

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

By

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Executive Summary of Dissertation

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ABSTRACT OF DISSERTATION

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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 of 2008. Document analysis of architectural information was conducted by the researcher for each site location and that analysis yielded shared characteristics of each site 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 of the respondents in both the 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.

EXECUTIVE SUMMARY

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

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.

Introduction

New school buildings most often contain the most advanced architectural design elements with state-of-the-art technological advancements. The expected costs associated with new construction or renovation projects have increased exponentially; 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. 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).

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?

Research objectives

The objective of this study was to explore the perceptions of principals, teachers, and staff at new high schools regarding the impact of design elements on student achievement, staff attitudes, and student and staff behaviors. The primary goal was to formulate a clear theory, based on the data collected from the research participants, to explain the perceptions of administrators, teachers, and staff members of the aforementioned factors. Because of increased construction costs, school divisions planning future school construction or renovation projects should be able to choose design elements that are not only cost effective but also beneficial for students.

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.

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), was 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.

Conceptual Framework

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.

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.

Methodology

This research study was conducted using a descriptive, holistic, multiple-case design that involved three research sites and three streams of data collection: principal interviews, focus group interviews, and document analysis. 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).

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. Interviews with research participants were conducted between April and June of 2008. Document analysis of architectural plans, construction information, and/or blueprints was the final stream of data collection for this study. Triangulation of data collection techniques was employed for this research (Yin, 2003; Maxwell, 2005). 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 research sites who were part of the focus groups.

Data analysis was based on the principles outlined by Creswell (1998) for conducting qualitative research through a phenomenological perspective. The outline of the research procedures was 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. Transcripts were cleaned and identifiers removed by a third party.

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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 legislators and school district personnel with additional information to determine the most effective use of state funds for necessary school construction projects.

Application of the study

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. 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.

State department of education officials need to provide greater financial support and information to districts in need of a new high school or other school building, which may not be able to afford it.

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 was 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 was included. A general description of the staff employed at each school was included in each of the case descriptions. All participants in the study were anonymous; names of schools, as well as names of participants, were changed to maintain confidentiality.

High School #1

High School #1 opened in the fall of 2006, with the old building still standing next to the new one. It is situated on a campus of 27.4 acres, contains 234,000 square feet of space, with 69 teaching staff, 35 support staff, and 3 administrators. 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 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 is situated on a campus of 97.8 acres and contains 353,000 square feet of space and was built to hold about 2200 students (Central Office Interview #1, 2008). 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 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 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. An example of this would be the elimination of a sink for the athletic training room from the original design. 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. 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 was verified by a central office representative responsible for construction, or directly from 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. 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	69	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

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. 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. 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.

Theme	Principal interview information leading to theme development	Principal interview information leading to theme development	Principal interview information leading to theme development
No Perceivable Impact on student achievement	Principal interview #1 Believed there was no impact Stated that scores actually fell in 1st year when compared to old school Better behavior Reorganize extracurricular activities	Principal interview #2 Achievement scores for EOC tests were better than expected Technology change drove staff development	Principal Interview #3 First semester grades showed traditional distributions EOC test results were better than expected Technology Limited amount of pathways, time for planning coursework could have skewed results
Planning and Preparation	Collaboration between builder, architect and school division Logistics of Actual move	Blending of new staff required work Coordinate installation of technology and staff development	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

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. 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. 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.

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

Summary

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; Ruzala, 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).

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.