by the same architect as High School #1. It consisted of 243,000 square feet of space on a campus of approximately 54.6 acres, serving 750 students with 68 teachers, 22 clerical and support staff (including 2 security officers), and 3 administrators. High School #3 was constructed for a total cost of $46 million. The building principal provided a breakdown of experience for the staff in the building at the time of this research study. In High School #3, the breakdown for years of experience was as follows: 0-7 years – 19 staff members, 8-14 years of experience – 31 staff members, 15 or more years of experience – 20 staff members, and 30+ years of experience – 5 staff members.

The design process, as well as the construction process, appeared to have been driven by cost-effective management strategies; often items were eliminated from the design solely because of cost, along with an incomplete understanding of the potential impact of those design elements on instruction. For example, a sink for the athletic training room was eliminated from the original design. The principal of High School #3 was required to justify the need for the sink and water lines; they were eventually installed well after the building had opened (Principal Interview 3, May 13, 2008). The

principal of the school experienced an extremely frustrating and difficult process in opening the school; however, it appeared that once the school opened and the staff was allowed to move into the building, many of those frustrations were replaced by successful experiences. Student performance on end-of-course standardized achievement tests was well above the expected outcome; consequently, both teachers and staff had reason to celebrate at the end of the 1st year.

Summary of Case Study Procedures

Once all data were collected and coded for appropriate themes, a narrative of each of the schools involved was written. When possible, direct quotes from the interviews were utilized to make the interpretation of the data clear and concise. To validate the research collection procedures, the researcher also maintained a field-notes journal for each interview. As data were coded and analyzed, the researcher maintained an audit trail that contained descriptive information about data collection methods, including how the data were interpreted and how decisions were made about open and axial coding. Information about the individual schools used in the case study was fact checked by the researcher with the principals of each school and with the architectural firms responsible for the design of the building. Architectural renderings and floor plans were provided either by the school divisions or the architectural firms responsible for the design. Construction costs and additional construction information were verified by a central office representative responsible for construction or by the principal of the building.

A matrix of information was created for each school in the case study; the matrix contained information used ultimately to write the descriptive narrative for each school.

The information contained the themes developed from the data collection procedure, as well as the names of the people who provided the information and quotations used in the research study. This matrix was maintained by the researcher in an electronic format. Information about each of the high schools used in this case study is summarized in Table 1.

Table 1. *Summary of Information for High School Case Study*

Site	Square footage	Campus size	Total teaching staff	Total support staff	Total cost of construction
High School #1	234,000 square feet	27.4 acres	65	35	$37 million
High School #2	353,000 square feet	97.8 acres	108	24	$63 million
High School #3	243,000 square feet	54.6 acres	68	22	$46 million

Potential Bias With This Research

Because the researcher conducting this research study had previously worked in several new high schools in the Commonwealth of Virginia, there was the potential for bias. As a former teacher at a new school, as well as an administrator who had opened a new high school, the researcher was well aware of the types of problems, constraints, and potential conflicts that are created when a new school opens. The value of the researcher's own theories, beliefs, and perceptual "lens" (Maxwell, 2005) was important in this case and drove the basis for the research study. Maxwell (2005) acknowledged the

importance of understanding how the researcher's values and "expectations influence the conduct and conclusions of the research study" (p. 108).

Additionally, selection of focus group participants with at least 8 years of experience could have potentially eliminated a group of research subjects (those with fewer than 7 years of experience). The selection of focus group participants was designed to provide a level of consistent experience among participants and provide the researcher with the ability to effectively compare data collected from focus group interviews.

Consequently, an extremely detailed interview journal, a field-note journal, and an audit trail were maintained by the researcher to eliminate any questions of possible bias and or concerns over validity and data analysis. Additionally, all interviews were recorded using audio- and video-recording technology. None of the audio recordings of interviews were transcribed until the data collection process was completed, and all transcriptions were completed by a third party. The researcher was also aware of the potential for bias created through the exposure to information that was generated through the literature review created for this dissertation.

Human Subjects Review Information

All human subjects who participated in this research study signed The George Washington University's Human Subjects Review authorization before participation in any of the data collection exercises. Fictionalized names were created for the high schools involved in this case study. Participants were not identified by name in the research study; all names were fictionalized to maintain confidentiality.

CHAPTER 4: RESULTS

The purpose of this study was to describe school personnel perceptions of the relationship between design elements present in new high schools in the Commonwealth of Virginia and student achievement, as well as the attitudes and behaviors of students, teachers, and staff. The primary goal of the study was to formulate a clear theory, based on the data collected from the research participants, to explain (a) why students who attend new high schools appear to have higher rates of student achievement and (b) why teachers and staff of new high schools report information either supporting or refuting that phenomenon. The information gathered from this research study could influence the determination of elements to be included in future design models for high schools as school leaders plan for growth, school construction, and renovation projects across the state. Because the cost of construction has significantly increased in the past 5 years, it is important for school divisions planning future school construction or renovation projects to be able to choose design elements that are not only cost effective but also the most beneficial for their student populations.

Three high schools whose construction began in the Commonwealth of Virginia between 2004 and 2006 were purposefully selected for this case study. One of the high schools opened in the fall of 2006, whereas two of the high schools involved in the case study opened in the fall of 2007. Two of the three high schools involved in the study were designed by the same architectural firm.

Research Procedures

The researcher developed a set of questions to be used for interviews with building principals and focus group participants; interviews were also conducted with district level personnel who had supervised or overseen the construction process for each division, except for the case of High School #3. Focus group questions were developed based on the original research question and subquestions and an attempt was made by the researcher to connect those questions to the CAPE instrument created by Cash (1993).

To assess the effectiveness of the focus group questions and determine their effectiveness and validity, a research field test with a sample focus group was conducted in the high school at which the researcher was employed as an administrator. The high school used in the research field test opened in 2006; approximately 1100 students were assigned to attend the school for the 2006-2007 school year and about 1725 students for the 2007-2008 school year. Because of the potential for bias with the researcher conducting the focus group to sample and field test the questions, the researcher's doctoral dissertation advisor conducted the field test focus group in March 2008. Based on the responses elicited from that sample focus group, original focus group questions were altered or revised to more closely reflect one of the research subquestions formulated for this research study.

The researcher utilized a qualitative research process (triangulation) that involved individual interviews with three building principals, a subsequent tour of each facility, and examination of any architectural or construction documents that might provide insight into the design or construction process. The researcher returned to each site about 2 weeks after the initial interview with the principal to conduct a focus group interview

with teachers at the location. Focus group members included one teacher from each discipline and either an administrator or guidance counselor. Additional information about the construction process was gleaned from two subsequent interviews with central office personnel responsible for school construction projects in two of the three districts (no interview was conducted with a representative for the district in which High School #3 was located). All of the high schools used in this case study were purposefully selected because they had opened in either 2006 or 2007; the researcher wanted to investigate school personnel perceptions within the first 2 years of the buildings' existence.

Data Collection Process

The process utilized by the researcher involved obtaining permission to conduct the research study from each division superintendent's office in March 2008 (Appendix A). Once written permission was obtained from each division, the building principal of each school was contacted, and interviews were scheduled to be completed in April and May 2008, about 2 weeks apart. Once an interview with the building principal and a tour of the facility had been completed, a follow-up interview was conducted with a division or district representative who was responsible for the oversight of the construction project. In the case of High School #3, that person was unavailable; therefore, no interview was conducted.

The qualitative research process involved individual interviews with three building principals, a subsequent tour of each facility, a focus group interview at each research location and examination of any architectural or construction documents that

might provide insight into the design and construction process. The researcher utilized the following research question to drive the interview process:

What is the impact of the design of new high school facilities in the Commonwealth of Virginia on student achievement and student, teacher, and staff attitudes and behaviors?

For the purposes of this qualitative research study, the research question was divided into four research subquestions. The first two subquestions were designed to explore the perceptions of the building principals, teachers, and staff members and to determine whether or not there was an identifiable characteristic perceived as having an impact on student achievement, as well as the attitude and behaviors of the teachers who worked in those buildings. The third and fourth subquestions were designed to ascertain the perceptions of principals, teachers, and staff members themselves regarding the design elements of a new high school and their effects upon student achievement, attitude, and behaviors.

Research Subquestions

1. Has the design of new high school facilities in the Commonwealth of Virginia improved student achievement as reported by principals, teachers, and staff members of the new high schools?

2. Has the design of new high school facilities in the Commonwealth of Virginia improved the attitudes and behaviors of staff members that work in those new school facilities as reported by principals, teachers, and staff members of the new high schools?

3. Has the design of new school facilities in the Commonwealth of Virginia improved the attitudes and behaviors of students who attend the new high school as reported by principals, teachers, and staff members of the new high schools?

4. Is there a relationship between sustainable design elements and student achievement as perceived by principals, teachers, and staff members of the new high schools?

Case Study Synthesis

The three high schools involved in this case study were designed to include the most current and most effective research-based design elements available. Each building was designed to incorporate the use of natural lighting throughout the classrooms, hallways, and professional working spaces of the facility. Each building contained technology designed to provide teachers with the most advanced instructional enhancements available, such as computers, LCD projectors, smartboards, integrated phone and e-mail systems, and a professional working space for each teacher. Each building contained electronically operated climate control systems to regulate thermal temperatures in the building, and in one case, in each classroom (High School #1). All of the buildings represented a similar architectural footprint (see Appendices E-M).

Two of the three high schools (#1 and #3) were designed by Moseley Architects of Richmond, VA. High School #2 was designed by Waller, Sadler & Todd and Rodriquez, Ripley, Maddux and Motley Architects of Virginia Beach. All three high schools employed similar design features with regard to the location of student lockers, integration of the performing arts department adjacent to the auditorium, multiuse design

features within the commons areas, inclusion of a large gymnasium with locker and team facilities for boys and girls, and soundproofing and auditory enhancement for all instructional areas.

The capacity of each of the three buildings was as follows: High School #1 was built to hold 1,000 students but currently enrolled only about 800. High School #2 was built to hold about 2200 students but enrolled just over 1750 students in its 1st year of operation, and High School #3 was built to hold about 1000 students but enrolled only 750 for the 1st year. All three schools were designed to support specific types of curricular instruction as well as extracurricular and community-based functions. High School #1 opened in the fall of 2006 with a complete enrollment of students in Grades 9-12. In 2007, High School #2 also opened with a complete enrollment of students; however, members of the senior class at the school had elected to come there. Consequently, the first graduating class of 2008 comprised only about 200 students. High School #3 had no senior class; it was not at capacity when it opened in the fall of 2007.

Synthesis of Principal Interview Themes

The administrators who opened the buildings involved in this case study reported similar experiences. Each of them was involved, to some extent, in slight alterations of the original design of the building and was able to provide input into minor changes after the construction process began. The experience of the principal of High School #1 was different from that of the other two principals because Principal #1 continued to serve as the building principal of the old school while the new school was under construction right next door. The principal of High School #2 served as the planning principal for 2 years prior to the opening of the school, thereby likely facilitating a smooth transition and

opening. The principal of High School #3 underwent a very frustrating and difficult experience in comparison to the experience of the other two principals in this case study in that the original planning principal deserted the project early in the process; the principal's desertion resulted in a state of flux or disjointedness that existed from the time the original planning principal left until Principal #3 was named as a replacement. Consequently, Principal #3 had the least amount of time to prepare for the opening of school, about 9 months between the time of appointment and the first day of school. All of the principals reported that they had noticed a difference in the attitudes of employees as well as students; they attributed the change to the "newness" of everything.

The responses of all three principals reflected similar themes in reference to the research question about the impact of the building and its unique design elements on student achievement and student and staff attitudes and behaviors. The first theme gleaned from the responses of all the principals was that the process of planning and preparation for the opening of the building was far more difficult than the actual act of opening the building. The second theme reflected in the principals' responses was that there was some identifiable impact on student behavior, related in some manner to the new school as opposed to the old school. The third theme evident in the responses of all three building principals was a shared belief that there was no perceivable or dramatic impact of the design elements within the building on student achievement.

Principal Theme #1 - Planning and Preparation

The theme of planning and preparation as a key factor for the successful transition of both students and faculty new to their individual buildings emerged through analysis of the data collected from all three principals in the high schools involved in this case

study. Each of the three principals was asked to plan for the opening of the school and to assist in some capacity with certain decision-making processes as the building evolved. All of the principals participating in this study mentioned specific factors that led to the generation of a theme focused on planning and preparation.

All three principals mentioned specific aspects that were new to them, such as their inclusion in the collaboration among the architect, builder, and school division, an activity for which they were not prepared. Principal #1 reported relying on the construction foreman to explain what needed to be requested. Principal #1 believed that the foreman, not the principal, was the expert in this regard. Principal #2 related the experiences of preparing for weekly construction meetings with the architects, builder, and division representatives. The principals indicated that planning for the technological infrastructure of the building and then adapting staff development and training for the teaching staff to meet that need were also difficult parts of the process of planning for the new school.

Principal #3 mentioned that identification of the level of proficiency required for an individual to be interviewed for a staff position was a difficult aspect of the planning process, which had to be incorporated into the overall opening plans for the school (Principal Interview #3, May 13, 2008). The blending of staffs at High School #2 and High School #3 were undertakings that both principals had expected to be more difficult; both expressed gratitude for their staffs' ability to work together and achieve a common goal.

Principal #2, because a 2-year planning process had been put in place by the district, had a very different experience when compared to the other two principals in this

research study. One of the main differences in the experience for Principal #2 was the fact that a great deal of new technology was added to the project once the initial construction project had been approved (smartboards, wireless electronic Internet communications, and classroom auditory enhancement systems). Additionally, some changes had to be initiated during the construction process of High School #2 to account for technological changes, such as the location of data closets, electronic components, and other devices (Principal Interview #2, April 17, 2008).

The experience of Principal #1 was very different from the experiences of the other two principals, involving simply a transfer of the same staff from the old building to a new one. The logistics of coordinating the move of all belongings, delivery of furniture and classroom supplies, and coordination of curricular adjustments in physical education and extracurricular practices and activities off site was reported as the most challenging part of the planning and preparation process for that principal (Principal Interview #1, April 8, 2008).

Although the principals did not believe they had experienced a change in educational philosophy per se, they all reported being more cognizant of the demands placed on their staffs and students by the transition process. All three principals believed that the planning and preparation undertaken by them and their administrative staffs prior to the school openings contributed to the smooth beginnings at all locations. During the data collection process, however, none of them attributed any academic influence or impact on students to the new building.

Principal Theme #2 - Positive Impact on Student and Staff Behaviors

All three principals perceived that behaviors exhibited by students in the new buildings had improved over behaviors exhibited in previous environments. Principal #1 mentioned that discipline referrals had dropped significantly when compared to the last year in the old school. Principal #2 indicated that when students were asked what they liked best about High School #2, they responded that it was the fact that the teachers cared about them; in turn, Principal #2 believed they behaved better (Principal Interview #2). As evidence of that phenomenon, Principal #2 indicated that there had been only two fights all year, both involving girls, whereas there might have been two fights on the first day at the previous school that principal had worked at (Principal Interview #2).

Both Principal #1 and Principal #2 expressed the opinion that students were proud of their school and enjoyed coming there. Principal #1 offered as evidence the fact that there was still no graffiti on the benches outside the building nearly 2 years after they were installed (Principal Interview #1, April 8, 2008).

All three principals perceived their staffs to be happier and more productive, and all three offered as evidence their frequent observations of staff in the building well after the instructional day had ended, at school functions, and at community events held at the school. Although staff had acted similarly at their previous schools, all three principals indicated that such actions had occurred far less frequently than was the case at the new schools. The principals opined that the traffic patterns had contributed significantly to the calm feeling and smooth daily operation of the individual schools. Principal #1 reported that the students were not “on top of each other,” as had been the case in the old building;

that freedom of movement had alleviated many of the proximity issues that led to confrontations in the previous building (Principal Interview #1).

Principal Theme #3 - No Perceivable Impact on Student Achievement

Principals were asked whether or not they perceived that the building design had any impact on student achievement during the 1st year the building was open (See Appendix B). The principals involved in this research study did not express any indication or belief that the new architectural design or features incorporated into the design of their individual buildings had resulted in any perceivable impact on student achievement. All three principals expressed a belief that the impact of the building design and layout was more easily identifiable through the actions and behaviors of the students but did not believe there was a significant impact on achievement. Principal #2 and Principal #3 did report that the achievement scores for standardized, end-of-course (EOC) state tests were better than expected at the end of the first semester. Both High School #2 and High School #3 used a 4-by-4 block schedule whereas High School #1 used a modified block schedule in which classes met every other day all year long. Principal #1 reported no perceivable change in achievement between the 1st year and the 2nd year and alluded to a perception that achievement scores had actually declined slightly when student scores from the old building were compared to those from the new building.

Principal #3 stated that typical results were seen at the end of the first semester, with 9th-grade students' having the worst grades and 11th-grade students' having the best (Principal Interview #3, May 13, 2008). Principal #3 attributed the better first-semester grade distribution seen primarily with upperclassmen as possibly being due to the fact that many of them were enrolled in the specialty center classes offered at High School #3.

Many of those students were taking classes that were challenging and demanding; oftentimes those students were viewed as the "cream of the crop" (Principal Interview #3).

The themes developed from the interviews with the principals closely mirrored those that emerged from the focus group interviews. The principal interview themes are synthesized in Table 2.

Table 2. *Themes Developed From Principal Interviews*

	Principal interview information leading to theme development		
Theme	Principal Interview #1	Principal Interview #2	Principal Interview #3
Planning and preparation	Better behavior Reorganize extracurricular activities Collaboration between builder, architect, and school division Logistics of actual move	Technology change drove staff development Blending of new staff required work Coordinate installation of technology and staff development	Limited amount of time for planning Process was accelerated by situation Technology drove staff selection and interview process
Positive impact on student and staff behaviors	Kids seem to be happy Discipline referrals are down People like coming to work Traffic patterns impact student behavior	Pride of student body expressed Students and staff worked together from day one Kids stated that "teachers care about them" Limited amount of student discipline	Not all students perceived the new school as a positive Historical influence on community Some behaviors were expected
No perceivable impact on student achievement	Believed there was no impact. Stated that scores actually fell in 1st year when compared to old school	Achievement scores for EOC tests were better than expected	First-semester grades showed traditional distributions EOC test results were better than expected Technology pathways coursework could have skewed results

Many of the concepts and ideas that were described by the principals of the new buildings as positive influences were echoed by their staff focus groups, and vice versa. The themes developed from the focus group interviews have been synthesized in the next

section. Findings related to each focus group are presented separately, and then ideas or themes shared among all groups are presented in the summary at the end of this section.

Focus Group Themes

Once the data had been collected, they were transcribed by a third party, and all names and identifiers were removed to protect the anonymity of participants. The collected data were then analyzed using the principles of data analysis outlined by Creswell (1998); three common themes emerged from the focus group interviews. A description of overall perceptions for each focus group is presented as well as individual themes developed and explained for each school in the case study. During all focus group interviews, participants reported a shared belief that students were better behaved and showed greater respect for the building itself than they had in their previous schools; this belief is reported as the first theme, improved student behaviors. A second theme, improved staff behaviors, involved participants' sense of improved staff morale and behaviors in the new buildings. The third theme, impact on student achievement, indicated that teachers did not believe that students performed any differently academically; nevertheless, most of them indicated that their EOC SOL scores were much better than anticipated.

After the three themes were developed, an attempt was made through the data analysis process to determine if the architectural features and design elements of the new buildings were perceived by staff members as having had an impact on student achievement or student or staff attitudes and behaviors. This factor is reported as the impact of architectural design elements. The findings are reported as a synthesis of data from all three focus groups as the factor represents a common idea that appeared in all of

the transcripts; further, the data answered the overall research question regarding a perceivable impact of design elements on students and staff. The final results reported in this section include limitations or deficiencies identified by participants in any of the focus groups.

Overall Perceptions

The focus group from High School #1 was mostly satisfied with the new building as compared to the previous location. According to the participants in Focus Group #1, the previous building had very narrow hallways and ventilation problems; many of the staff had concerns that their own allergy and sinus ailments were caused in part by the mold and other allergens that might have been contained in the carpet in place throughout most of the building. In indicating their primary concerns regarding the condition of the old building, the members of the focus group cited crowded hallways and the reciprocal effect that those conditions had on student behaviors as well as attitudes of students in poorly ventilated, overcrowded spaces. All of the members of Focus Group #1 reported that virtually none of those concerns existed in the new building. They reported that most days at the old building involved at least some minor disruption or dispute between students in the halls, indicating that, more often than not, it was caused by the physical limitations of the building itself. The participants in Focus Group #1 reported that, because of the security system in place in the new school, as well as the fact that everything was new in High School #1, the concerns they had in the old building about student behaviors and discipline did not exist in the new building.

Participants in Focus Group #2 expressed a belief that they had experienced an outstanding opening for the school year because students were brought together from

three different high schools. All members of the focus group perceived that the students had an overall sense of respect for the new school and thought the open spaces and large classrooms enabled students to maximize their potential and minimize conflicts. Participants in Focus Group #2 reported an overall sense of accomplishment at the end of the school year and reported not feeling as rundown or exhausted as they had at previous schools at that time of the year. The focus group participants also reported a shared belief that the leadership of the principal and the administrative team of the new school assisted with the transition process for them, aiding in the process of adjustment for both students and staff.

The participants in Focus Group #3 perceived that students and staff had improved attitudes and behaviors when compared to the attitudes and behaviors of individuals at other places where they had worked. They reported that in the fall of the opening year students were resistant to the new school, perceiving that the building was all about rules and regulations, with many of them indicating a desire to return to their old school. As the year progressed, however, the students became more comfortable with the building, staff, and faculty; participants in Focus Group #3 asserted that this had been one of the best school years they had experienced. In fact, many of them stated that they could not believe the school year was over (Focus Group #3, June 11, 2008).

Focus group participants at all three locations reported that they had more energy, felt happier and more content at work, and believed the natural light within their classrooms and the overall incorporation of natural light within the building was most likely responsible for those feelings. Focus group participants also reported a shared belief that morale in their new buildings was much better than it had been in other

buildings. All participants attributed improved student behavior to the wide hallways as well as the location and placement of specific features in the building. All of the participants also perceived the overall mood of the building to be different from that of other places in which they had previously worked. Many of the participants in the focus group interviews attributed the initial feelings to the newness of everything in the building; however, as the school year progressed, all of the participants reported that those feelings were amplified or enhanced rather than decreased, as many of them had expected. The three themes developed from the focus group interviews are presented individually with examples of support that appeared in each of the data sets derived from the three focus group interviews.

Participants in all three research sites were asked specific questions about the classroom environment; they were asked to elaborate on the impact the building itself may have had on student achievement (see Appendix C). The participants from all three focus groups expressed a belief that student achievement had not been impacted and that the same results to which they had been witness in previous work locations were also found to be true in their new environment. In each case, the researcher requested elaboration by all focus group members on this topic, and responses indicated a shared belief that student performance had not changed or been altered. A shared belief that overall student achievement had not been impacted was common across all three focus group interviews. Participants did, however, believe that behaviors had improved; that belief led to the development of the first theme.

Theme #1 - Improved Student Behaviors

High School #1. With regard to the perceptions of student behaviors in the new building, members of each focus group were asked if they perceived any changes when comparing observed behaviors in the old building to observed behaviors in the new building.

The participants from Focus Group #1 responded in a variety of ways. The majority of the participants in the group perceived that students in the new building were better behaved and that, in fact, some students' behaviors had changed. A great deal of that change related to having a different flow pattern in the hallways, locker areas separate from the hall itself, and a variety of stairways and access routes to the upper floor of the building for students. In the old building, because of the physical limitations, there was an "up staircase" and a "down staircase" designation. Participants indicated that they believed students were better behaved because they had room to move around (Focus Group #1, April 18, 2008). One person stated, "You are dealing with less behavioral stuff right from the very start because they have the freedom to move without restriction. Personally, I like it" (Focus Group #1, P3: S21).

The overwhelming majority of the members of Focus Group #1 sensed that the students had pride in the building and were proud to tell others where they went to school, whereas they would never have done that with the old building. One of the participants in Focus Group #1 commented that students were now asking if their school would be able to host regional DECA contests and other activities. In the old building, students would have never considered asking for that to be done (Focus Group #1).

The members of Focus Group #1 did agree that the students who were behavior or discipline problems in the old school were still problems in the new school, with the primary difference being that those students were unable to have as great an impact in the new school because of the use of technology (surveillance cameras) and their being more spread out, as open space made it easier to identify potential hot spots or discipline concerns. The security cameras and card reader pads were two factors mentioned by Focus Group #1 participants as having contributed to an improved sense of safety. All of the participants expressed a shared belief that locker design and hallway design had also contributed to a safer environment.

High School #2. The participants in Focus Group #2 reported a belief that student behavior was, in fact, better in the new school when compared to behavior in their old building. Not all of the participants in this focus group, however, had worked in the same division the previous school year. Participants indicated that students showed more respect for the new things in the building and that the new school evoked a sense of pride from the student body as well as a sense of ownership of the school itself (Focus Group #2, May 23, 2008). Participants also believed that light impacted all who were in the school, including the students. In addition, they reported a belief that the temperature controls, freedom of movement within the hallways, and the traffic pattern between classes all contributed to the improved behavior of the students. All of the participants in Focus Group #2 agreed that attention to small details such as the placement of the commons area, the proximity of the performing arts wing to the auditorium, and the design of locker areas was beneficial. These architectural design elements, as well as the

newness of the building itself, were all noted by Focus Group #2 as factors contributing to improved student behavior.

High School #3. Participants in Focus Group #3 reported similar findings with regard to student behavior; however, they were the only group to report some sense of student resistance to the new building when it first opened. In the other two high schools in this case study, all participants reported a positive outlook and attitude on the part of the student body from the day the building opened. Teachers in Focus Group #3 did report a shared belief that student discipline problems in the new building were not as severe and that the 9th-grade class had experienced the least number of problems related to adjustment to the new building. Students in Grades 10 and 11, according to the focus group participants, were the students who experienced the most difficulty with the transition. All of the participants agreed that the low level of stress felt within the school, which they attributed to the design and overall feeling of comfort within the building, was the primary reason that student behaviors were more positive in the new building.

Participants from Focus Group #3 also identified one other possible factor contributing to the perception of improved student behavior in High School #3: the absence of a senior class. Both of the other high schools in this case study had senior classes; in the case of High School #2, a small senior class of fewer than 200 students was present in the building. The fact that High School #3 had fewer than 750 students in Grades 9-11 could not be ruled out, according to members of the focus group, as a factor in improved observable student behaviors. Additionally, it is important to acknowledge that three different high schools were used in this case study, each with different student demographics and community influences.

Theme #2 - Improved Morale and Staff Behaviors

High School #1. Participants in Focus Group #1 indicated a belief that staff members and coworkers were happier and, in some cases, possibly healthier in the new building. They cited as an example the fact that the daily absence list in the old building sometimes included five to seven teachers' names, whereas the list in the new school might include only one or two names on a given day. One member of the group reported actually feeling better when he or she came to work, attributing that feeling to the amount of sunshine brought into the classroom and throughout the building by the large skylights and windows. Although none of the members of this focus group offered any tangible proof, many of them cited the amount of mold in the old building as one of the chief health concerns that the staff had shared. Many of them believed the entire staff was healthier in the new building, citing as evidence the fact that many of them worked long after the day had ended for students. In the old building, many of them left work as soon as the buses departed.

Focus Group #1 participants identified the lack of health concerns in the new building that had been present in the old building as the number one component impacting the attitude and behaviors of the staff in the new building. The new building was described as having none of those concerns, and many of the participants of Focus Group #1 reported that the new building had motivated them to continue teaching although they had previously considered retirement. Many of the members of Focus Group #1 described the carpet in the old building as being at least 30 years old; there was no such concern in the new school as none of the classrooms were carpeted. All of the concerns about the old building that had been identified by members of Focus Group #1

were absent in the new building; the lack of those concerns was identified as having possibly contributed to the perceived improvement in attitudes and behaviors of fellow staff members.

High School #2. Participants in the focus group at High School #2 reported an increased feeling of energy and a perception that many of their colleagues felt the same; many of them indicated that the exhaustion typically felt at the end of a school year had not been present to negatively affect the overall morale and attitudes of the staff. All of the participants in this group reported feeling, many of them for the first time, that they were being treated as professionals. They indicated that the professional areas to which each teacher had access and the sense of collegiality within the building contributed to this pervasive feeling. The majority of the participants agreed that morale in the new building was considerably higher at that point in the year compared to their experiences in other places (Focus Group #2, May 23, 2008). One person even stated that although he or she would have been counting down the days left in the school year after spring break at a previous building, that was not the case in this new building. One person in this focus group stated that most people in the new building did not hit the doldrums or low points of the school year that they had experienced in other buildings (Focus Group #2). Although they were tired, these individuals believed they had a purpose and considered themselves more likely to complete the tasks at school.

Many of the members of Focus Group #2 attributed much of the success of the inaugural year to the leadership in the building. In addition, they cited a general sense of cohesiveness among all teachers in the building, not just the teachers within their individual departments. Although many of them were not sure at first what it would be

like to be divided by grade levels instead of departments, they agreed that the interdepartmental setup eliminated a feeling of "toxicity" among the teachers (Focus Group #2, P23: S15). Participants cited as evidence of improved staff attitudes their friendships with people from other departments, stating that oftentimes they gathered outside the school for social events that were interdepartmental as well. They also believed that the design of the building contributed to the improved collaborative environment; they noted that there had not been a particular boiling point that caused frustration or discontent for any of the teachers (Focus Group #2, May 23, 2008). The participants also expressed a belief that the design of the new building allowed for the new teachers to seek out veteran teachers in a nonthreatening environment and fostered a greater sense of collegiality among all teachers within the building.

High School #3. The participants in Focus Group #3 reported a positive influence on their own attitudes and behaviors, which they attributed to the amount of natural light in the building. They also reported a sense of collaboration and teamwork among all members of the staff. Many of the members of this focus group reported that they believed the designers of their building, as part of the design process, did listen to the teachers when they asked for more storage in the building. All members of the focus group for High School #3 indicated that adequate storage and professional working spaces did, in fact, contribute to their positive outlook and overall attitude. Members of Focus Group #3 reported they were often happy to come to work; many of them indicated that it had actually been a long time since they enjoyed coming to work (Focus Group #3, June 11, 2008). They reported a feeling of excitement on the part of the faculty and staff that had been present when the doors opened in the fall and that continued to exist.

Participants reported that negative people "could not get a foothold here" (Focus Group #3, P36: S15) because of the attitude and atmosphere of teamwork developed within the new building. They believed that the decreased level of stress felt throughout the entire building contributed to the overall sense of satisfaction. Many of the participants reported that although there were frustrating days, the realization of where they were working was usually enough to alleviate the feelings of frustration (Focus Group #3, June 11, 2008). All of the participants in Focus Group #3 reported a belief that the team-building activities in which all staff participated prior to the opening of the building led to a general feeling of satisfaction and a sense of belonging within the building. They also expressed a shared belief that the atmosphere of collegiality created by the administrative team and the principal had contributed to many of the positive aspects of staff morale and attitude (Focus Group #3).

Theme #3 - Impact on Student Achievement

High School #1. The majority of the participants in Focus Group #1 did not believe the building itself had impacted their teaching in a significant manner. Most believed that the technology package available to them in the classroom had enhanced their teaching ability in terms of preparation and planning, but they did not believe there had been an overall reflection in the distribution of grades or achievement test results. There was a sense that the architectural improvements had, in fact, had a greater impact in elective courses and other areas of instruction that would not be reflected in test scores or any other form of hard statistical data. The primary areas cited by the group included the creation of a driver education simulation lab, the performing arts wing—specifically the drama, band, and chorus rooms—as well as the impact of the new building on

physical education classes, which had all new fields and a new outdoor track to utilize within their own curriculum.

High School #2. The participants in Focus Group #2 did not believe the architectural design elements of the building had impacted student achievement. They did believe, however, that the layout of the classrooms had facilitated the implementation of more effective instructional strategies to meet the needs of all students. The participants in this group believed that the ability to rearrange all the desks in the classroom allowed for improved instruction and a more effective collaborative learning environment. They also believed that the layout of the professional work spaces, as well as teachers' being integrated within the building by grade level rather than arranged by content, provided teachers with the opportunity to collaborate and plan. The integration of teachers in that manner affected achievement because it directly impacted the development of lesson plans and instruction. It also allowed for teachers new to the profession to more readily seek advice and information from veteran teachers. Participants also noted that because each of the workrooms was integrated as multidisciplinary, most people did not feel threatened when they went to another workroom to make copies or obtain supplies. All of the participants in Focus Group #2 agreed that, in their old buildings, no one would have dared to enter the workroom of another discipline without fear of reprisal or at least a question as to why they were there (Focus Group #2, May 23, 2008).

High School #3. The participants in Focus Group #3 echoed comments similar to those from the other two focus groups when posed with the question of whether or not they believed the building impacted student achievement. The general consensus among the members of Focus Group #3 was that the technology and classroom design had

enhanced their teaching and made some portions of it easier; however, overall, they did not believe there was a discernible impact on student achievement at the new school compared to achievement at their previous school. On the day this focus group met, the participants had just seen preliminary EOC SOL test scores for their students, and many of them expressed shock and disbelief at how well their students had performed. The guidance counselor indicated that more "jigs were danced in her office that day than ever before" (Focus Group #3, P22: S7). All of the participants perceived an unending feeling of support from the administration throughout the school year, which, they indicated, had made the process of planning, teaching, and assessing student performance much more effective.

Focus Group Synthesis

Impact of Architectural Design Elements

Participants in all three focus groups cited three major design elements as being the most significant or influential: the amount of natural light incorporated into the overall design of the building, the amount of open space available in the hallways and commons areas for students, and the integration of technology within the building itself.

Participants cited the overall use of natural light within the building as the number one factor impacting the staff and students in a positive manner. The following statement is representative of participants' perceptions: "You cannot go anywhere in this building, without the light impacting you in some manner" (Focus Group #1, P25: S12). At all three locations, lighting, including the use of natural light, was the design feature most frequently described by participants as having impacted their overall performance, their individual moods, and in some cases their performance as the year progressed. Many of

the participants indicated a sense of greater happiness at work and a willingness to stay longer than normal in the building because of the light; many of them reported having more energy, as well.

In each of the focus group interviews, participants also indicated that the amount of open space and the wide, open hallways contributed to a positive work environment as well as improved student behaviors. Many of the participants asserted that the large classrooms and hallways and the high ceilings actually helped to diffuse some of the behavior problems they had seen at other buildings, such as pushing and shoving and disruptions in the hallways during class changes. All of the participants opined that the enhanced athletic facilities and greater access to equipment had contributed to increased numbers of students participating in those activities.

All of the participants in the three focus groups stated that the technology package integrated within each of the three buildings was well beyond what any of them expected. Further, as a result of the technology package upgrades at each school, many of the teachers became more comfortable with the inclusion of technology in their own lesson planning and classroom instruction. The increased technology present in each of the new buildings impacted decisions about the staff development and training provided for staff members in the buildings.

The information collected from the focus group interviews led to the development of several themes, which are synthesized in the matrix of information presented in Table 3.

Table 3. *Themes Developed From Focus Group Information*

	Focus group information leading to theme development		
Theme	Focus Group #1	Focus Group #2	Focus Group #3
Improved student behaviors	Better behavior Freedom of movement Open spaces Large classrooms Safety	Improved behavior Sense of ownership Temperature controls HVAC Natural light	Less severe discipline problems No senior class Freedom of movement Open spaces
Improved morale and staff behaviors	Happier, healthier people Natural lighting Open spaces Veteran teachers made the decision to stay Health concerns from old building are nonexistent People like coming to work	People have more energy Natural lighting Professional spaces make employees feel valued No sense of doldrums in second semester Leadership cited as a cause	Natural lighting People enjoy coming to work Negativity cannot take hold of staff Leadership cited as a cause Strength of administration
Impact on student achievement	Believed there was no impact. Agreed that students are the same. Felt there was more of an impact on elective courses. Athletics and extracurricular participation seemed to grow	Ability to manipulate classroom layout was seen as beneficial Technology integration made the process of teaching easier Sense of calm in the hallways meant less discipline in the classroom	Technology had enhanced the art of teaching for many members Students still struggle with the same concepts Classroom environment was made more enjoyable—larger, more open, and room to move freely

Limitations or Deficiencies Identified

The overall impact of change on the staff was cited as the number one concern for focus group members. Many members of Focus Group #1 felt closer and more connected to other faculty members in the old building than they did in their current setting. Much of that feeling stemmed from the fact that there was only one teacher workroom in the old school, and everyone ate lunch together and congregated in that area during planning time. Because there was a prep room located in each of the academic wings in the new building, many of the staff indicated they saw only the people in their wing, thereby feeling less connected to the rest of their peers. Teachers from the career and technical education department cited the most difficult change to which they had to adapt: their integration within the building instead of a separate area, to which they were accustomed. Many of them were frustrated by not being next door or across the hall from their departmental colleagues in case they forgot to bring something with them or needed supplies from a colleague (Focus Group #1, April 18, 2008).

Participants from the other focus groups did not identify any particular limitations of the new building compared to the old building. Many of the participants believed that teachers' input regarding the design process before the building was constructed had been incorporated into the new building, but not to the degree that many of them would have liked.

Data Collected From Document Analysis and Observation

Each of the three high schools involved in this case study was designed with a similar architectural theme throughout the building. The architectural design of each building involved the incorporation of natural light into as many areas of the building as

possible. Many of the classrooms at each location contained large, open windows, skylights, or both, which allowed for ample amounts of natural light to penetrate most areas of the school including the classrooms. All of the hallways were wide and spacious, designed to facilitate supervision by teachers and staff at various strategic locations, including the commons and locker areas. Each of the schools in this case study had a large, open commons area, which allowed for multiple uses, especially for night-time events; supervision problems were eliminated with the use of elevated areas within the commons that provided a clear line of sight during lunches and other activities held in the area.

Each of the buildings in this case study was designed so that academic wings and elective wings were separated, located in different parts of the building. In all three locations, an auditorium that served multiple purposes and contained state-of-the-art electronic sound and lighting equipment was located adjacent to the band, choral, and performing arts departments. Separate facilities were provided for dressing rooms, storage, and individual practice rooms for performing arts classes, as well. Two of the three locations contained a smaller drama production area called a “black box,” which allowed for rehearsals and smaller plays to be performed by students.

Shared aspects of the gymnasium, locker and storage facilities, and athletic fields and facilities on the school campuses constituted the final design element that was observed in all three locations. All of these types of amenities were designed to be manipulated and adjusted to fit the needs of the activity being planned. All of the gymnasiums contained portable wall systems or curtains that could be used to divide the gym into three separate areas for activities. Each building contained athletic training and

medical facilities as well as fitness centers and areas for students and staff to utilize fitness and exercise equipment.

It should be noted that in only one of the high schools involved in the case study, High School #2, were the administrative and counseling offices integrated within the academic wings of the building. In both High School #1 and High School #3, the administrative offices and counseling offices were located in the front of the building, and all members of the administrative and guidance staffs were housed within one centralized location. Whether or not that factor had an impact on the information reported by participants was not determined by the researcher. All three locations contained video surveillance and security features such as electronic door locks and card reader access pads, which allowed for certain staff members to have 24-hour access to the building.

Data and Information Collected After Interviews Were Completed

In the Commonwealth of Virginia, the state department of education releases a yearly school report card that details specific information regarding student achievement, accreditation status, and safety and attendance data for every school. This information is released to the public each year following the completion of all state and federally mandated end-of-course testing. Much of the data collected by the Virginia Department of Education (VDOE) is used to determine whether or not a school or division has met federal AYP benchmarks. Performance data included in the schools' report cards for the 2007-2008 school year are presented in Tables 4, 5, and 6, respectively (VDOE, 2008b).

Table 4. *Performance Data for High School #1*

EOC test	Percent passing state average	Percent passing division average	Percent passing school average
Overall English performance	88%	82%	93%
Overall writing performance	89%	85%	91%
Overall mathematics performance	84%	78%	87%
Overall science performance	88%	83%	85%
Overall history performance	88%	84%	88%
Overall attendance rate	95%	94%	93%

Table 5. *Performance Data for High School #2*

EOC test	Percent passing state average	Percent passing division average	Percent passing school average
Overall English performance	88%	91%	91%
Overall writing performance	89%	92%	97%
Overall mathematics performance	84%	89%	92%
Overall science performance	88%	91%	94%
Overall history performance	88%	92%	98%
Overall attendance rate	95%	96%	96%

Table 6. *Performance Data for High School #3*

EOC test	Percent passing state average	Percent passing division average	Percent passing school average
Overall English performance	88%	89%	91%
Overall writing performance	89%	90%	93%
Overall mathematics performance	84%	85%	92%
Overall science performance	88%	91%	89%
Overall history performance	88%	87%	87%
Overall attendance rate	95%	95%	93%

Researcher Observations

The researcher alone conducted the interviews for the data collection process of this research study; therefore, it became readily apparent during the process that the emerging themes were common to all three sites involved in the research. One unintended theme that emerged related to planning and preparation on the part of the planning principal for each school and the importance of that key element in the overall process of opening a large high school. Although all three of the principals involved in this research study were veteran administrators, none of them had ever opened a building. The level of planning and organization that each of them worked toward was the element in each case that allowed the building to open on time, without incident. All three

principals and all three focus groups expressed a belief that three architectural design components had a significant impact on both students and staff: the use of natural light, the incorporation of wide, open spaces into the design process, and the integration of technology into the infrastructure of the building itself. Those themes were prevalent and constant throughout all of the interviews and other data collection procedures.

Summary

Through analysis of the themes reflected by the building principals of the three high schools involved in this case study and comparison of those themes to those generated through the focus group interviews at the schools, it can be determined that the perceptions of the principals and the staff of these new buildings were shared and sufficiently common for identification. The data collected from both groups of participants indicated that three predominant themes, particular to this case study, existed. Theme #1, which was reflected in the responses of both principals and focus group members, represented a belief that student behaviors had improved in the new buildings in comparison to behaviors in the old buildings. Theme #2 was also evident in the responses of both principals and focus group members: Morale and attitude had improved for both students and staff in the new schools in comparison to those characteristics noted in the old buildings or previous work locations. The third emergent theme based upon responses of both principals and focus group members was a lack of belief that the new buildings had more positively impacted student achievement than had the old buildings. Principals at High School #2 and High School #3 did state that the end-of-year assessment results were slightly better than they had expected; however, not all data were available to them at the time of the interviews. Both principals and focus group members

provided comments or statements indicating that the design elements present in each of the high schools in this case study had, in fact, contributed to positive student and staff attitudes and behaviors. Chapter 5 of this dissertation presents interpretations of the findings as well as conclusions and recommendations for further study.

CHAPTER 5: INTERPRETATIONS, CONCLUSIONS, AND RECOMMENDATIONS

Introduction

Because of personal experience, the researcher who completed this case study was interested in the perceived impact that new high school facilities might have on student achievement, as well as staff and student attitudes and behaviors. As both a teacher who had worked in a new high school, and an administrator who had opened a new high school, the researcher was intrigued by the marked difference in achievement and behaviors of students in a new high school when compared to students in an old school. Having worked in both new and old high schools as a teacher and as an administrator, the researcher was intrigued by this possible phenomenon. Additionally, when the researcher initiated the process of designing this research study and when he conducted the research methodology, he was employed as an assistant principal in a brand new high school; however, when the writing of this chapter began, the researcher was employed as a principal of a high school that had been built in 1959. The contrast in those two experiences and the obvious physical differences between a building built in 2006 and one built in 1959 solidified in the mind of the researcher what had been observed throughout the research study.

Previous research indicated that the quality of the school facility can in fact impact student achievement (Cash, 1993; Crook, 2006; Hines, 1996), as well as staff attitudes and behaviors (Hickman, 2002; Lee, 2006). Hines reported that student achievement scores were higher in schools that were newer, had more windows, and were carpeted. Earthman and Lemasters (1998) reported that student achievement was

impacted by as much as 11 percentile points in a building deemed to be in above-standard condition. Lemasters' (1997) synthesis of previous research studies found that students attained higher achievement scores in newer facilities. Ayers' 1999 research study found that between 2% (math and writing) and 6% (English and social studies) of the variance in achievement scores was attributed to school design. Crook compared SOL achievement scores with overall building condition and found that differences of as much as 11.2 percentile existed in achievement scores on the SOL when comparing standard to above-standard buildings. All of these studies, it should be noted, involved existing school buildings.

At least two previous research studies focused on new high schools. Hickman (2002) asserted that student achievement and student and staff behaviors were improved in new high schools. Lee (2006) specifically examined staff perceptions of school climate before and after the move to a new high school, concluding that improved staff morale and behaviors led to an environment conducive to learning, thereby improving student achievement. The research conducted by Hickman (2002) contained an element of qualitative analysis, but was primarily quantitative in nature, as participants completed a free-response survey following the collection of quantitative data. Research conducted by Lee concluded that school climate improved in new facilities and determined that positive changes in staff perception of school climate were not influenced by demographics.

One research study in contrast to the aforementioned research studies was conducted by Broome (2003), who suggested that variances in student achievement were more likely related to SES rather than the condition of the school facility. The research

conducted by Broome determined that when SES is controlled, there is "no statistical relationship between building design and student academic achievement" (p. 40).

The purpose of this research study was to conduct a qualitative analysis of the perceptions of principals, staff members, and faculty of new high schools in the Commonwealth of Virginia. Other researchers suggested that a qualitative analysis of the conditions of school facilities was warranted to provide more in-depth documented quantitative results (Crook, 2006). Specifically, this research study was designed to answer the following research question:

What is the impact of the design of new high school facilities in the Commonwealth of Virginia on student achievement and student, teacher, and staff attitudes and behaviors?

Four subquestions were designed to gauge the perceptions of principals and teachers who worked in the buildings involved in this case study and to determine whether or not there was a perceived impact on student achievement, student and staff behaviors, and student and staff attitudes. The research question was divided into the following four subquestions:

1. Has the design of new high school facilities in the Commonwealth of Virginia improved student achievement as reported by principals, teachers, and staff members of the new high schools?

2. Has the design of new high school facilities in the Commonwealth of Virginia improved the attitudes and behaviors of staff members that work in those new school facilities as reported by principals, teachers, and staff members of the new high schools?

3. Has the design of new school facilities in the Commonwealth of Virginia improved the attitudes and behaviors of students who attend the new high schools as reported by principals, teachers, and staff members of the new high schools?

4. Is there a relationship between sustainable design elements and student achievement as perceived by principals, teachers, and staff members of the new high schools?

Previous research conducted in the Commonwealth of Virginia identified significant correlations between school facilities and student outcomes (Cash, 1993; Crook, 2006; Hines, 1996; Lemasters, 1997) as well as a correlation between school facilities condition and teacher satisfaction (Ruszala, 2008). Previous research related to school facilities indicated that the physical condition of the school facilities impacts not only student achievement (Cash) and student behaviors but also staff attitude and behaviors (Hickman, 2002; Lee, 2006). The preponderance of data collected from the literature shows a clear connection between building conditions and student achievement, behaviors, and attitudes. This research study connects the work of Cash, Crook, Hines, Lemasters, and Lanham (1999), all of which measured varied statistical information about student achievement and compared it to the ratings of the physical environment. This research study adds to the body of knowledge about the relationship between the physical (constructed) environment (Bandura, 1976) and the cognitive impact of that environment of achievement, behaviors, and morale.

The impact of new school buildings on students and staff was documented in two previous research studies. Hickman (2002) concluded that new high schools seem to positively influence student behavior as well staff attitude and behavior. Hickman also

concluded that staff and student attendance improve and incidents of vandalism decrease within a new school building. This research study seems to support the assertions of Hickman, which were validated through a holistic, multiple case study examination of school personnel perceptions of the learning environments within new high schools. Hickman suggested that a qualitative examination of the environment of new schools would provide more detailed information about the relationship between student behaviors and new buildings. Crook (2006) suggested that further study of the learning environment be completed to assess the perceptions of teachers who work in a new school building.

The findings presented in this research study provide school district personnel, contractors, and architects with information to determine the most effective design components for inclusion in future construction projects to positively impact student achievement. The themes generated from this research study provide suggestions for school boards and district personnel regarding the most effective design elements and information to be included in future design projects. Information about the process of opening a new school and the experiences of the three principals involved in this research study provide other educational leaders with a possible blueprint to follow in the process of opening a new school facility, specifically a high school in the Commonwealth of Virginia. This research study was prompted by the researcher's personal experience working in two new high schools in the Commonwealth of Virginia.

Summary of Results

There were three separate streams of data collection utilized in the research study (principal interviews, focus group interviews, and document analysis related to the construction and design process); three distinct themes emerged from both the principal interviews and the focus group interviews. Overall themes were developed from those that were present in both the principal interviews and the focus group interviews.

The interviews with the principals of the high schools used for this research study generated three distinct themes: the planning and preparation for the opening of the building was far more difficult than the actual act of opening the building, a shared belief that there was no perceivable impact of the design elements within the building on student achievement, and there was a positive impact on student behaviors in the new building in comparison to behaviors in the old building.

The focus group interviews likewise generated three identifiable themes: improved student behaviors, improved staff behaviors, and impact on student achievement. Improved student behaviors was identified as a shared belief that students behaved better and had more respect for the building itself than they did in a previous school. Improved staff behaviors involved a sense of improved staff morale and behaviors in the new buildings. With regard to impact on student achievement, study results indicated that teachers did not believe students performed any differently academically, despite the fact that most of them described the recent EOC SOL scores of their students as being much better than anticipated. This apparent anomaly in the findings highlights a need for further research in this regard.

Overall Themes From This Research Study

Examination of the findings from both groups of respondents for this research study revealed that three clear overall themes emerged as being present in both data sets. Through analysis of the themes reflected in the responses of the building principals of the three high schools involved in this case study and comparison of those themes to those gleaned from the focus group interviews at the schools, it can be determined that the perceptions of the principals and the staff of these new buildings were shared and sufficiently common for identification. The data collected from both groups of participants indicated the existence of three shared themes particular to this case study. Theme #1, which was reflected in the responses of both principals and focus group members, represented a belief that student behaviors had improved in the new buildings in comparison to behaviors in the old buildings. Theme #2 was also evident in the responses of both principals and focus group members: Morale and attitude had improved for both students and staff in the new schools in comparison to those characteristics noted in the old buildings or previous work locations. The third emergent theme based upon responses of both principals and focus group members was a lack of belief that the new buildings had more positively impacted student achievement than had the old buildings.

Interpretation

In comparing the themes generated by both the principal interviews and the focus group interviews, it is apparent that the third theme most closely aligns with the content of the first research subquestion. Based on the responses made by participants in both the

principal interview group and the focus group, that is, all the participants in this research study, neither principals nor teachers believed the architectural design elements of the new high schools had a significant impact on student achievement. All of the principals expressed the shared opinion that neither had achievement scores risen significantly nor had there been unexpected surprises when student achievement scores were calculated. It should be noted, however, that all three focus groups mentioned a significant improvement in the learning environment; they also shared a belief that the environment of the classroom was impacted by the design of the building. These shared beliefs appear to indicate that although the research participants were unaware of it, the design of the building likely impacted student achievement. This information and the data that led to the development of this theme support the contentions of Tanner (2007) that the design of the building represents a comprehensive learning environment. This assertion was represented in comments that identified shared collaborative planning, improved lesson plan implementation, and improved instructional practices and activities for the classroom. It is the opinion of the researcher that all of the comments made within both the principal and focus group interviews support the contention that the design of the building, though not directly correlated to a rise in achievement scores, does, in fact, impact the achievement of students within the classrooms and building as a whole.

Theme #1, which was reflected in the responses of both principals and focus group members, represented a shared belief that student behaviors had improved in the new buildings in comparison to behaviors in the old buildings. Theme #2, which was also evident in the responses of both principals and focus group members, indicated that morale and attitude had improved for both students and staff in the new schools in

comparison to those characteristics noted in the old buildings or previous work locations. Both of these themes closely align with the second and third research subquestions because they correlate with the concept that attitudes and behaviors of both students and staff were positively impacted by the design and layout of the new high schools as reported by research study participants. All of the data collected from both the principal and focus group interviews indicated a belief that both students and staff were happy to be in the new building and that evidence of that phenomenon was reflected in a decrease in student discipline, an increase in staff attendance and participation in school activities, and a general sense that students liked their schools and appreciated the actions of their teachers.

Theme #3, which was reflected in the shared perceptions of principals and focus groups, was the idea that there had been no impact on student achievement, a notion that was in contrast to the statistical data collected for each school. The data reported by the Commonwealth of Virginia for each of the schools involved in this case study did support the contention that students in new high school facilities perform better overall in terms of student achievement than do students in older facilities. The data presented in chapter 4 appear to contradict a theme reflected in both the principal and focus group interviews. Neither of those groups believed the design and architectural elements of the new building had an impact on student achievement. Nevertheless, analysis of the data, as reported by the Commonwealth of Virginia, revealed several key points worth noting.

In all three high schools involved in this case study, the students exceeded the state average scores in English, writing and mathematics performance for the 2007-2008 school year. In two of the three high schools, students exceeded the 2007-2008 state

average in science performance, as well; further, in two of the three high schools, students met or exceeded the state average for history performance for the 2007-2008 school year. Only one of the high schools involved in this case study exceeded the state average for daily attendance rate. High School #1 exceeded the division average for English performance, whereas High School #2 exceeded the division average in overall writing, science, and history performance. High School #3 exceeded the division average in overall English, writing, and math performance. This information, although noteworthy, was not a part of the original research design; it is cited as support for the conclusions drawn from the qualitative research data collected for this case study.

With regard to the fourth research subquestion, the data collected seemed to represent acknowledgement of a relationship between sustainable design elements and student achievement as well as student and staff behaviors. All of the respondents in both the principal interviews and focus group interviews agreed that the amount of natural light incorporated into the design of the building had a positive impact on both student and staff behaviors, indicating that it may have positively impacted student achievement. All respondents also indicated that the incorporation of open spaces within the design of the building as well as the integration of technology throughout each of the buildings significantly impacted student achievement from the perspective that those features facilitated the minimization of student misbehaviors and the maximization of student academic performance within the classroom.

Conclusions and Recommendations

The following conclusions and recommendations were drawn from the themes developed from the research data collected through principal interviews, focus group interviews, and document analysis of architectural plans and construction information.

Theme #1, which was reflected in the responses of both principals and focus group members, represented a shared belief that student behaviors had improved in the new buildings in comparison to behaviors in the old buildings. The principals and focus group members both mentioned that they had expected student behaviors to eventually worsen once the school year began and the everyday routine was established; however, in each of the buildings involved in this case study, both the principal and the focus group members reported that worsening behaviors never materialized. Both the principal and focus group members of each school also reported a sense that students, in fact, took more pride in the new school when compared to the old and that the building itself, in some cases, inspired a sense of belonging for both students and staff.

Theme #2, also reflected in the responses of both principals and focus group members, was that morale and attitude had improved for both students and staff in the new schools in comparison to those characteristics noted in previous buildings or previous places of employment. As evidence of that theme, both principals and focus group members expressed the shared belief that people were happier and more content when they were at work than they appeared to be in the older schools. No squabbling or bickering among department members was reported; in the case of High School #2, the integration of academic disciplines had, in fact, according to the participants, strengthened the atmosphere of the building, and staff members felt as if they were

treated as professionals. The most frequently mentioned factor that led to the development of Theme #2 was a shared belief by principals and focus group members that because they were treated as professionals, having personalized and individual working areas as well as technological advancements and supplies to enhance their individual teaching capabilities, many staff members exhibited more positive attitudes and behaviors. The focus group members provided numerous examples of features that supported this contention, including the professional work rooms, separate restrooms, kitchen facilities with refrigerators, and the shared space that teachers could utilize for meetings, lunches, or informal gatherings during off periods of the school day.

Theme #3, reflected in the responses of both principals and focus group members, was the shared belief that the new buildings had no significant impact on student achievement when compared to the old buildings or previous work locations. The principal of each high school reported a similar belief that there had been some impact on student achievement, but that it had been minimal when compared to possible expectations. The members of the focus groups reported the shared belief that although the design and layout of classrooms and work areas had provided additional opportunities for collaborative learning and small group work, there had been no noticeable impact on daily student performance, overall grade distributions, or student achievement for the year.

The data collected from all of the focus group participants reported almost identical perceptions, yet the statistical data reported by the Commonwealth of Virginia appeared to contradict that contention. This point is important to note because both the principal interviews and the focus group interviews reflected the same viewpoint: the

shared opinion that the building had not impacted student achievement. Whether or not the participants in the three focus groups held similar understandings of the concept of student achievement is a point that needs to be clarified should this study be replicated in the future.

With regard to the fourth research subquestion, all of the participants in this research study reported the use of natural light within the building as the number one design element having a positive impact on both student and staff attitudes and behaviors. At all three locations, participants expressed a shared belief that natural light had affected their overall performance, their individual moods, and, in some cases, their ability to maintain their levels of performance as the year progressed. Other factors mentioned by all participants as having had a positive impact included the following: open space in classrooms and hallways, the high ceilings and sense of openness in all the buildings, and enhanced safety and security features present in the buildings. All of the data collected from the participants in this research study led to a researcher conclusion that design elements such as natural lighting and climate controlled HVAC systems, as well as wide, open hallways and shared student spaces, do positively impact student behaviors and student and staff attitudes and behaviors. The preponderance of both principals' and focus group participants' references to the aforementioned design elements provided support for that contention. Further, all of the participants identified the technology package incorporated into each of the buildings as a positive component, but not necessarily in the manner for which it was designed.

The major point that was emphasized by both the principals and the focus group members in this research study was the overall impact of the element of change on the

principals, faculty members, and students. The new interactions that were created by the design and layout of the individual buildings were continually mentioned as having a positive impact on the culture and climate of the building for both students and staff. One major drawback mentioned by all of the focus group members, but not by the principals, related to the teachers' need and requests to be included in the design process when new schools are being created; a majority of the participants in all of the focus group interviews expressed a shared or similar concern in this regard.

This research study was based on the theoretical model created by Cash (1993), which suggested that identifiable variables such as leadership, maintenance staff, and financial ability influence building condition. Cash further theorized that (a) building conditions impact parent, faculty, and student attitudes and (b) the condition of the building impacts student achievement and behavior. In chapter 1, Cash's theoretical model was introduced. In this research study, the following themes associated with Cash's theoretical model were identified: improved student behaviors, improved morale and attitude of students and staff, and impact on student achievement. It should be noted that in this researcher's study, however, the impact on student achievement was not identified by research participants specifically, whereas the research conducted by Cash provided statistical evidence of the impact of building conditions on student achievement. Figure 2 denotes areas of the Cash model that were reflected in the themes developed for this study.

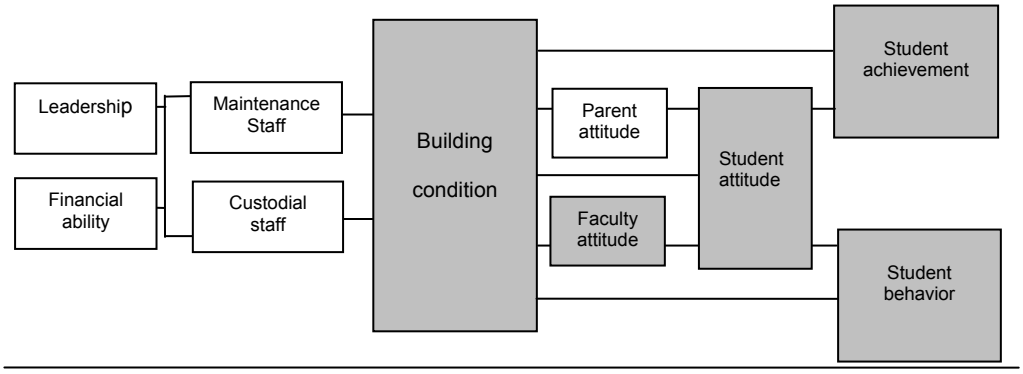

Figure 2. Cash's theoretical model (1993) (shaded to reflect current study theme development) illustrates the relationship between physical environment and structural as well as cosmetic items and their combined impact on student achievement. The areas in gray represent the areas reflected in the theme development of this research study.
From *Building Condition and Student Achievement and Behavior*, by C.S. Cash, 1993. (UMI No. 9319761), Copyright 1993 by the American Psychological Association.

The theoretical model for this research study also was based on the work of Tanner (1998, 1999, 2000, 2003, 2007), whose contention was that the physical layout or design pattern of the school building positively impacts and influences student achievement. Tanner's assertion was that the entire school building, or the architectural footprint, should be viewed as a comprehensive learning environment. This contention connected theoretically to the work of Bandura (1989) and the tenets of social cognitive theory, which identified the influence of and differentiated between three types of environmental structures: imposed, selected, and constructed environment (Bandura, 1997).

The themes developed from this research study—a shared belief that student behavior improved, a shared belief that morale and attitude of students and staff improved, and a shared belief that the building had not positively impacted student achievement—all reflect the ideology of the work of Bandura. The work of both Bandura (1976, 1989, 1997) and Maslow (1954) relate to cognitive development of the individual

and the reciprocal relationship of the physical environment with learning. This research study supports previous quantitative research (Cash, 1993; Crook, 2006; Hickman, 2002; Hines, 1996; Lemasters, 1997) that investigated the relationships between physical environment and student achievement and provides school leaders, architects, and educational facilities planners with a rich description of the perceptions of school personnel who work in the new high schools involved in this case study.

Implications for Practice

This study was limited to the perceptions of the principal and a focus group at each of the three high schools involved in the research. The results in no way reflect the ideology of all new high schools built in the Commonwealth of Virginia. The findings do, however, provide implications for practitioners.

Implications for School Divisions

1. A principal selected to open a new high school not only should be given the opportunity to serve as the planning principal for a period of at least 2 years but also should be provided with some background knowledge or training with regard to the construction process for a new high school.

2. When seeking to create a new high school, architects and school designers should seek input from focus groups of teachers, not only those who have worked in an existing building but also those who have worked in a new school building, to more accurately predict the effectiveness of design elements as they relate to overall cost and construction.

3. School divisions that are planning to build new schools in the future need to incorporate not only the most effective design elements available but also those most beneficial for students and staff: for example, the incorporation of natural light into the design of the building, the use of climate controlled HVAC systems, and the concept of wide, open spaces and shared areas for students and staff.

Implications for the State Department of Education

State department of education officials need to provide greater financial support and information to those districts in need of a new high school or other school building, but who may not be able to afford it. The PPEA passed by the Virginia legislature in 2003 provides assistance; however, clearly defined financial guidelines and policies need to be implemented to ensure that all school divisions have the opportunity to build new facilities.

Recommendations for Further Research

This study was limited to the three research sites utilized for data collection. The information generated through interviews with building principals, interviews with focus group participants, and document analysis suggest a need to explore the topic in another state, or perhaps in a different setting. The following recommendations for further research into this phenomenon are presented:

1. A return to the three research locations in 2 years might reveal whether the themes generated from this research study are still present or whether they appear to have been due to mitigating circumstance.

2. Further research is needed to determine whether or not the results and themes generated from this research study are prevalent in other new school facilities, at other levels, and in other states.

3. This study needs to be replicated with teachers and administrators at both the middle school and elementary school levels to determine if the themes presented in this research study are common across the spectrum of public education.

4. A qualitative analysis of teachers with fewer than 8 years of experience who work in new school facilities might determine if findings similar to those presented in this research study involving veteran teachers are found in that particular population.

5. A qualitative analysis to determine if the structural footprint of integrated academic disciplines versus a traditional hallway model is the most effective design for maximizing student achievement. The researcher noted a marked difference in responses from the members of Focus Group #2, who were integrated in a multidisciplinary format, when referencing staff morale and attitudes, as opposed to the members of the other two focus groups, who were situated in semitraditional formats.

6. An analysis of attendance rates for high schools and whether or not there are statistical differences in attendance with regard to race, ethnicity, or SES for new and existing schools might provide beneficial information for school personnel.

7. Hickman (2002) identified suspensions as being lower in a new school. A qualitative research study that explores discipline and suspension information in a new high school as compared to an existing high school might yield an identifiable cause for the shared perception of focus group members and principals that student behaviors were better in a new school.

Summary

This chapter concludes the report from the case study on facility design of three high schools constructed in the Commonwealth of Virginia between 2004 and 2006 and opened between 2006 and 2007. Data were collected through the triangulation of sources: principal interviews, focus group interviews with teachers who worked in those schools, and document analysis of architectural and construction information for each of those schools. Data were coded for general themes (open coding), and themes were generated for both principal interviews and focus group interviews. Perceptions of the principals and perceptions of the staff members were shared and sufficiently common for identification. Three predominant themes emerged from this research study: improved student behaviors, improved morale and staff behaviors, and impact on student achievement.

The results of this study validate information previously reported in quantitative research studies conducted both within the Commonwealth of Virginia (Cash, 1993; Crook, 2006; Hines, 1996; Lemasters, 1997; Ruszala, 2008) and in other states (Hickman, 2002; Lee, 2006). Previous research regarding school facilities indicated that the physical condition of the facilities impacts not only student achievement and student behavior (Cash) but also staff attitude and behavior (Hickman; Lee). This research study, suggested by both Crook and Hickman, validates and supports the contention that one of the most important factors in determining academic success and improving student achievement is, in fact, the condition of the building itself.

As an educator and administrator who had worked in both new and old school facilities, the researcher found the results of the study to be personally validating. The

experiences that the researcher had while working as a teacher in a new school were significant enough to be explored. As the researcher developed more of an appreciation for the research previously conducted in this field, it became evident that many researchers had reached similar conclusions: Improved conditions of school facilities impacts student achievement, as well as staff attitudes and behaviors (Cash, 1993; Crook, 2006; Hickman, 2002; Hines, 1996; Lee, 2006). What was not present in the quantitative research was an explanation from the people who actually work in the building: the principal, teachers, and staff members. The researcher was interested in determining whether or not the experiences that he had as a teacher in a new school facility were present in other new school facilities.

Implications for current practitioners in the field of education have been highlighted and recommendations for further research have been presented; there is a need to document further the impact that new school facilities have on overall student performance, student achievement, and staff and student attitude and behavior. The VDOE can benefit from this information to ensure that regulations and guidelines that govern the size of new school facilities, as well as recommendations made by architects and designers, are followed by school divisions. All students deserve a quality education in an environment that promotes the attainment of 21st-century skills and mastery of the skills that will enable future successes. It is hoped that school divisions planning to construct new school facilities will understand the long-term benefits inherent in such an undertaking.

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APPENDICES

APPENDIX A - SOLICITATION LETTER SENT TO SCHOOL DIVISIONS

Dear _____,

My name is Michael E. Bishop, and I am currently a doctoral student at The George Washington University, in the Graduate School of Education and Human Development. I am working on my dissertation under the direction of Dr. Linda K. Lemasters and am seeking your approval to conduct a qualitative research study within one of your schools.

My doctoral research involves the investigation of the impact that new high school facilities have on student achievement, as well as student and staff attitudes and behavior. Previous quantitative research conducted in the Commonwealth of Virginia has indicated that the condition of the school facility can impact student achievement by as much as 11%.

The research study is designed to determine if there is a relationship, based on the perceptions of the building principal and purposefully selected staff, between the design of the new high school and student achievement and student and staff attitudes and behavior. The data collection methods to be utilized in this study include interviews with the principal and select staff members, as well as one or two focus group interviews with veteran teachers (those with at least 8-10 years of experience) designed to gauge their perceptions of student achievement and behaviors, as well as staff attitudes and behaviors. The third method of data collection will be the gathering of descriptive data related to the design, planning, and construction of the new high school.

To ensure confidentiality of all participants, no names or identifiers will be used within the body of the research study; no information about the participants that might identify them will be reported within the context of the research study. All participants will be protected under the confidentiality clause of the Office of Human Research at George Washington University as well as the tenets of federal regulation 45 CFR 46 (protection of human subjects). Three new high schools built between 2003 and 2008 are needed to complete this case study. _____High School meets the criteria for this study.

I would appreciate your approval to participate in this study as it would provide valuable insight into this phenomenon and lead to a rich, thick description of the perceptions of teachers, staff, and administrators of the importance of creating an optimum learning environment. I anticipate conducting the interviews over a 2- to 4-day period (after school hours, if needed) at a mutually agreed upon time with the principal of the above named school. I would like to come to the site during the month of April or May of 2008. If you approve of this research study, please complete and sign the attached form and return it in the self-addressed, stamped envelope provided. A letter from your office with your signature would be greatly appreciated as it will become a part of the dissertation document itself. Copies of any other documentation that you may require can be made available upon request.

A copy of the results of this study will be made available to you upon request and a final copy of the dissertation will be available through the UMI dissertation database. If you have any further questions regarding this study, please call me at 804-730-3516. I foresee the information from this study as being helpful to your school board and governing body when considering new or remodeled facilities.

Thank you for your help in making this research study a reality.

Sincerely,

Michael E. Bishop
Doctoral student, GWU

Enclosures: Research Permission form

APPENDIX B - BUILDING PRINCIPAL INTERVIEW QUESTIONS

Administrators:

1. What is your position here and how long have you held it? Did you open the school? Please explain.

2. When was the first time you entered the building? Was it finished?

3. Please describe the feelings you experienced the first time that you came into the building? What types of things did you think about?

4. Did you work somewhere else prior to working here? If so, please describe your previous position.

5. Does the building have any structural design components that you believe are different from other places you have worked in before? Explain.

6. What design components do you feel have had the greatest impact on the students and staff? Explain.

7. Have/Did you notice any difference in the students' academic performance when compared to their previous school?

8. Is there anything that you have noticed about the students here as opposed to where you used to work that is different? Can you explain?

9. Do the teachers that work here behave differently? Can you describe that difference?

10. If yes to answer 9: How do you think they are different? Please describe things you have noticed that would lead you to believe that teachers have been affected.

11. What behaviors have you noticed that are different in the students? Explain.

12. Describe the attitudes of staff members who work here as opposed to where you worked before. Explain.

13. Did you have any input into how the classrooms or other academic areas were laid out or designed? Please elaborate.

14. Do you believe that the design of the school building, the classrooms, and the traffic patterns of the building help or hinder academic achievement?

15. Do you believe that the design of the classrooms helps or hinders academic achievement? Why?

APPENDIX C - FOCUS GROUP INTERVIEW QUESTIONS

Case Study: The Impact of New High School Facilities in Virginia on Student Achievement and Staff Attitudes and Behaviors

1. Please tell me about the building that you currently work in. What features do you like about this building as opposed to where you worked before?

   Explain your attitude when you are at work. Has it changed compared to where you worked before?

   Explain how students behave in this building compared to where you worked before.

   Is it noisy during class changes? Are the classroom spaces adequate?

   Do you like it here? Why? Talk about what makes this place different from your previous school.

2. Talk about the attitudes and behaviors of the students in this building as compared to previous locations?

   Describe some of the problems you encountered previously and the ones you have now. How are they different? How are they the same?

   What about the student behaviors, if any, is different in this building? Why?

3. Talk about the attitudes and behaviors of your coworkers here, as compared to where you previously worked.

   Different? Better? Worse? Give examples.

   How is morale in this building as compared to others?

   How is attendance?

4. Talk about the classroom you work in and compare it to the one you previously worked in.

   Better or worse? Why?

   What is your favorite architectural feature in the room? Why? Explain.

   Has the classroom environment hindered or helped your ability to teach the students in this building? Why do you think that is? Explain.

   Can you identify anything in particular that you like about the new building? Explain.

APPENDIX D - CENTRAL OFFICE INTERVIEW QUESTIONS

Central office Administrator responsible for construction

1. What is your position, how long have you held it, and what are you specifically responsible for?

2. What was your role in the design process of _____ High School?

3. Were there specific design or architectural elements that the district requested from the designer or architect for _____? What were they?

4. Please explain what some of the design or architectural elements were that are found in _____ High School.

    a. Structural elements -
    b. Professional working spaces -
    c. Acoustics -
    d. Daylighting -
    e. Thermal/HVAC -
    f. Multi-use facilities -
    g. School safety and security -

5. What were your major concerns with the completion of the project?

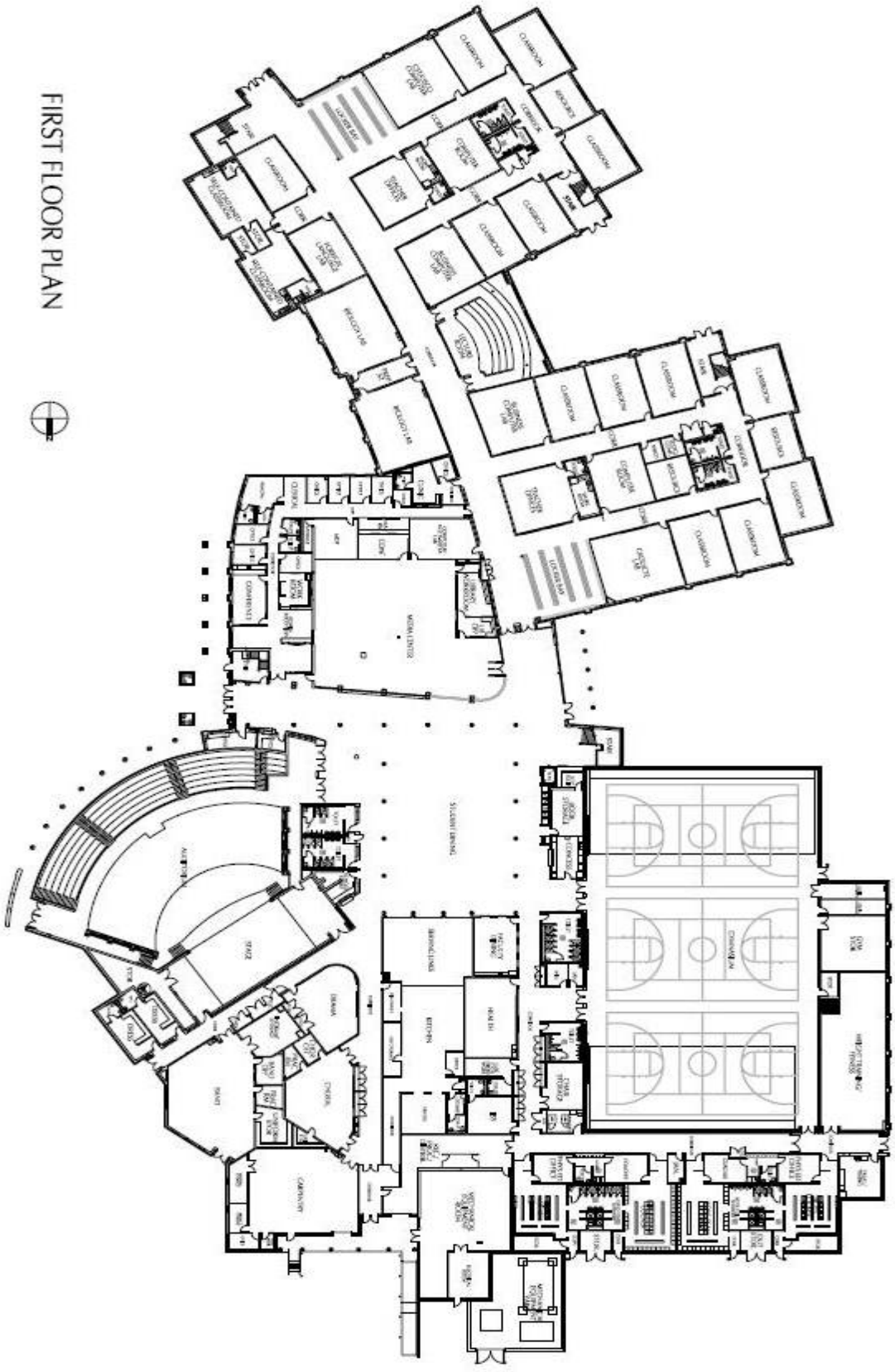
6. What was the cost of construction?

7. How was the construction financed or paid for by the district?

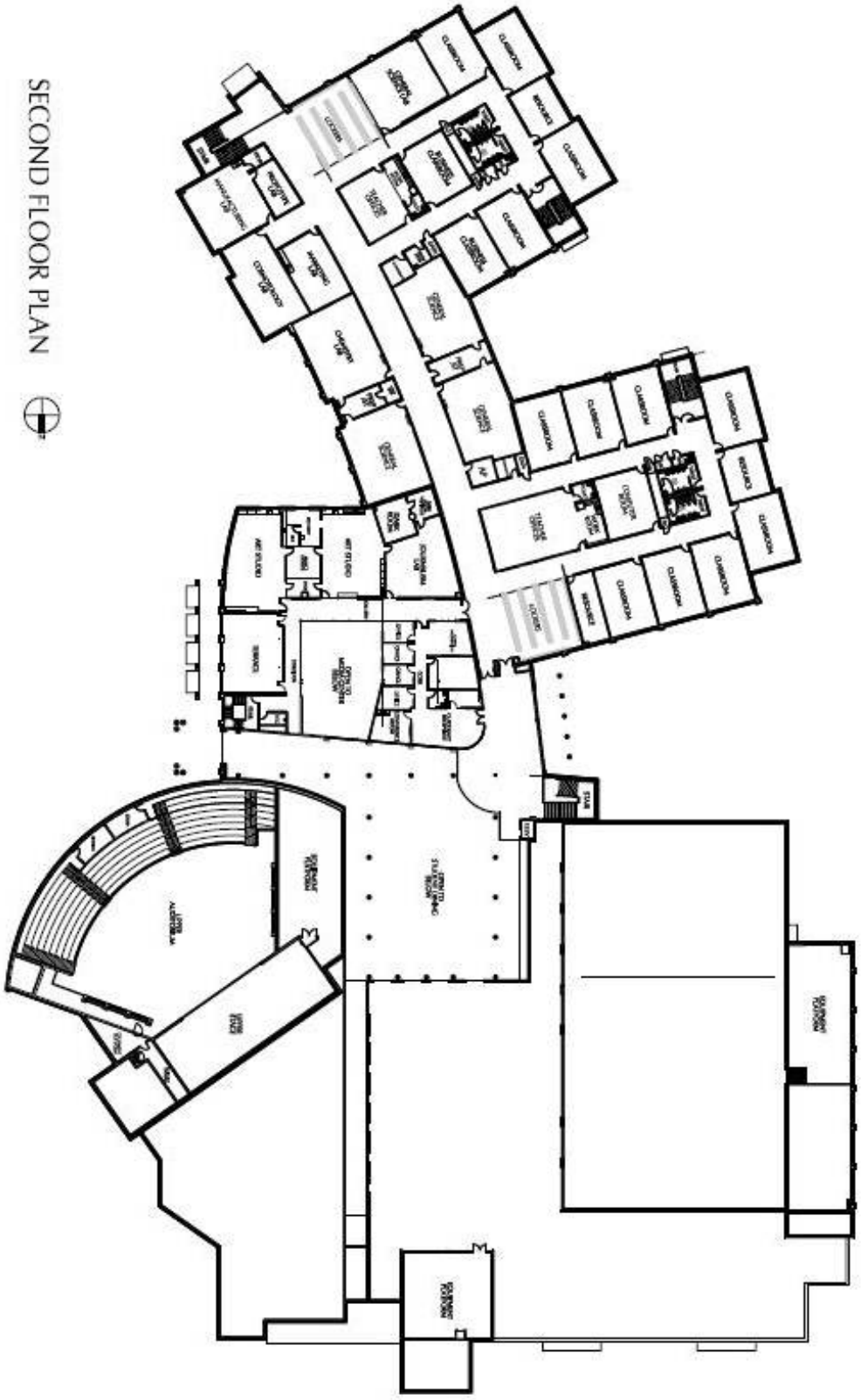
8. Who was the architect or design firm? Construction company?

9. What are your thoughts on this process? Challenges? Problems? Things for others to consider?

APPENDIX E - HIGH SCHOOL #1 FLOOR PLAN

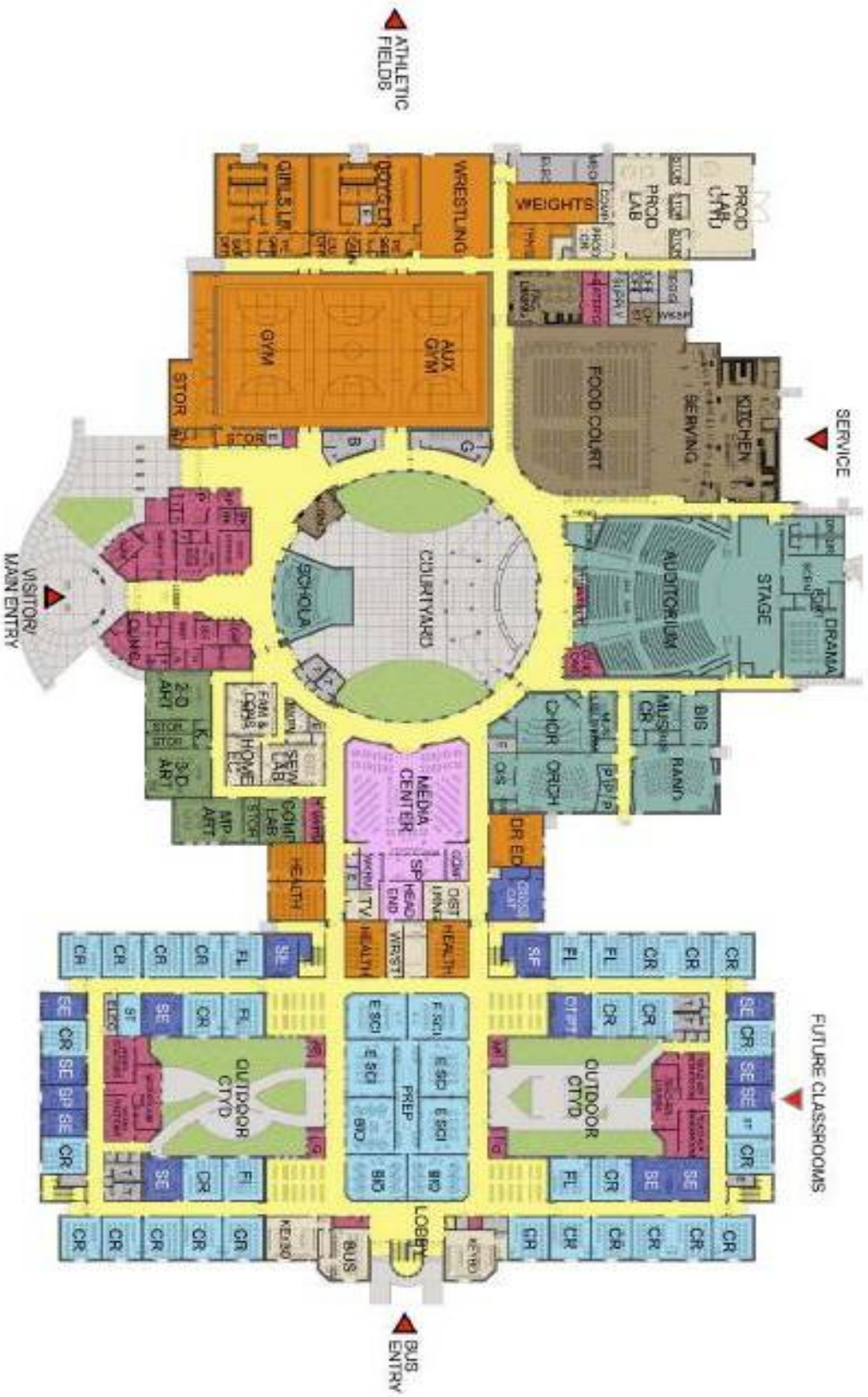


APPENDIX F - HIGH SCHOOL #1 FLOOR PLAN 2ND FLOOR

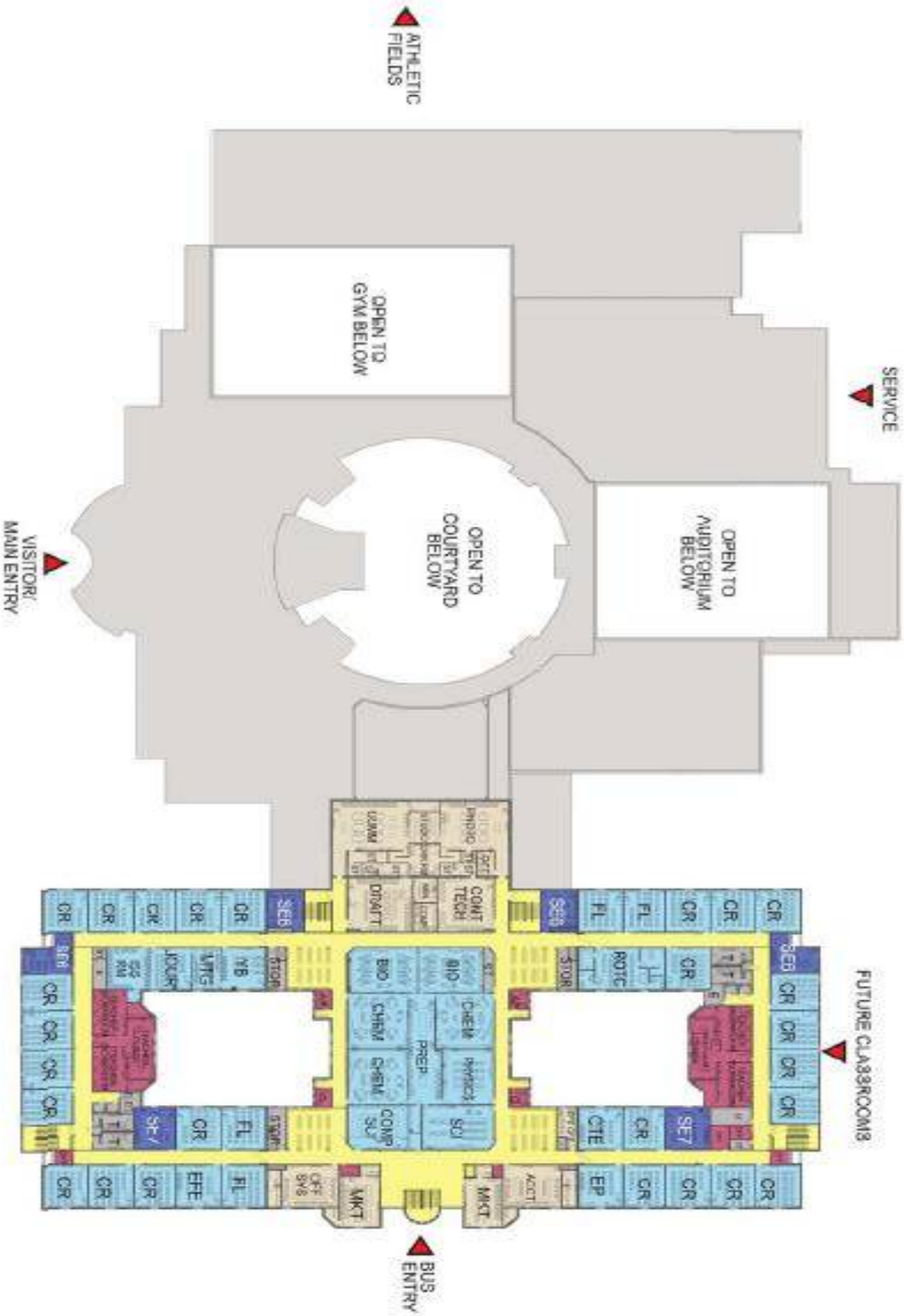


APPENDIX G - HIGH SCHOOL #1 SITE PLAN

APPENDIX H - HIGH SCHOOL #2 FLOOR PLAN 1ST FLOOR

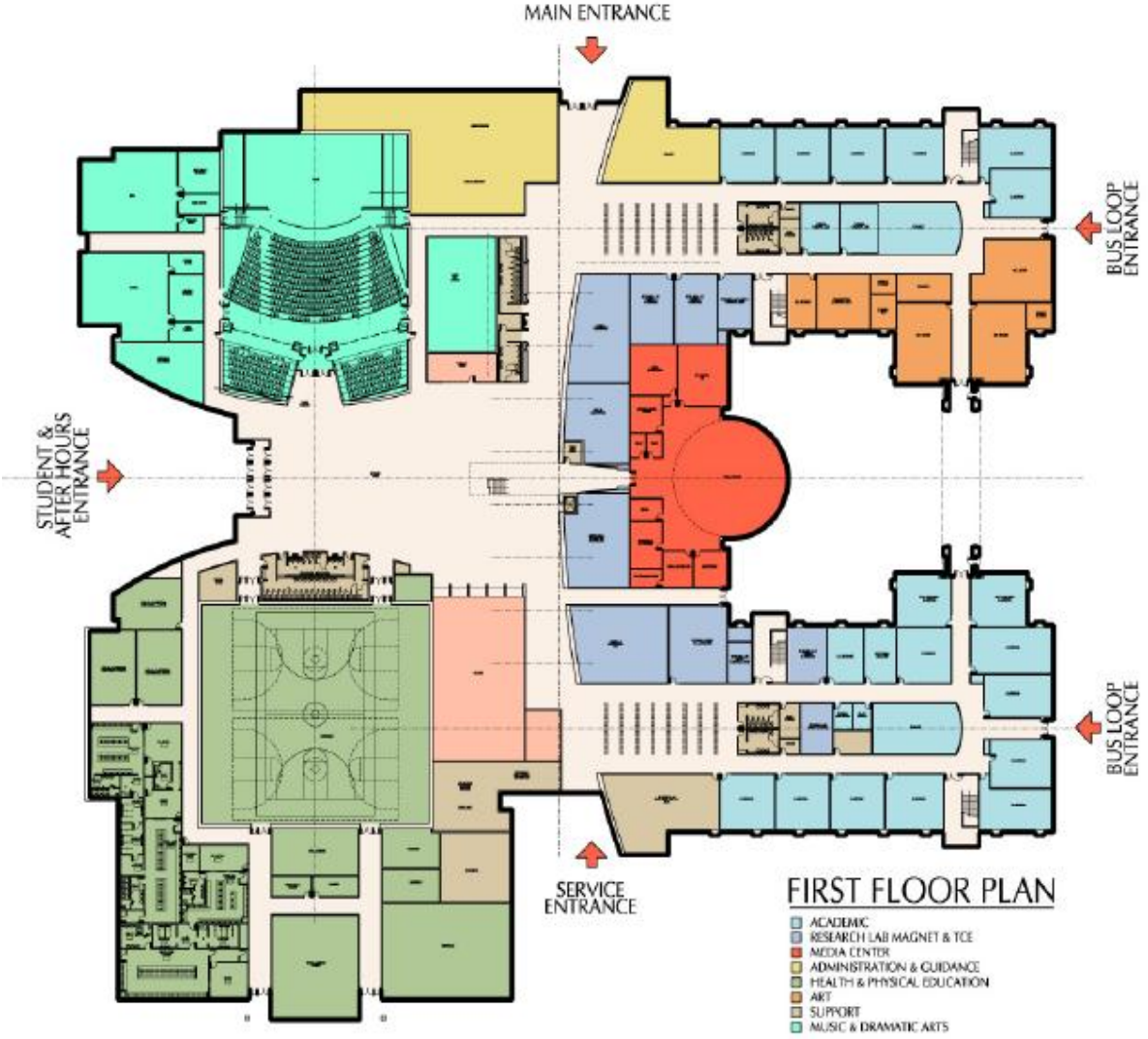


APPENDIX I - HIGH SCHOOL #2 FLOOR PLAN 2ND FLOOR

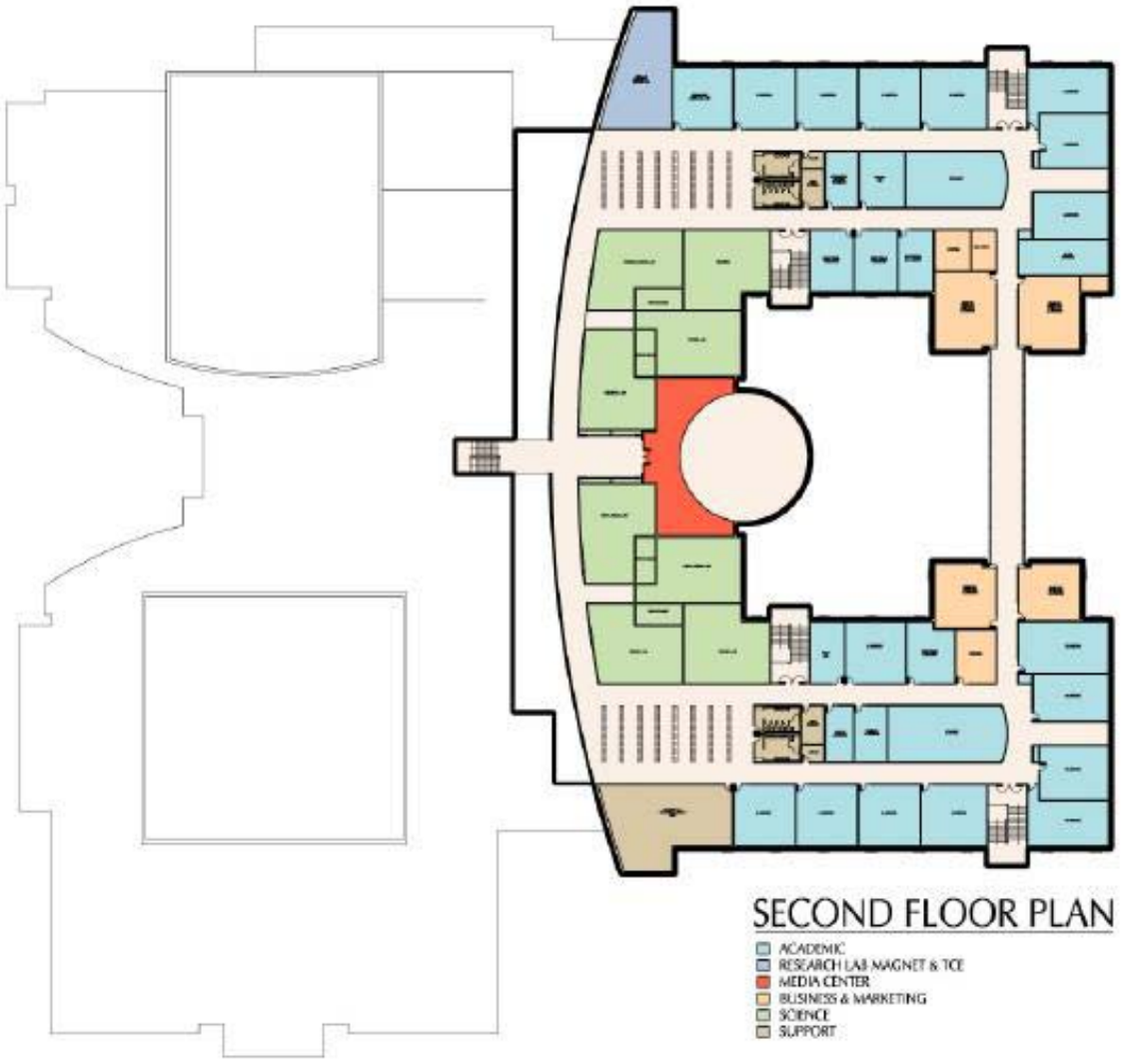


APPENDIX J - HIGH SCHOOL #2 SITE PLAN

APPENDIX K - HIGH SCHOOL #3 FLOOR PLAN 1ST FLOOR



APPENDIX L - HIGH SCHOOL #3 FLOOR PLAN 2ND FLOOR



APPENDIX M - HIGH SCHOOL #3 SITE PLAN