DISSERTATION

THE COMMUNITY COLLEGE STUDENT PERCEPTION ABOUT CLASSROOM FACTORS THAT AFFECT LEARNING

Submitted by

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In partial fulfillment of the requirements

For the Degree of Doctor of Philosophy

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WE HEREBY RECOMMEND THAT THE DISSERTATION PREPARED UNDER OUR SUPERVISION BY SANDRA K. VELTRI, ENTITLED "THE COMMUNITY COLLEGE STUDENT PERCEPTION ABOUT CLASSROOM FACTORS THAT AFFECT LEARNING" BE ACCEPTED AS FULFILLING IN PART REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY.

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ABSTRACT OF DISSERTATION

THE COMMUNITY COLLEGE STUDENT PERCEPTION ABOUT

CLASSROOM FACTORS THAT AFFECT LEARNING

Historically the classroom has taken on many forms and meanings to various individuals. The evolution of the classroom has progressed from the crude campfires of cavemen and nomads to the technologically advanced spaces for learning of today. Those who fund education and other stakeholders are now investigating the relationship of the built environment to the learner. This study investigates how the physical factors of a community college classroom affect a student's learning. A brief review of the history of the community college provides a context for this study. An overview of buildings in relationship to behavior is also presented. The conceptual framework of brain-based learning is discussed as a connector between the physical classroom environment and learning.

This is a qualitative multiple case study that uses focus groups, wish drawings, and archival data to investigate the value placed on the learning environment by a chosen community college and perceptions of students interacting within those environments to identify factors that they identify as a contribution and/or hindrance to their learning.

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It is with deep gratitude that I thank my family for their constant support. Without this love and support, I know that I would not have persevered. There is a saying that goes something like this, "We choose our friends, but not our family." I'm lucky enough to have a family that stands behind me. My parents, Gloria, Steve, and Alex, have always recognized and supported my need to pursue a higher degree, which is not always the case for a first-generation student from a Hispanic culture. My in-laws, Frank and Marlene, have always encouraged me to follow my dreams and aspirations and are the reason that my husband, George, has given me the confidence to look beyond my abilities and believe in what I could become. My sisters, Beverly and Debbie, have always been there to cheer me on and give me that extra push when necessary. Finally, my children, Kevin and Megan, have shown me that we are only limited by our own inhibitions and that we must continue to strive toward our goals.

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so fully without his guidance and assistance. I am truly thankful for this individual's willingness to share his expertise and time so freely.

Finally, to the community college that allowed me to conduct my research at their institution, I wish to thank you. I cannot name this institution for confidentiality purposes, but I wish to thank the present and past administration for their willingness and cooperation during this study.

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DEDICATION

This is dedicated to George, Kevin, and Megan Veltri. Your patience and support are greatly appreciated, and I love you dearly.

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CHAPTER ONE: INTRODUCTION

Close your eyes and imagine a classroom filled with twenty-five students. In one seat a young man stares out the window. In another seat a young woman of about twenty-five quietly sits and reviews her notes. Two young women chat about their weekend activities. Other participants are either quietly visiting or just sitting in their seats. Suddenly the instructor enters the room and slowly the students respond to her presence. One by one each look up and a few smile. A student shuffles into the room late. His hair is uncombed and his clothes are wrinkled. Actually, he looks as if he just rolled out of bed.

Could the instructor read their minds, she would be astounded. The young man staring out the window has just learned that his mother has been diagnosed with breast cancer. The twenty-five or so year old woman recently discovered that she is pregnant with her third child. She wonders how she will tell her husband, much less finish school. Of the two young women chatting, one just learned that she will become an unwed mother. The late student did just roll out of bed. There was a party in the dorm last night, and he did not get to bed until 4:00 a.m.

Although the instructor is not aware of her students' private challenges, she does know the room is cold again! The thermostat reads 66° Fahrenheit; the lights are flickering. As she grumbles to herself, she tries to bring a little levity to the situation. She quips, "As if it is not difficult enough to spark your love and interest in this subject, now I

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have to worry about hypothermia." Silently she curses the maintenance department for failing to respond to her third work order. Mumbling under her breath she grouses, "I did not realize that maintenance of the facilities had been added to my job description. I thought our mission was to serve our community, not to change light bulbs and monitor room climate."

While this might seem like an exaggeration, conditions and student populations similar to this story are not uncommon to community college classes. Students enrolled in community colleges are diverse in gender, age, ethnic origin, and experience. Statistics showed that almost three in eight students are over 30 years of age and one in eight is over 40 years of age. Sixty-three percent of the students attend part-time and about half of all students work full-time (Rosenfeld, 1999). Issues faced in higher education are fundamentally related to an institution's ability to function in a pluralistic environment (Smith, 1989). Cohen and Brawer (1996) used two words to sum up the student population attending community colleges: number and variety.

The opening vignette not only captured the diversity of the students, it also captured the poor physical condition of the classroom. In many instances, antiquated equipment and crumbling infrastructures are combined with student diversity. It is the functionality of the classroom's physical aspects that is the focus of this study.

Background

Conditions of Educational Facilities

A number of K-12 studies have been funded through the U.S. Department of Education (2000b) to investigate how school buildings and classrooms affect student health, safety, and learning opportunities. Research collected from these studies has

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linked student achievement to the physical building conditions. Approximately 14 million K-12 students attended schools in need of extensive repairs in 1994. School officials estimated that it would cost about $112 billion for necessary repairs and technological updates.

Research in K-12 environments funded by the U.S. Department of Education (2000a) indicated that decaying environmental conditions could affect learning as well as staff and students' health and morale. Examples of environmental conditions cited included poor lighting, inadequate ventilation, and inoperative heating and cooling systems. Technology was also noted to be a contributing component of learning. While technology has the power to transform education, most of today's educational facilities were designed for a past era. Many facilities lack basic electrical power to support educational technology (U.S. Department of Education, 2000a; 2000b). The National Clearinghouse for Educational Facilities (1999) noted that most facilities were deficient in key technologies and structural features required to adequately support contemporary learning technologies. In addition, it was reported that 60 percent of American K-12 school buildings had a major flaw, and 30 to 40 percent in every region were deemed inappropriate (U.S. General Accounting Office, 1996a; 1996b).

The numbers of lawsuits challenging school funding for facilities has also drawn attention to the poor conditions many students encounter at school (U.S. General Accounting Office, 1995). One case heard by the Arizona Supreme Court, *Roosevelt Elementary School No. 66 v. Bishop*, 877 P. 2d 806, called attention to the disparity among districts. While some school district facilities were unsafe, unhealthy and in violation of building, fire, and safety codes, others were equipped with state-of-the-art

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libraries, science laboratories, computer rooms, art programs, gymnasiums, and auditoriums (Lewis, Snow, Farris, Smerdon, Cronen, Kaplan et al., 2000).

The Physical Facility and Student Performance

Earthman (1997), referred to various studies that examined the relationship between student performance, achievement, behavior, and the built environment. Four studies showed students' standardized scores in above standard schools as being anywhere from one to eleven percentile points higher than students from standard buildings. These studies all hinted at linkages between the physical classroom and the students' learning and persistence, but there was no specific statement made (Tinto, 1997). Reports generated by the U.S. General Accounting Office (GAO), addressed the needs of school facilities in the K-12 educational system but did not address how the physical classroom contributed to student learning (U. S. General Accounting Office, 1995, 1996a; 1996b). Research in this area, specifically for community colleges, was even more sparse.

Other Physical Factors and Student Performance

Besides school facilities, other contributing factors needed to be explored. Maxwell and Evans (2001) studied the link between noise and reading. They found that chronic noise exposure could be linked with lower reading skills in children. These two researchers identified a correlation in an earlier study by Evans and Lepore (1993) which studied the non-auditory effects of noise. The noise source was a nearby airport and the planes flew over the school every six minutes. This resulted in a classroom decibel level of 90. The Environmental Protection Agency (EPA) recommended no higher than an

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average of 70 decibels. Their study found that students attending this noisy school had poorer reading skills than children attending a school in a quieter neighborhood.

They also found that children from the noisy school were not able to distinguish speech masked by white noise or background sounds. The children were able to distinguish specific sounds, however, such as a cat meowing or a baby crying. They concluded that there was a possibility that children selectively screen out auditory stimuli in chronic noise settings. They postulated another theory; speech could be used differently in noisy settings as compared to quiet settings and children could miss learning certain language skills.

Maxwell and Evans (2001) also found that certain language skills were related to reading skills and that noise exposure was a contributing factor to the success of the child. They looked at four-year-old children attending a day care center. The noise source was the classroom itself. Ceilings were high and no sound absorbent materials were used. Some classrooms were formed with partitions allowing the noise from one classroom to leak into adjacent classrooms. Their study tested children on several measures of pre-reading language skills in conditions as quiet as possible before and after noise abatement. In addition to the tests, children were given puzzles, one solvable and one unsolvable, to measure their persistence. They found that children in a quieter environment were rated as having better language skills and performed better on a cognitive language skill measure. The children in quieter settings took less time to solve the solvable puzzle and had better attention skills. While their studies were with children, they felt that chronic exposure to noise could be harmful to children and students of various ages.

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While the data reviewed were primarily for pre-kindergarten or K-12 educational settings, researchers in the postsecondary setting concurred that the classroom plays a key role in the development and learning of postsecondary students (Merkel, 1999; Tinto, 1997.) Research has been conducted and implications have been made as to how the physical qualities of the classrooms, such as furniture, temperature, and lighting, linked to student learning. To date, no clear statement has been made at the postsecondary level. Yet, various individuals believe that the college classroom still remains the center of activity and educational structure at institutions of higher education (Tinto, 1997).

Student learning, or lack of, cannot be blamed wholly on the physical structure, nor on noise and poor lighting, but in summary the research does point to the influence of these factors on student learning behavior.

Purpose of Study

The purpose of this qualitative study was to investigate how a community college student perceived specific classroom attributes contributing to or hindering his or her learning. A multiple case study, utilizing focus groups, documents, student drawings, and photographs was conducted.

Research Question

What classroom factors did a community college student perceive as a contribution and/or hindrance to his or her learning?

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Significance of Study

Abraham Maslow, a psychologist, identified a hierarchy of human needs and categorized them as physical or physiological, safety, social, esteem, and self-actualization. Maslow believed that before individuals focused on higher level needs, such as self-esteem and actualization, their most basic needs must first be met (Griffin, 1990).

Griffin (1990) felt that it was a widely accepted concept that "once the most basic of Maslow's hierarchical needs had been met the human aspects of the environment played a more significant role in the elicitation of behavior than the physical ones" (p. 1). He asserted that the physical environment did play a role in human behavior and added that research on purely physical environmental factors, specifically in higher education was lacking. Given the significance the role of the physical classroom can play in learning coupled with the lack of research specific to the community college class, the purpose of this study becomes significant. As funding resources for higher education become limited and accountability measures become more stringent, research on the relationship of the physical classroom and its affects on student learning is warranted.

Assumptions

The assumptions that guided this research fall within three general areas: (a) the basic ecological assumptions that are foundational to environment-behavior relationships. (b) the assumptions related to the nature of the influence between the physical environment and behavior; and (c) the importance of the developmental dimension in understanding the influence of the physical environment.

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Ecological Assumption

Endler and Magnusson (1976) cautioned that four basic assumptions of an ecological relationship needed to be considered. First, "behavior is determined by a continuous process and multidirectional interaction between person variables and situation variables" (p. 956). Second, they cautioned that the student had to be an active participant in the interactive process. Third, they identified cognitive and motivational factors to be important determinants of student behavior. The fourth assumption stressed the need for more situational systematic psychological studies (Banning, 1992).

Nature of the Influence

The literature revealed three positions relating to the nature of the influence between environment and behavior: architectural determinism; environmental or architectural possibilism; and architectural or environmental probabilism. The first position, architectural determinism, hinted that there was a direct or causal link between the built environment and behavior or effect. There have been speculation and research directed toward the effects the various environments have on certain behaviors, such as suicide. These positions have been criticized because they were believed to be too simplistic to account for the effects of design. Critics felt it underestimated the importance of social and cultural factors. Determinism overlooked the importance of indirect environmental effects and interactions between multiple variables. The final criticism of determinism was the theory that people engaged in transactions with the environment. People were noted to be active, not passive, and found to influence and change the environment just as the environment influenced and changed them.

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The second position, environmental or architectural possibilism, stated that the building or physical environment provided opportunities and set boundaries for behavior. Environmental possibilism proposed that the environment was part of the tapestry in which behavior occurs.

The third position, architectural or environmental probabilism, assumed that certain behaviors were probably related to the built environment. While determinism assumed that the environment determined the behavior absolutely and possibilism posed that a much larger role in an individual's behavior could be accounted for by individual choice, probabilism became the compromise. This theory postulated that while there may be several possibilities in organism response presented with varying environmental situations, probabilities would be associated with specific instances of design and behavior (Banning, 1992, p. 21; Bell, Fisher, Baum & Greene, 1990, pp. 364-365; Porteous, 1977).

Developmental Assumption

Wachs (1983, 1987) questioned what specific aspects of an environment were relevant to certain stages of an individual's development, as related to that individual's age. In his writing he integrated the principles, methods, and databases from other disciplines to delve into the investigation of the consequences of the built environment for children's development. In the past 70 years there have been shifts in the types of questions being asked by developmental psychologists about the relationship of experience to an individual's development. Research has shown that the environment was somehow relevant to an individual's development. (It should be noted that environment took on many meanings and interpretations.) Research commencing in the 1960s and

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continuing to date found that some aspects of the environment, such as noise and space availability, were relevant to an individual's development. This research, however, was predominantly from birth to 12th grade.

In summary this study is guided by the assumptions that there is an important ecological developmental (educational) relationship among students and their classroom environment and this relationship's influence is best described by the positions of possibilism and probabilism.

With these underlying assumptions, the study attempted to discover what classroom factors students perceive as a contribution or hindrance to their learning. Literature is lacking that speaks specifically to this question within the community college learning environment.

Definition of Terms

Architectural determination or environmentalism – A philosophy suggesting that behavior was determined in a direct, causal, and mechanistic manner by the physical environment (Strange & Banning, 2001).

Built environment - Environment defined as the climatic and biotic factors that act upon an organism or an ecological community and ultimately determined its form and survival (Merriam-Webster, 1993). The built environment of a classroom was referred to as the environment an instructor/teacher built for his or her students through various stimuli, i.e., arrangement of classroom furniture, visual aids, and use of classroom space (Arnold, Britton-Simmons, Williams, Brewbaker, Ranson, Tomasik, et al., 1993).

Campus design – Manipulation of the physical environment to create a rich, dynamic, and meaningful experience for students. Aspects that are included in campus

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design, but not limited to are: campus size, site, population served, inter-disciplinary curriculum offered, decentralized buildings, and ecological issues (Stueck & Tanner, 1996).

Campus environment – Resources provided by an institution that allowed an individual to determine the extent and nature of growth according to the quality of effort or involvement (Pascarella & Terenzini, 1991).

Campus mission – The specific task with which an institution of higher learning was charged. Bogart (1994) explained, "In the case of community colleges, the mission is what the institution purports to do" (Baker, 1994, p. 60).

Community college – First labeled as a "junior college," the community college's definition evolved. Cohen and Brawer (1996) cited Eells's 1931 definition of the junior college as including "the university branch campuses offering lower-division work either on the parent campus or in separate facilities; state junior colleges supported by state funds and controlled by state boards; district junior colleges, usually organized by secondary school district; and local colleges formed by a group acting without legal authority" (pp. 3-5). Since then the definition developed into a college which "...may, and is likely to, develop a different type of curriculum suited to the larger and ever-changing civic, social, religious, and vocational needs of the entire community in which the college is located" (p. 4). It was understood that the work offered should be at an appropriate level for high-school graduates.

Defensible space – The concept of claiming and defending physical space a person or group exhibited ownership over (Strange & Banning, 2001).

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Ecological perspective or ecosystem – Ecology originated from the Greek word oikos, which meant house (Banning, 2001a). Banning quoted Odum's definition as being the "study of households" and expanded that to the total environment. He considered a college classroom's environment an ecosystem, which was a basic functional unit between the living and nonliving organisms within that environment (p. 5).

Environmental displays – A common approach that used everyday language to specify events and entities. For example, a classroom described in terms of the objects it contained, such as desks, chairs, lighting, equipment, and the arrangement of such objects, i.e., desks in rows and column arrangement (Mehrabian & Russell, 1974).

Environmental or architectural possibilism – Position, which viewed the physical environment as a source of opportunities that may set limits on, but not restrict behavior (Strange & Banning, 2001).

Environmental or architectural probabilism – Notion that viewed the physical setting as possibly affecting student performance (Scott-Webber, Marini, & Abraham, 2000).

Inclusion – "Web-like" approach utilized to structure organizations which was an alternative to top-down structures (Helgesen, 1995). It was utilized to include all groups and to ensure that all are treated in a manner that does not exclude them from participation (Strange & Banning, 2001).

Interior design – The design of settings that has a direct impact on motivation, concentration, and performance by affecting comfort, control, attention, access, and enjoyment (Scott-Webber, et al., 2000; Miller, Erickson, & Yust, 2001).

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Physical environment – Stimuli of a physical nature, which surrounded an individual, i.e., lights, buildings, heat and air-conditioning, and windows. The ecosystem that included both organisms and the nonliving environment (Banning, 2001b).

Proxemics or proxemic zones – Perception of space that provided actual dimensions where one behavior began and another ended; includes territoriality and privacy behavior in individuals (Scott-Webber, et al., 2000).

Retention – Concept of persistence that led to satisfactory completion, or educational attainment at an institution of higher education (Pascarella & Terenzini, 1991).

School Culture – Restructuring of educational settings to encourage inclusiveness between those that interact within it (Rhoads & Valadez, 1996).

Sense of place – Environment that was made up of objects that hold meaning for an individual, and was believed to contribute to his or her job satisfaction, and motivation (Miller, Erickson, & Yust, 2001).

Territoriality – "A set of behaviors and thoughts persons or groups exhibit, underlying their perceived ownership of a physical space" (Strange & Banning, 2001, p. 120).

Delimitations

Student learning is dependent on many variables and circumstances, which this document cannot fully identify nor justify. For that reason, this study focused only on how the community college classroom was perceived to contribute to or hinder a student's learning.

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Researcher's Perspective

I am a faculty member with no control of the classroom's physical factors and have had to teach either in my jacket and gloves or with multiple fans circulating hot air. I have also had the pleasure of trying to instruct over the din of a power saw while electricians rewired a building or completed other remodeling projects.

A look in the classrooms reveals desks in uniform rows or bolted to the floor, which is not very conducive to a learning and open environment. For historical and monetary purposes, the design of the buildings have not been remodeled or renovated, as needed. When renovations are approved, it is the researcher's contention that stakeholders have not been invited to participate in the environmental design and planning. Architects, administrators, and other building professionals became the decision-makers and the end-user, (teachers, students, and staff), were overlooked.

I have had the opportunity to tour several community colleges and have discovered that this physical environment of the classroom was usually the norm, not the exception, as I had thought. Yet, capital budget projects funded by the legislature do not always include items supporting learning environments. It has been difficult to explain to a roomful of students why classrooms were antiquated in design and furniture or lacking in climate control. Yet, the student only had to look out the window to see that thousands of dollars were spent to erect a retaining wall. It was my intent to show a direct link between the community college classroom's physical factors and student learning.

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CHAPTER TWO: LITERATURE REVIEW

Introduction

What physical classroom factors did a community college student perceive as a contribution and/or hindrance to his or her learning? This research question guided the review of literature and its organization. First a brief review of the history of the community college is included to provide a context for the study of community college classrooms. Second, an overview of buildings and their relation to behavior is presented followed by a more detailed discussion of classroom design and the role of spatial and physical arrangements, visual factors, aural factors, physical stimulation, technology, and safety. Finally, the conceptual framework of brain-based learning is discussed as a connector between the physical classroom environment and learning.

History of the Community College

Before the research question could be addressed, the evolution of the community college, its mission, purpose, and facilities was explored. The community college has been described as "...a social system because its internal functions and parts are affected by outside forces, and the institution in turn affects its external environment" (Baker, 1994, p. xii). Its role and function has evolved with the public's perception. Originally seen as a branch campus to a university offering lower-division work, facilities were sparse and often organized by a secondary school district. Many times the classes were actually offered in local school district buildings or other temporary structures and were

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actually under the control of the local school board (Garms, 1976; Cohen & Brawer, 1996). The lack of buildings and equipment tended to inhibit the role of these institutions and hindered their proper development (Ratcliff, 1994; Parker & Smith, 1968, p. ix).

Later writings described the institution as an institution "...likely to, develop a different type of curriculum suited to the larger and ever-changing civic, social, religious, and vocational needs of the entire community" offering course work at "a level appropriate for high-school graduates" (Cohen & Brawer, 1996, p. 4).

This new social and civic role the community college embraced acted as a trigger to induce two-year colleges to begin thinking in terms of lifelong learning, education for community and economic development, and institutional services better defined as its mission. The need to define the institution's beliefs and values was recognized for its impact on concepts such as: student development, faculty development, human resource management, curriculum and instructional development, fiscal management, and shared governance. Succinctly put, the community college's contribution to society and the population served depended on its values (Baker, 1994).

Taking its cue from social forces, the community college responded to the need for an industrial trained workforce, a lengthened period of adolescence, the return of servicemen desiring advanced training, and the drive for social equality (Cohen & Brawer, 1996; Baker, 1994; Koos, 1924). Originally established in temporary facilities, many moved to their own sites, building in the same district. The colleges sought to put classrooms and the "best teaching equipment" within the reach of their target audiences (Parker & Smith, 1968, p. ix).

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Community college expansion and growth was the outcome. While the early 1900s reported 20 junior colleges, by 1967 the movement had grown to more than 800 institutions and had broken out of the "junior" label to be named community colleges. Enrollment exploded from an average of 150 students per campus to nearly six million total enrollments in the 1990s, with a rise in enrollment predicted between 1998 and 2010 (Parker & Smith, 1968; Koos, 1924; The National Center for Education Statistics, 2000).

Since the 1940s, each decade has brought new challenges to the community college. The GI Bill, resulting in the first large-scale financial-aid packages, rapidly increased the number of people attending college (Cohen & Brawer, 1996). The 1940s also saw an emphasis on vocational and community-based education, and the Truman Commission proposed the name change from junior college to community college. This is believed to have resulted in vocational enrollment growth at the expense of liberal arts enrollments (Eaton, 1994). A technological growth spurt was experienced in the 1950s and community colleges responded with new technical programs to meet the needs of a more savvy and non-traditional student (Davies, Schwind, & Quick, 1996). A rise in enrollments of diverse, nontraditional aged students was reported in the 1960s thereby increasing enrollments nationally (Townsend, 1995; Rhoads & Valadez, 1996).

College administrators and architects chose to shift the focus to planning and building community college facilities that were modern in design with what was referred to as maximum utility built in. It was the general belief at that time it would cost less to construct a facility and include modern teaching equipment than it would cost to remodel an older structure. Unfortunately many communities were unable to build new campuses. Instead, they acquired more land and added on to existing structures. The U.S. Office of

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Education estimated that between 1960 and 1965 community colleges spent $500 million for new facilities. Experts estimated that from 1965 to 1970 over $1.5 billion was spent on construction of community colleges (Parker & Smith, 1968, p. xi).

In November 1967, Michigan State University's Council of Educational Facility Planners and the College of Education and Continuing Education Service co-sponsored a four-day conference committed to the topic of how community/junior college institutions could improve facility-planning processes, specifically looking to the twenty-first century. There were 225 participants, including professors, community/junior college administrators, and board members, architects, educational facility planners, U.S. Office of Education specialists, American Association of Junior College personnel, and students who gathered to tackle this important issue (Parker & Smith, 1968).

Expansion and growth of community colleges had been dynamic up to this point and efforts needed to be taken to plan community college facilities for optimal use and function. Gores (1968), in his presentation to the Council of Educational Facility Planners, warned that the "classroom box had been busted." He felt that the ancient habit of teaching everything to a class in something called a classroom was fading away. The ancient tools of teaching – book and chalkboard – were fast giving way to ingenious devises for self-teaching. He asked the conference participants to realize the importance of environment. Gores wrote that the college was three things – people, ideas, and a place, in exactly that order. He felt that the "place of education tended to be depreciated." He quoted a colleague who felt that the environment of office workers could make a 15% difference in their productivity. In his opinion the same could be true for the environment of professors and students (pp. 2-3).

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The foregoing documents a brief history of the community college, including the history of its facilities. The following reviews the literature describing the relationship of the built environment and its occupants.

Building Design: Community College

While some believe there is a relationship between the building and a student's learning, many believe this to be a romantic notion (Chan & Petrie; 1998; Stricherz, 2000). Winston Churchill's quote: "We shape our buildings and then they shape us" bears some thought as it applies to student behavior within the built environment (Banning & Cunard, 1996; Lang, 1996). Looking from an ecological perspective at the major issues embedded in the building and learning relationship, we discover that individuals are influenced by the physical surroundings in various ways (Banning, 1992; Strange & Banning, 2001).

The nature of influence has been conceptualized by three positions: (1) architectural determinism, which suggests direct and causal links between the built environment and individual behavior; (2) environmental or architectural possibilism, which views the building for opportunities and behavior limitations; and (3) architectural or environmental probabilism, which assumes that certain behaviors have probabilistic links to the built environment (Banning, 1992, p. 20). All three positions are worthy of further investigation and clarification.

Architectural determinism suggests that individuals behave according to the inducements of the built environment. For example, individuals will exit and enter buildings in predictable patterns and move in certain directions because of the inflexibility of the physical structure and design. (Imagine a church: Patterns of direction

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are indicated by the aisles and openings.) Unfortunately, this position fails to do justice to the complex concept of the environment and the complexities of individual learning and does not encompass the diversity of students (Banning, 1992; Bell, Fisher, et al., 1990; and Porteous, 1977).

Environmental or architectural possibilism delves into the relationship between the school building and the social environment. Does the built environment influence behaviors? Aggression, interaction, attendance, questioning and attitude are some behaviors believed to be modified by the function and design of a structure, whether that be a building, office, or classroom (Bell, Fisher, et al., 1990; Stokols & Altman, 1987; Schroeder, 1991; Miller, Erickson, & Yust, 2001; Banning, 1992). In addition, the social environment should not be ignored in the attempt to understand the impact of the physical environment on student learning and on the stress encountered (Weinstein & David, 1987; Evans, 1982). Nor should findings be generalized. In other words, findings for one age group should not be automatically applied to another age category, since behavior differs at various development stages (Wachs, 1983).

The final issue of functionality and symbolic nature of the physical environment emphasizes that the built environment not only affords certain activities and impedes others, but it also communicates a symbolic meaning. For example, classroom arrangement of furniture could foster communication, in a functional sense, but it could also encourage greater social interaction among all users. Before looking at the relationship between educational buildings and learning, a quick look at the evidence within the commercial, retail, and the entertainment industries is warranted (Banning, 1992).

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It has been suggested that a worker's physical surroundings contribute to and affect their job satisfaction and motivation. An individual's sense of place or environment is made up of objects that hold meaning for that individual, contribute to his or her job satisfaction and motivation. These objects or features of meaning might include architectural characteristics of the building, the atmosphere or character of the interior, emotions and cultural background of the individual, plants and landscaping contours, odors, colors and sounds, and specific events or rituals. As an individual ages, more meaning seems to be placed on these objects and there is reason to support a linkage between ambient factors and motivation, satisfaction, and productivity of an individual, also referred to as organizational development (Miller, Erickson, & Yust, 2001, p. 36).

Organizational development has two purposes: (1) the improvement in the organization's ability to perform or reach its goals referred to as organizational functioning, and (2) the "improvement in the development of the organization's members, as it pertains to their well-being, their level of self-actualization, or realization of their capabilities" (Porras & Robertson, 1992, p. 723). This model behooves the organization to focus on four basic categories in a working environment: (1) organizing arrangements, (2) social factors, (3) physical settings, and (4) technology (Porras & Robertson, 1992).

The relationship between the classroom and learning environments has been investigated, and it has been found that the built environment can influence behaviors. Again, behavior varies depending on individual variables, such as age and diversity, but the design of setting for learning, whether a classroom, a research lab, or even a cafeteria, can have a direct impact on students (Banning, 1992; Scott-Webber, et al., 2000). "The

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design of settings for learning could have a direct impact on student motivation, concentration, and performance by affecting their comfort, control, attention, access, and enjoyment" (Herman Miller, Inc., 2001, p. 3). To be exact, uncomfortable temperatures in a room, uncomfortable chairs or ergonomically incorrect furniture, and poor aesthetics and lighting bring uneasiness to a participant and a feeling of helplessness. How much does the focus shift from learning to the physical factor and what is the consequence to learning?

K-12 studies assessing the impact of a building's physical conditions to student achievement found: students' standardized achievements were lower in buildings with lower cosmetic factors, rather than structural deficiencies; student behaviors, with regard to disciplinary problems, were fewer in properly maintained buildings; and teachers reported control of the physical conditions contributed to their morale, sense of personal safety, effectiveness, and personal value within the system (U.S. Department of Education, 2000a; Weinstein & David, 1987; Myrick & Marx, 1968).

One unpublished study from a higher education institution linked performance to the built environment. Teachers and students were surveyed concerning how the classroom's physical environment enhanced teaching and learning. Teachers generalized four physical environment concerns impeding learning: aesthetics, temperature, ventilation, and cleanliness. Students rated these factors as impediments, as well, but the overall student complaint was overcrowding. The rooms were described as "...ugly, stark, cold, grim, spiritless, windowless, and colorless," and students commented on their discomfort in the furniture, the room(s) being "...kind of ugly and uninspiring to learn in" and "...an instructional blah" (Babey, 1992, pp. 3-6).

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The implications of the facility functionality must be considered. Customers, or students in this case, who do not want to come to a facility or stay in that facility and are anxious to leave will not contribute to either the educational or financial objectives of that institution. After all, the decision to even come to the educational institution might have been influenced significantly by the facilities and the messages associated with the sense of place (Banning, 1999). Within the framework that buildings can influence learning, the important question is what are the specific features that serve as a mechanism of influence?

Mechanism of Influence

Several important ingredients in the physical classroom have been discovered to serve as mechanisms of influence on learning and classroom behavior. These are the design of the classroom; spatial arrangements within the design; visual factors; aural factors; ambient conditions associated with temperature, humidity and ventilation; support for electrical power/technology; and perception of safety.

Classroom design. The architectural experts have proposed various guidelines and specifications for college classrooms. Niemeyer (2001) felt that guidelines were necessary to communicate technology requirements to administrators, architects, and contractors, but he also felt that each classroom required individual attention. He proposed that each classroom should emphasize easy use of hardware, user-friendly controls and clear signage. His homepage on the Internet, http://classrooms.com/consulting.html, gave specifications for classroom design and functionality, but more importantly, his Web site gave specifications for classroom design principles to improve teaching and learning. He asserted that the classroom should

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be a location that empowered the faculty. He felt that pedagogy should drive the design of the room. Designers needed to focus on a user-friendly approach with attention to simple controls and signage. His idea that presenters should be able to operate equipment at eye-level, without having to crawl around on the floor or fumble with poorly labeled controls in the dark can certainly be appreciated.

Because so many students and faculty frequent college classrooms, flexibility must be emphasized. Since the college classroom serves multiple users with many teaching and learning styles, it should be designed to serve the needs of many while excluding few. Classroom design should encourage interaction, stress simplicity, and expand connectivity (Niemeyer, 2001; Arnold, Britton-Simmons, Williams, Brewbaker, Ranson, Tomasik, et al., 1993; Brubaker, 1999).

Today classroom usage is being re-evaluated. Many are comparing the intended use of that classroom with the actual use and finding it lacking (Brase, 1988). This has resulted in expensive and extensive renovations to upgrade classroom quality. The problem is neither architectural neglect nor budgetary deficits, but rather the quality problems seem to stem from the attitude that classroom design was not an important element at the onset of the projects. As a result, many design flaws occurred from misunderstanding the factors that affected user need. In many instances designers failed to account for acoustics, ability to see throughout the classroom, and seating. It would seem that effective classroom design with attention to detail and an understanding of functional objectives and adherence would lead to effective classroom design conducive to learning (Brase, 1988).

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For instance, common sense dictates that poor lighting would impede a learner's ability to read or see visuals correctly. If students are unable to hear an instructor over noise through "leaky" walls and windows, or cannot concentrate because the classroom is too hot or too cold, then the learning process has been interrupted. One can only wonder what other aspects of the classroom, such as bolted desks or chairs, interact negatively with the end-user (Reicher, 2000).

Tips for designing classrooms that improve teaching and learning can be found through various resources. Many of these resources gave facility specifications, such as seating capacity, window and color usage, to mounting chalkboards, and projection screens. However, these sites failed to document how specific controllable physical factors of a classroom contribute to student learning (Every & Walborn, 1999; Sanoff, 1994a; 1994b; Murphy, 2001; Calcara, 1999; Neimeyer, 2001).

For example, if a traditional classroom requires 20 square feet per student for arrangement of materials, writing surface, and privacy, and less than this space is available to each student, what is the consequence to learning? Would designing a classroom with curved rows and no teacher's platform or desk encourage more interaction between the instructor and students or student-to-student interaction?

Classroom design has been found to influence student behavior. Given the considerable amount of time students and teachers spend in classrooms, it is not an unreasonable request that the rooms be hospitable (Sanoff, 1994a; 1994b). A classroom designed to emphasize flexibility by allowing for manipulation of furniture to create an atmosphere of collaboration between the students or privacy for individualized work is adaptable to multiple learning and teaching styles. Simple design principles should be

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stressed. (Niemeyer, 2001; Lang, 1996). The students should be enthusiastic about their learning process and encouraged to create and maintain positive social relationships while interacting within the classroom environment (Sanoff, 1994a; 1994b).

Researchers affirmed that the classroom environment was more conducive for particular activities, yet constrained others. The classroom design communicates symbolic meanings to its users. For example, a teacher's desk placed on a dais at the front of the classroom with all of the student desks arranged in precise order, (rows and columns), conveyed a message of the classroom as a log or an assembly line with everything and everyone in their place during production. It would be difficult to imagine much student-to-student interaction or student-to-instructor interaction in this environment. How much interaction could be expected in a classroom with pods of desks or tables arranged throughout the room with the instructor's desk centrally located? The latter fits a family image that fosters more open communication and encourages greater social interactions between all of its occupants (Banning, 1992; Wohlwill & Heft, 1989).

One study of particular interest was undertaken to 1) determine differences between faculty and student opinions about university classrooms when the User's Environmental Interaction Framework (UEIF) model's quadrants were considered together, 2) to determine the positive, negative, and different effects between these populations within each UEIF quadrant, and 3) to determine faculty and student use. The UEIF was a framework with four quadrants: environmental/value dimensions, and behavioral or internal responses, proxemics concepts, and interactional influences. Key findings from the study included adequate lighting, air quality, maintenance, equipment, and general comfort. A lack of commitment to the classrooms was found and it revealed

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that the subjects had little desire to remain in the classrooms (Scott-Webber, et al., 2000, p. 16).

In their comments, the researchers warned that it was important for classroom designers to become familiar with scientific theoretical models, and singled out environmental psychology, to understand how individuals behaved in built spaces, i.e. general-purpose classrooms at institutions of higher education. Their literature review called attention to the importance of recognizing the interaction between the user and their environment in order to design a better classroom environment for faculty and students. They charged designers to take into account not only physical dimensions of the room, but behavioral responses of the users.

Along with classroom usage, this study considered communication styles and identified four: 1) One-on-one, which was more self-directed and might utilize electronic tutorials, teacher-to-student interaction, and was self-absorbent; 2) Presentation involved lecturing, sharing of information utilizing demonstrations that motivated; 3) Team work was sharing of ideas in an intergroup which allowed for consultation, brainstorming, and decision-making opportunities; and 4) Discussion was the exchange of information and included decision-making, more of a meeting format (Scott-Webber et al., 2000).

Their study found that the built environment has an effect on users, particularly in relationship to providing flexibility to accommodate social settings and environmentally controlled conditions, such as temperature and lighting. The physical setting did affect a student's performance (Scott-Webber, et al., 2000). It cannot be disputed that other variables affect a student's performance, but the built environment is one variable that can and should be controlled by educators and design professionals.

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Estabrook, in a 1990 personal study entitled *Recommendations for improving the aesthetics of the classroom environment,* suggested that the aesthetics of classroom can actually impact student motivation, attention, and productivity. Teachers and students alike recommended each classroom have its own distinguishing features. The more distinguishable each room became, the easier it became to orient oneself in the building and the easier it was to communicate about a room to another person. The general consensus was synonymous with boring and dull and that it was antithetical to what faculty and students expected in a classroom. As a result, many of the proposed changes were actually considered changes to the interior design, such as wall colors, chair colors, moveable pieces of furniture, chair rails along the walls, lighting, and graphics in the classrooms.

Another study reviewed classroom aesthetics, specifically from the student and faculty's perspective. These authors found evidence that a relationship did exist between attitudes toward the physical classroom and the attitudes towards subject matter taught in a particular classroom, as well as student achievement in that subject. Primary dislikes of existing room features relative to aesthetics included: lack of seating space or access to seats, uncomfortable chairs, poor ventilation, wall colors, and excessive clutter. The participants noted that ideal characteristics of rooms were largely independent of room size; instead they emphasized comfort, space, and function over artistic beauty (Caldwell & Hoyt, 1990). The literature recommended specific design and aesthetic value.

Spatial arrangements within the design. One major factor to consider in behavioral phenomena is proxemic or proxemic zones. The proxemic area or zone is a human's perception of sense of space and distance. Humans sense other people as being

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too close or too distant. Four zones have been identified: intimate, personal, social, and public (Altman, 1970; Hall, 1969; Scott-Webber et al., 2000).

The intimate zone is the surrounding area that is closest to the individual (zero to one and one-half feet). All of the individual's senses are heightened in this zone and this space contains the most private and inviolate spaces that an individual claims as his or her own, it is usually fiercely protected. The personal zone extends from one and one-half feet to about four feet and contains space where friends are able to interact within. An individual's sensory perception is still strong in this zone, but not as overwhelmingly protected as the intimate zone. The social zone is about four feet to twelve feet from an individual and there tends to be more formal interactions in this zone. The last zone, the public zone, has a distance from twelve to twenty-five feet from the individual and is a more formal area that is relative to large gatherings. This zone has the least amount of sensory engagement (Scott-Webber et al., 2000).

There is an imaginary line where one behavior becomes distinct from another. The notion of proxemics includes territoriality and privacy (Scott-Webber et al., 2000, p. 17). How does violation of this zone threaten an individual? Territorial behavior is the basic relationship between any animal and its environment. An animal will restrict geographical areas for specific periods of time, demand fixed spaces for specific natural drives, mark its turf, and experience an overwhelming need to belong to certain behavioral units. Classroom designers need to remember that a student will exhibit mannerisms associated with territorial behavior and proper spacing, to protect themselves from overexploitation. A student, as with any animal, needs to be able to spread his or her

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belongings, mark his or her turf, and obtain a private area within the classroom (Scott-Webber et al., 2000; Epstein, 1982; Hall, 1969).

If classrooms are to be viewed as spaces where communications takes place, then several design factors need to be incorporated. First of all, what type of communication takes place in that classroom? Since it is a community college classroom, several classes will move in and through it every hour on the hour, daily. Nine different classroom scenarios are presented:

1. As a discussion room, talking and open discussion are the method of exchange.

2. As a meeting room, open discussion, talking, and consulting are the main mode of delivery and the object is to collect information that is provided by a set agenda.

3. As a general meeting room where presentation and lecture are the methods of delivery. The intent is similar to the meeting but is also motivating, "generating identification" and sharing information.

4. As a conference or symposium, method of delivery is lecture, presentation and panel discussion. The intent of the room is to exchange information, inform and provide networking opportunities.

5. As a training facility, the method of delivery is presentation, lecture, and possibly use of educational games. The intent of this classroom is to train, motivate and intensify participant skills and abilities.

6. As a seminar, the method of delivery is interactive group techniques, presentations, lecture, discussion, and possible use of educational games. The intent for this room is to teach, learn, motivate for the purpose of conveying information and to enhance competence.

7. As a workshop, the method of delivery is interactive group exchange with discussion and brainstorming activities. The intent is to collect ideas and develop concepts while motivating and generating identification.

8. Group work is delivered through talks, consulting, discussion, interactive group techniques, and brainstorming. The intent is to inter-group cooperation with quick exchanges of information to enhance processing of material.

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9. Finally project work, which is seen as a project-oriented endeavor that incorporates interdisciplinary cooperation for a high degree of information exchange to optimize developmental processes. The method of delivery is talks, consulting, discussion, interactive group techniques, and brainstorming (Scott-Webber et al., 2000, p. 18: Englich & Remmers, 1998).

It has been proven that less crowded spaces offering each person more room produces less stress. The more crowded an area becomes, the scarcer the resources. Thus, one person's activities may infringe on another's activities. Violations of an individual's personal space may increase arousal and/or discomfort (Epstein, 1982). Organized spaces that are neat in appearance seem to produce more psychological stimulation and less physiological stimulation. Interestingly enough, the building design can facilitate or discourage the formation of interpersonal relationships depending on how it requires individuals to interact with each other (Ahrentzen, Jue, Skorpanish, & Evans, 1982; Mehrabian & Russell, 1974; Griffin, 1990). A study conducted in 1968 suggested that positive learning and development was enhanced by relationship development through informal interaction (Myrick & Marx, 1968). In other words, did facilities provide open, large gathering places where people were encouraged to commune with each other or provide solitary spaces where people were isolated and withdrawn?

In 1998 the U.S. Department of Education sponsored the National Symposium on School Design. While the information pertained to K-12 classrooms, one statement cautioned that the size and scale of a classroom could impact health and safety. They encouraged the belief that classroom should be kept small enough to allow teachers and students to form personal relationships and a sense of community which would promote a safer environment (National Clearinghouse for Educational Facilities, 1999). Will (1998) quoted one college professor who said, "when a student sits 60 rows back in a cavernous

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lecture hall, in a crowd of 300 other students, such mass production of college credits is an incitement to disrespect for setting" (p. 84).

Researchers argued that an important element for consideration was the distance between the learner and the teacher. This critical element could hinder or facilitate engagement between the student and instructor. There should be minimal distance between the instructor and student. Several options were presented: (1) keep students about 15-20 feet from the instructor; (2) provide space for the instructor to circulate; (3) include multiple instructional stations that facilitate student groups as their own teachers; and (4) include flexible seating appropriate to different pedagogical and learning needs (Scott-Webber et al., 2000, p. 19).

Other researchers described instructional and learning models that found a need for paradigm shifts in terms of how knowledge was shared and learning occurred. The traditional model has been the instructional delivery model. Remember the log or the teacher with the desk on the dais, this is the same concept. This method suggested that the teacher was "all important and imparts his or her wisdom from on high", or as they referred to it, "the sage on the stage" (Scott-Webber et al., 2000, p. 19). This delivery approach related to a passive learning mode on behalf of the students. (You might have even heard an instructor within this environment say, "Just shut up and listen!")

A more modern instructional model places the student as the primary participant in the learning process and the instructor in a coaching position. The student is actively engaged in his or her own learning. The classroom design is crucial to the success of this instructional model. The layout has to be flexible in seating or provide for multi-purpose areas that are integrated into the space.

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The general nature of the physical environment of an institution can influence human behavior because there is "a direct link between the built environment and behavior within it." This phenomenon is referred to as "environmentalism." Simply explained, people become a product of their environment. Individuals become creatures of habit and will usually follow in predictable patterns. For instance, students will gravitate to the same seats in a class without being assigned, sometimes by choice, other times because the physical structure and designs limited their options (Strange & Banning, 2001, p. 13).

The attractiveness of a room will also produce positive effects and energy levels for those working within the confines of that room. Much research has been done with hospitals and businesses in just this area. Common sense and past experience indicate that when the physical environment of a campus, building or classroom supports the desired behavior, better results are the outcome. "Campus designs and spaces did not merely create functional space, mood, or atmosphere, they facilitated certain behaviors" in this case, learning (Strange & Banning, 2001, p. 20).

Ingenuity has become many an instructor's middle name. When presented with a classroom, it has become necessary to adapt the physical environment to their students' needs. For example, a collection of vignettes from some very creative K-12 instructors showed how the classroom can become so much more. One found a way to transform his ordinary, traditional five-row, six-seats-in-a-line arrangement to a three-sided seating arrangement very similar to the Globe Theater; allowing the middle of the room to become center stage. This enabled the class to be "closer to the action" and students

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related that they could hardly wait to come to class because of its unique arrangement (Ranson, Arnold, Britton-Simmons, Williams, Tomasik, & Proctor, 1993, p. 82).

Yet another instructor shared how she changed from "sage on the stage" by building an environment within her classroom that reflected her belief in the formation of a community of thinkers simply by losing her desk in the spatial arrangement of her classroom. The center of her room housed a table where she had her roll book and where she worked with medium-sized groups of students. Around this table she positioned the desks in a circle and she facilitated the learning process by moving to an empty desk, so that she was usually able to sit by each student throughout the year. She related that students were more apt to share their thoughts, questions, and feelings in this environment (Arnold, et al., 1993, pp. 81-83).

One last concern to consider when designing spatial arrangements; are students being forced to learn in spaces never intended for use as a classroom, such as libraries, gymnasiums, laboratories, or quickly converted closets? It is true that community colleges might not have the same number of incoming students as a university, but has a need for immediate classroom space spearheaded the conversion of space never intended for learning?

In a K-12 study, the U.S. Department of Education (2000a) admitted that there was limited evidence that concluded overcrowding could have an adverse impact on student learning. One reason being that overcrowded classroom conditions limit the amount of time a teacher could spend on innovative teaching methods, such as cooperative learning and group work. Griffin (1990) categorized the following factors that also needed to be considered when evaluating an existing building or designing new:

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size, shape barriers, and links or order versus disorder, apparent age and condition of the building, height, and scale. Combine these factors with visual, aural, ambient conditions, electrical and technology, and safety factors, and it becomes apparent that designers have a challenging task to create a classroom that will enhance a student's learning.

Visual factors. The use of light and shade, light intensity, and light quality should be of extreme importance in any building design (Griffin, 1990; Rapoport, 1982). Klein (2001) felt that it was important for any designer to include daylight in all structures. A study, entitled *Daylighting in Schools—An Investigation into the Relationship Between Daylighting and Human Performance*, prepared for Pacific Gas & Electric, was presented at the 2000 Build Boston trade show which showed that daylighting impacted more than energy savings. The study indicated that daylighting "could increase productivity in manufacturing facilities by at least 25 percent and cut absenteeism rates up to one half, increase purchases in retail stores by 40 percent and increase students' test scores by 20 percent" (Heschong Mahone Group, 1999, p. 111).

The 1999 study reported that students in classrooms with more daylighting "...progressed 20 percent faster on math tests and 26 percent on reading tests in one year" than those in classrooms with less daylighting (p. 2-3). Students in classrooms with large window areas progressed "...15 percent faster in math and 23 percent faster in reading" than those without large window areas (p. 2-3). This study was conducted on behalf of the California Board for Energy Efficiency and only included the following K-12 school districts: Capistrano Unified School District in Southern California, Seattle City Public Schools in Washington State, and Poudre School District in Fort Collins, Colorado.

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The study noted that in the 1950s and early 1960s rigorous standards set by the California Department of Education ensured that architectural designs of classrooms include daylighting standards to be met for all facilities. As a result, multiple rows of single classrooms, having windows on both sides, became a standard for California K-12 districts. Other factors started to influence building designs by the late 1960s, and as a result, daylighting became discouraged. Classrooms were built back-to-back or grouped together, with open walls to encourage team teaching and creative learning, and to be more portable. Similar trends swept the nation in all learning institutions.

The Pacific Gas and Electric study also found that operable windows had a significant positive coefficient. They postulated that allowing teachers the option of using natural ventilation was a positive feature for the classroom. While the study established a positive correlation between higher test scores and the presence of daylight in a classroom, it did not prove that daylighting actually caused the students to learn more or perform better. They agreed that other studies needed to be conducted to identify what it was about daylighting that actually causes the effect.

Grocoff (1995) referred to research published in the *Journal of Environmental Psychology* stating there was a biological need for windows. Rather than windows being a distraction to the occupants, they provided a necessary relief, requiring "soft" attention. This "soft" type of attention, associated with window gazing or staring out the window and not paying attention to the instructor, was less consuming than the focused attention used to draw pictures or "doodle." It was much easier to pull the student back to refocus his or her attention to the instructor, the group, or the activity in the classroom (p. 5).

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What, if any, was the difference between natural light and fluorescent light in a classroom? Fielding (2000) quoted several studies that demonstrated a positive correlation between daylighting and academic performance. "Daylight gives off a continuous spectrum of all light wavelengths, including blue, red and green, appearing as a bright white and it was the standard for color quality in lighting, with a Color Rendering Index (CRI) of 100" (p. 1). He contrasted daylighting with fluorescent lamps, which gave off a discontinuous spectrum, or a flickering light, with spikes of color. Fluorescent lamps would produce a CRI from the low 50's to 86. It was true that they would provide an efficient utilization of electricity, but Fielding quickly added that the fluorescent lamp could not be compared to daylighting.

Both Fielding (2000) and Grocoff (1995) cited technical jargon to inform their readers to the proper installation, usage, wattage, and type of man-made lighting. They found that the increased amount of computer usage in classrooms increased the amount of problems for proper placement and usage of fluorescent lights. For instance, improper usage of prismatic lenses could cause bright spots, or a reflected glare, to appear on computer monitors, which made it difficult for students to read the screen. Because the eyes were continually adjusting to these contrasts, visual fatigue and headaches were common side effects when engineers and architects chose to use prismatic lenses in a lab or classroom. Parabolic louvers cast shadows on the walls. They could also cause an indirect glare on computer monitors, causing severe eyestrain and headaches (Grocoff, 1995, pp. 2-3).

What about accent lighting and placement of the lighting controls? Accent lighting on display areas or whiteboards can enliven a space. Recessed cove lights or

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pendant mounted directional fluorescent lighting provide accent and task lighting for more efficiency in the classroom. It is imperative that these lighting controls be near the presentation areas to allow the presenter to reduce the light levels during media presentations and to increase them for lecture and discussion (Fielding, 2000).

Ponder this when considering the lighting aspects in a classroom; researchers have proven that bright light made a difference to the brain chemistry, although the exact extent to which it affected an individual has not yet been determined. One explanation was that the nerve centers in our brains, that control our daily rhythms and moods, were controlled by the amount of light that entered through our eyes. During the night the pineal gland produces a substance known as melatonin. It is the melatonin that makes us drowsy. When day breaks, the bright light causes the gland to stop producing this melatonin, thus waking us. On dull winter days, especially when we are indoors, not enough light is received to trigger the waking process or to put off the drowsiness. It is not a psychosomatic or imaginary illness; it has been given a scientific name, Seasonal Affective Disorder or SAD (S.A.D., 2000).

Seasonal affective disorder or SAD, commonly referred to as the "winter blues," is a disorder that is a real problem for about ten million people a year. People who had been diagnosed with SAD have lost their natural rhythm that signaled the body to fall asleep and awake at proper times (Corwin, 1996, pp. 1-2). The symptoms seem to start around September each year and last until April, but have been known to be at the worst during the darkest months of the year. The problem seems to be caused by the lack of bright lights in the winter (S.A.D., 2000). While you cannot totally blame a darkened

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classroom for any sleepiness that its occupants might exhibit, there could very well be a correlation.

While there is no conclusive evidence that the absence of windows in a classroom has a consistent negative affect on student learning, it does seem to reduce the pleasantness of student's moods. Open spaces for learning, which were illuminated, ergonomic, acoustical, and pleasant to the individual, were perceived to contribute to a user's end result, i.e., learning (Bell, Fisher et al., 1990).

Griffin (1990) added that color was another aspect of visual stimulation in the physical environment. Colors seemed to have some psychological effects on individuals (Rapoport, 1982). Mehrabian and Russell (1974) discovered that pleasure and activity were two elements which could be measured in relation to color. They found brighter colors, especially warm colors, stimulated an individual's pleasure, as could contrast or variability of color usage. They also found that physical activity increased with the use of warm colors.

Jago and Tanner (1999) agreed that color choices could contribute to the teaching and learning process. Their literature review included findings that color influenced student attitudes, behaviors, and learning. Color did affect a student's attention span and affected the student and teacher's sense of time. A color preference by age and grade has also been investigated. Several studies reported color preferences varied with age and grade level. For instance, all grades but the eighth grade preferred orange, red-violet, and blue. As the child grew and developed, his or her color preference shifted from warm to cool colors. By the ages of 17-20, individuals reported preferring blue, red, and green to orange, yellow, and violet. Cultural biases would also play into the individual's color

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preference. This was an important aspect to consider since all educational facilities, regardless of level, are multicultural in makeup. (Sinofsky & Knirk, 1981, pp. 17-18).

Papadatos, in a 1973 study, suggested that the proper use of color in schools could convert depressing monotonous areas into pleasing, exciting, and stimulating learning environments. Many of the researchers found that colors liked by students could actually influence a student's muscular tension and motor control and reduce stress (Bell, Fisher et al., 1990).

Visuals in a classroom can actually contribute to the learning environment. One K-12 instructor reported that he used posters in his room to allow the students' ownership or territorial empowerment in his classroom. Yet another instructor, a college professor, recognizing that he was one of many utilizing the space, better referred to as the classroom, claimed ownership of the room by suspending an eight-foot-long oak branch across the ceiling of the classroom. Eventually the branch was named by his students, painted, and decorated by the students in his class with artifacts which stimulated memory writing or signified an important event that occurred in their field studies (Arnold et al., 1993, p. 81-83).

Aural factors. What impact did noise have on a student's learning? What exactly constituted noise? In the simplest terms possible, noise is any unwanted sound. "The concept of noise implies both a significant psychological component (unwanted) as well as a physical component (it must be perceived by the ear and higher brain)" (Bell, Fisher et al., 1990, p. 128). It is a more complex question than first perceived with a technical explanation of how sound is perceived by the brain through a physical component.

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Sound is any "changes in air pressure detected by the ear. These pressure changes are created by wavelike motions of air molecules in response to object vibrations" (Cohen & Weinstein, 1982, p. 45-46). Auditory sensation was the activation of the nervous system by the sound stimulus. Perception occurred when a code, which was yet unraveled, allowed the organism to interpret the sound stimulus as a high or low pitch and volume. This occurs between the basilar membrane and the temporal lobe of the organism's brain. Frequency is defined as the number or times per second that a wave motion completes one cycle and is perceived by the organism as pitch or highs and lows. The more times per second the wave motion completes a cycle intensifies the frequency or increased the sound. Sounds vary in height or amplitude and the organism experienced this as loudness (Bell, Fisher et al., 1990; Cohen & Weinstein, 1982).

Mehrabian and Russell (1974) studied musical noise and its effect on individuals. They found that when music was used, loudness and tempo had a direct positive relationship to an individual's respiration and physical activity, i.e., loud noises increased an individual's respiration and anxiety and were found to increase arousal. It was reported that loud music played over the intercom of a supermarket causes shoppers to buy the same quantities of groceries in a shorter amount of time. If you have ever been to a sporting event, you would recall how the use of noise and loud music aroused fans to a fevered state.

Unpredictable and/or irregular noises were even more annoying than predictable, constant noise. For example, the constant hum of the fluorescent lights was not as disturbing as the sporadic sound of a jackhammer outside. If the noise came in unpredictable spurts, it was even more disturbing (Bell, Fisher et al., 1990). What then

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was the effect of noise to a student in a classroom? What measures could be taken by architects, designers, and end-users to ensure a positive learning environment when considering acoustical effect on the learner?

Lackney (2000) contributed what he felt the proper acoustical support should be in classroom design. Sound absorbing materials should be used for not just walls, but also floors and ceilings of the classroom. Acoustical barriers that diminish the effects of different sounds, noises and speech patterns that could distract learners should be invested in. Lang's (1996) work referred to acoustical liveliness and explained that it was a product of room configuration, which included parallel walls; surface finishes, hard as opposed to soft, material density, solid as opposed to hollow, and air tightness or sound transfer. Rooms were usually designed for different uses. A music classroom would not have the same design as a classroom designed for quiet conversation or a classroom designed for presentations. In other words, while a shower might be great to sing in, its conditions would be poor for conducting discussions because of the echo or hollow feedback.

If a classroom's intent was for group activities as opposed to single lecture sources, the room should be built with more sound absorptive material. Hard walls, such as glass or marker boards should not oppose each other, rather be opposite an open storage area of differing heights and depths, to absorb sound and not pass it back to the other hard surface. Architects and builders could mitigate disturbing echoes or flutters of sound by angling walls at least five degrees out of their original parallel plane. Floor carpeting and acoustical sound insulation could be used to cut down on reverberation or noise that seems to bounce around the classroom. Why go to this much trouble?

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Much research was conducted in the area of prolonged exposure to high-intensity noises in community or work settings. Prolonged exposure was found to often be harmful to the health and behavior of large segments of exposed populations. In a Congressional Briefing to the United States House of Representatives on Science, sponsored by the Environmental Energy Study Institute, Lackney (1999b) commented that the noise could originate from within the building or outside of it and could be short- or long-term. Regardless of the noise's origination or length, research found that noise could have a major affect on student behavior and sometimes achievement.

Lackney (1999a) referred to several studies that indicated an increased systolic and diastolic blood pressure in middle school children where schools were close to noisy urban streets. These studies reported an abnormally high blood pressure in children living around airports. Evans, Kliewer and Martin's 1991 study, which synthesized a series of studies in the United States between 1980 and 1986, found a significant increase in systolic and diastolic blood pressure associated with schools near noisy urban streets.

Once again data was gathered from children, yet this factor of the physical environment was transferable to the adult learner. Noise was still an interruption in the teaching process. Noise, could for example, decrease the amount of teaching time if an instructor was forced to continuously pause or if the noise made it difficult for the teacher and student to interact (Lackney, 2000).

Ambient conditions of temperature, humidity, and ventilation. An individual's perception of the ambient or surrounding conditions relating to temperature, humidity, and ventilation has also been found to be important factors in the physical setting that influence behavior. Does the thermal comfort of an environment affect performance and

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if so, exactly how? The general consensus is that temperatures above 90°F or 32°C can affect an individual's mental performance after several hours' exposure. The exact effect, however, has not been agreed upon. Reports showed that while some students were negatively affected by the rise in temperatures, others performed better. (Bell, Fisher et al., 1990, p. 166; Bell & Green, 1982, p. 83-84).

Lackney (1999a; 1999b; 2000) discussed how thermal comfort has been proven to influence task performance, attention spans, and levels of discomfort in individuals. He referred to several researchers whose work spanned over 50 years of empirical studies indicating that temperatures above 80°F could produce harmful physiological situations that decreased work efficiency and output in humans. If thermal conditions were below optimal levels, than an individual's dexterity was affected. Higher than optimal temperatures could decrease an individual's general alertness and increased one's physiological stress.

It has been found that temperatures above 74°F adversely affected mathematical and reading skills in school age children. Reading speed and comprehension were found to be the most affected by temperature fluctuations. It had been noted that there could be a significant reduction in a student's reading speed and comprehension when room temperature were between 73.4°F and 80.6°F. Achievement in mathematical operations was also studied and was significantly reduced when air temperatures exceeded 77°F. One other factor found to have an inverse relationship to activity and stimulation was the level of humidity in a classroom (Griffin, 1990; Lackney, 1999a; 2000).

Heat and aggression have been studied extensively. It was noted that the United States Riot Commission in 1968 found that all but one riot studied in 1967 began on days

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where the temperatures reached 80°F or higher. Various researchers have also studied heat and crime rates. Interestingly enough, heat did not always cause aggression in those studied. In some instances, the presence of heat decreased aggression. The findings of various studies was confusing, but still needed to be explored (Bell & Greene, 1982)

If heat could cause aggressive behavior in individuals, did cooler temperatures cause the opposite? Bell and Greene (1982) explained that as the body cools, an individual's extremities are affected. The skin of the hands and feet showed the fastest and most dramatic cooling response. Studies have found that a decrease in tactile sensitivity, dexterity, and strength were the result of exposure to cooling temperatures. It has been suggested that recall may be affected in low or high temperatures. Some researchers have found that cool temperatures were conducive to the performance of mental tasks students perform. One particular study was conducted with English school children and the researcher believed that this might be explained because children have higher metabolic rates than adults and prefer cooler temperatures than adults (Bell, Fisher et al., 1990; Stokols & Altman, 1987).

Lackney (2000) felt that achieving good indoor air was as essential as providing comfortable, healthy thermal conditions and functional, aesthetically sound lighting and acoustical environments. Designers should be concerned with providing environmental control systems to maintain temperatures well within the thermal comfort zone and should maximize individual control within the learning environment, better known as the classroom.

Lang (1996), however, cited several studies that indicated teachers rather than students became more upset by temperature fluctuations in a classroom. He concluded

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that test scores were not adversely affected by classroom temperatures, unless in extreme conditions. He found that students generally liked cooler temperatures (five to ten degrees) than did teachers. The flexibility for manipulation of the current state of the classroom's temperatures should be accessible to the users. If an instructor must open a window, for example, to augment the classes' comfort, then the system was self-defeated and the teacher was probably agitated, and in his opinion, not doing as good of a job. For that reason, controls should be independent for each space and simple to operate.

Indoor air quality also needed to be a priority for designers. Providing for increased levels of fresh-air intake and increased ventilation rates in buildings was essential. The design measure cost very little and saved energy, and in Lackney's (2000) opinion, provided a more healthy environment for learners. Sick building syndrome has become a real concern with modern buildings. Roodman and Lenssen (1994) found that in 1984 up to 30 percent of new or renovated buildings suffered from this malady. They stated that often ventilation systems subjected occupants to stale air for hours or harbor and spread unhealthy molds. Sealed, climate controlled buildings could trap volatile organic compounds (VOCs), such as formaldehyde, that could seep out from adhesives, drying agents found in furniture, paint, and carpets.

In private correspondence, an Occupational Safety and Health instructor and inspector commented on air quality studies conducted in accordance with guidelines established by the U.S. Environmental Protection Agency's Office of Atmospheric and Indoor Air Programs, better known as the EPA, and the U.S. Department of Health and Human Services' National Institute for Occupational Safety and Health (NIOSH). The guidelines were available in a joint publication entitled Building Air Quality. According

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to the EPA and NIOSH, increasing health problems could result when institutions failed to respond promptly and effectively to indoor air quality (IAQ) problems. Consequences, such as cough, eye irritation, headache, and allergic reactions, and, in some rare cases, resulting in life-threatening conditions (e.g., Legionnaire's disease and carbon monoxide poisoning) had been reported.

According to a 1998 private memo from this instructor/inspector, the EPA and NIOSH recognized four factors affecting IAQ problems as follows: odors or contaminants; problems with heating, ventilation, and air condition (HVAC) systems' design or operation; pathways between source and location of the complaint; and the building occupants. Guidelines outlined basic approaches to mitigate IAQ problems as follows: control of pollutant sources; modifications to the ventilation system; air cleaning; and control of exposure to occupants. References to researchers who reported that conditioned air could cause employees working in buildings, suffering from sick building syndrome, to complain of headaches, weakness, and a general poor feeling, and oxygen deprivation were also included in the memorandum. This could ultimately lead to illness, rapid fatigue, and a reduction of the capacity to work. Air cleaning devices could be used to introduce an ozone-ion complex that fights sick building syndrome. It has been found that the atmospheric ozone had a positive effect on animals and people, namely on the breathing system, blood composition, arterial pressure, immune system, general feeling of well-being, and mental and physical work capability. The ozone-ion complex was a necessary component of fresh air that gave the air a curative effect (McGlothlin, 1998).

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Lackney (1999b) reported that individuals who were exposed to sick buildings or buildings with poor ventilation and air quality, exhibited clear signs of sensory irritation, skin rashes, and mental fatigue, which could potentially decrease the ability of students to perform. The U.S. Environmental Protection Agency (Roodman & Lenssen, 1994) estimated the medical and lost-productivity costs of worker breathing poor air amounted to tens of billions of dollars each year in just the United States.

Technology. Many people pictured computers as the only technology source used in classrooms. There are other forms of technology that have been incorporated into the classroom. As early as the 1950s, higher education institutions have utilized television as a medium of cultural enrichment and entertainment to the public, as well as for credit-course instruction. This development of television technology induced many colleges to develop their own material. Video production facilities were erected in many institutions and staff was added to utilize the media. By the 1980s, two-third of the instructors nationwide had access to media production facilities. Television instruction became established and is still prevalent. Surveys identified women and older students as the end-users, because this was the population that did not have the time to attend regular classes (Cohen & Brawer, 1996, p. 166).

The advent of computers gave colleges another instructional opportunity. It has been reported that community colleges have both the highest ratio of student-owned to institutionally-owned desktop computers and the highest percentage of classes using such technology for instruction. Computer-based instruction found applications in a growing number of situations (Cohen & Brawer, 1996). Unfortunately, a poorly designed information technology department (IT) can become a handicap for any institution. A

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quote from John Charles, associate vice president for information technology at California State University, stated it best: "If the network is down, it's almost like a snow day. You cancel classes; you can't run your financials; you can't purchase anything or hire anyone" (Sturgeon, 2001b, p. 24). For those and many other reasons, Sturgeon wrote that institutions needed to create carrier-class facilities or structures that offered power protection and physical atmospheres that protected the network both physically and environmentally.

Distance education has become the thrust for many institutions of higher education. Videoconference technology allows students at a remote site the ability to attend classes without having to travel to the actual classroom. It also gives the institution the capability of providing classes simultaneously to multiple distant sites. Picture Tel is an example of videoconferencing technology often used by institutions of higher education. Unfortunately, everybody but educators has taken the lead in the movement to network education. Representatives from telecommunications companies, college administrators, and even politicians have taken the lead because they see monetary gain in electronic ventures (Feenberg, 1999). Once again leading us to question how much thought was instituted in the design of a teleconferencing classroom that enhances and supports student learning.

Besides time lost for downtime, how much time was lost using technology incorrectly or not for its intended use? McDermott (1998) wrote of how the physical environment of one facility impacted computer training. She was charged with the task of training art librarians to use the Internet. As the librarians filed into the amphitheater and took their respective seats, the sound of clicking became so prominent that she described

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it as "insect-like clicks crescendoing until it seemed as if a swarm of locusts had invaded the training room" (p. 22). Tongue in cheek, McDermott explained that these librarians, or "gatekeepers to the doorway of knowledge" as she named them, were all involved in a round of good old-fashioned Solitaire. In her opinion, the physical factors of the room were not conducive to learning. The lights were dim, so that everyone could see her screen projected on the whiteboard, the room was warm, although there was a distinctive hum coming from the air conditioner, and the trainer was isolated at the front of the room. She concluded that the room did not foster a learning environment and the librarians, having lost interest, used the computer to occupy their interest. How many instructors, who utilized technology in the classroom, would have a similar story?

Lang (1996) agreed that the advent of electrically powered devices have increasingly invaded the home, business, and educational environments. Regardless of the individual pedagogy or curriculum utilized, electronic tools or gadgets not only augment, but also have become a vital part of the classroom.

Technology in the classroom was a separate topic just by itself, but researchers agreed that several factors should be considered when integrating technology into the classroom. Coppola and Thomas (2000) cautioned that the average e-classroom installation costs $175,000 to $300,000. He felt that most educational institutions paid little attention to proper design, research and implementation planning. As soon as the budget was approved, the race was on to spend and install equipment with little or no consideration for the end-users: students and instructors. Lang (1996) agreed and pointed out that something as minor as placement of power and data outlets should be considered with facility flexibility incorporated when planning for technology in the classroom

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setting. Conway (1996) added that technology in the classroom should not hinder, but help, instructors who relied on improvisation and unexpected happenings to illustrate problems. Therefore, the classroom needed to be a flexible environment, with means to present information in varying manners, with access to varied information sources, yet flexible to foster interaction between and among the teacher, the students, and information.

Too often, technology in the classroom was under-utilized. Many classrooms exhibited the first wave of what was called a virtual classroom and were still considered high-tech. This first wave of technology allowed instructors to utilize Power Point presentations in their lectures, while their peers still depended on the overhead projector stored in the closet. Innovative technology allowed the user to increase "the richness of the educational experience as well as broaden their reach to students across the globe" (Dickson & Segars, 1999, p. 152-156).

The layout for modern e-classrooms was simple. Computers were usually placed on long tables with the monitors resting on top of the computer's casing. The teacher's station was a crowded desktop with wires running everywhere at the front of the room. Usually there was an overhead projector by the teacher's station and sometimes a VCR was included in the matrix. Large television sets were sometimes available in the room, depending on the budget, and some classrooms were equipped with some type of LCD projector. Other electronic bells and whistles might be found in the room, but Coppola and Thomas (2000) questioned whether learning was enhanced because of the efficiency provided by the technology or impeded by inefficiency, whether it be inefficiency of the technology or usage.

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Ergonomic and environmental designs were factors to consider when it came to furnishing the e-classroom. Two major factors Coppola and Thomas called attention to were: students' desktop space and student-teacher eye contact. (Remember the story of the librarians and librarians?) Designers needed to recognize that comfort played an important part in student satisfaction. Chairs that were comfortable and could swivel with adjustments for height and armrests were suggested.

Ever been at a computer workstation that seemed to take forever to process the data requested? It could be that the necessary wiring to support voice, video, and data capabilities in the classroom was overlooked or already antiquated. For that reason, wiring should be accessible to deal with inevitable upgrades and electrical outlets and data drops should be ample throughout the classroom. Facility designers should give consideration to both wireless and wired communication, since much of the wiring in the classroom could quickly become outdated (Butin, 2000).

Safety. The National Clearinghouse for Educational Facilities (NCEF) (1999) felt that health and safety issues were top priorities for learning institutions. The past decade has seen a rise in campus crime, youth violence, substance abuse, and other unhealthy conditions. While it should be the intent of the designers to create learning environments that were open and inviting to the larger community, the design also needs to promote the health, safety and security of its students, staff, and community users.

The most basic level demanded that school designs address environmental safeguards and meet all safety codes. Buildings should be designed with healthy indoor environments. The buildings should incorporate physical features that enhanced safety

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and considered traffic patterns. The elimination of features that provided for potential violence and crime, such as poorly lit and obscured places, was important.

The NCEF (1999) report noted that designers needed to consider that features which enhanced a school's safety function, such as the right kind of doors, locks, alarm systems, and elimination of windows. These features could also alter behavior norms and attitudes of the end-users. They reported that a "growing body of evidence" suggested that the learning environment could affect student behavior. They found that "attractive, well-designed and well maintained facilities communicated respect for the people and activities housed in them... and ...they contribute to positive school climate, good discipline and productive learning" (p. 5). Biehle (2000) stated it best when he said, "When students have to learn in spaces with leaky roofs, poor lighting, dirty floors and walls, and plumbing that does not work, it is easy to see how many students can assume that society places little value in them and in their education" (p. 44-45).

Brain-Based Learning

Brain-based learning/research focuses on how the brain functions and how best to support that functioning by learning strategies. Kotulak's 1996 book entitled *Inside the Brain*, stated that an enriched environment could contribute up to a 25% increase in the number of brain connections early in an individual's life and during maturation. It was proven that an individual's environment could change his or her intelligence quotient (IQ) measurement in different ways and this same environment could monitor the individual's score by as much as 20 points up or down. Understandably, the individual's environment encompassed more than just room design, but the built environment needs to allow for active manipulation. This relationship between classroom and learning via

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the brain-based perspective should included the following twelve design principles based on brain-based learning research presented at a 1998 Council for Educational Facility Planning (CEFPI) Conference:

1. The environment should be rich and stimulating;
2. There should be places for group learning;
3. Indoor and outdoor activities should be linked;
4. Corridors and public places should contain symbols of the school community's larger purpose and should provide coherency and meaning that increase motivation;
5. The environment should be a safe environment;
6. There should be a variety of places, which provided different shapes, color, and light;
7. Displays should be changed to alter the environment because research showed that interaction with the environment stimulated brain development;
8. Have all resources available to provide educational, physical, and the variety of settings in close proximity to encourage rapid development of ideas generated in a learning episode;
9. Allow for flexibility;
10. Provide active/passive places because students need places for reflection and retreat as well as places for active engagement;
11. Allow for personalized space—the concept of home base needed to be emphasized more than a desk or a locker. This space would allow learners to express their self-identity, personalize their special places, and places to express territorial behaviors; and
12. Emphasize that the community-at-large is the optimal learning environment.

When threat is decreased through cooperation a safe learning and motivational climate for positive emotions is promoted and learning results. Research suggests that the brain learns best when confronted with a balance between stress and comfort: high

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challenge and low threat. The brain needs some challenge or some stress factor to activate emotions and learning. Stress motivates a survival mode in the brain. Too much anxiety or stress can shut down opportunities for learning, however. On the other hand, too little anxiety allows the brain to become too relaxed and comfortable to become actively engaged, sometimes referred to as relaxed-alertness. Designers and educators need to create places that are safe and which spark some emotional interest through celebrations and rituals (Evans, 1982; Lackney, 1998).

Brain research found that the brain was a pattern maker. The brain thrived on taking random and chaotic information and ordering it. This signifies that a learning environment that mirrors real life allows the brain to order information and form meaningful patterns that can be remembered and learned. This creates coherency and meaning for the learner. Research found that we learn best by doing. This suggests that learning should be facilitated in "an environment of total immersion in a multitude of complex interactive experiences which could include traditional methods of lecture and analysis" as part of the total experience (Lackney, 1998, pp. 1-7).

School design principles that support brain-based learning are those that incorporate the twelve design principles chosen as brain-forming principles based on scientific knowledge of neurophysiology of the brain and optimal learning environments. When designing for optimal learning environments, designers must holistically and systematically approach the facility design, considering not only the physical setting, but also the social, organization, pedagogical, and emotional environments that are integral to the experience of the facility and the user. Reduction of these principles to physical

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design solutions negates the potential for creating authentically brain-compatible learning environments (Lackney, 1998; Kotulak, 1996).

The environment should be used as a three-dimensional textbook for teaching concepts (content) across all of the disciplines. We learn by construction of our knowledge through a variety of learning processes across body, mind, and spirit. Spaces for learning should support hands-on exploration. These spaces should function as studios, rather than as traditional classrooms. The furniture and equipment should be modular, flexible, deployable and easily manipulated by students. This discussion focused only the K-12 realm, but the principles are not limited to elementary and secondary facility design. The surrounding environment can impact a student's learning, at any age (Taylor, 2000).

Synthesis Statement

There is support that physical aspects of a classroom are a contributing factor to a student's learning. The literature review revealed several concerns facing postsecondary institutions: budgetary constraints; a diverse population with different needs; buildings; technology; and classrooms that were not always conducive to learning. Combined with these concerns, architects, designers, and administrators seemed to have dissimilar objectives and were not always able to work in harmony for the benefit of the classroom's end-user, in this case the students and instructor.

Duke (2001) in its Thomas Jefferson Center for Educational Design Web site presented five principles of good classroom design that provide a comprehensive summary for this study:

1. The learning environment (classroom) should reflect a clear understanding of how people learn. The facility (classroom) should encourage and

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facilitate inquiry and experimentation by the students. The classroom should support social interaction. A variety of stimuli for learning should be incorporated in the classroom design, i.e., visual, tactile, and auditory stimuli. The latest technology should be accessible to the students. Settings, free from distractions, should be available to allow students to focus attention.

2. The learning environment (classroom) should reflect the prevailing ideals and values of the community, which support it. Is the quality of the design, technology, instructional space, and support facilities reflective of value that community places on the learning process? Does the learning environments serve the needs of citizens of all ages? Are the learning environments attractive inside as well as outside?

3. The learning environment (classroom) should be characterized by pervasive caring and help. Does the environment allow for organization of units that are small enough to ensure that all students have ready access to assistance? Does it reflect an individual's periodic need for privacy? Is caring reflected in the availability of adequate lighting, ventilation, temperature control, and allergy-resistant surfaces? Is caring reflected in the quality of furnishings, i.e., comfortable seating?

4. The learning environment (classroom) should inspire and nurture hope? Is the classroom safe, full of opportunities and support, and does it appeal to the senses? Is it a place where the students feel valued, not diminished, by the very nature of their surroundings? Does the classroom environment expose the students to a variety of opportunities to utilize their knowledge? Does it inspire and stimulate the imagination? Do students feel good about spending time in that classroom environment?

5. The learning environment (classroom) should be one in which the quality of desired learning dictates the quality of the setting and not vice versa. Have efforts been made to "customize" classrooms and other settings to the needs of the different disciplines that utilized those spaces? Are the learning environments accessible to all students? Is the classroom designed as a teaching tool with cultural contributions reflected in the design?

Lackney (1999a) questioned whether it was possible to assess the impact of school facilities on learning, but he felt that it could be assessed; the question was how? He noted that there were models in existence, but felt that they came with their own problems. He challenged his audience to conduct action research. He explained that

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action research, introduced by a social psychologist in 1946, was an approach that combined both traditional goals of social science (generating theories) and goals of practice that acted to affect change within a social system. Research and practice melded to become integrated activities. He challenged this researcher to attempt to identify how the facilities or the physical environment of a campus linked to educational outcomes or learning. Specifically for this research, how does the community college student perceive the physical classroom contributing to his or her learning?

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CHAPTER THREE: RESEARCH DESIGN

Introduction

This chapter will begin by presenting the assumptions and rationale for the selection of the qualitative method and the case study approach. A detailed description of each case, Classroom A and Classroom B, will follow. Next, a discussion of the participants, data collection, instrumentation, and procedures will be presented. Strategies for data analysis and trustworthiness are also presented. Finally, the chapter will close with the researcher's role in the study.

Assumptions and Rationale

After reviewing the quantitative and qualitative approaches and the five assumptions discussed by Creswell (1994), the paradigm that was most applicable to this study and the researcher's intent was the qualitative or constructivists' model. The researcher believed that there were indeed multiple constructed realities in the study of how the physical environment of a community college classroom contributed to a student's learning (Gliner & Morgan, 2000). Thick and rich description will be provided to give the reader detailed data necessary to analyze the situation (Firestone, 1987). Several K - 12^{th} grade level studies similar to the intent of the researcher were reviewed (Heschong Mahone Group, 1999; Myrick & Marx, 1968; U.S. Department of Education, 2000a; 2000b; U.S. General Accounting Office, 1996a; 1996b). While they did indeed provide data that were included and referenced in this document, they did not give a voice to the participants describing how they perceived the classroom environment

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contributing to or hindering their learning. Studies with higher education students were also reviewed and data were included, but participant voices were not heard in many of these unpublished and published studies (Scott-Webber et al, 2000; Babey, 1992; Caldwell & Hoyt, 1990). In addition, these studies did not focus on community college classrooms.

It was the researcher's intent to learn what specific environmental factors of the classroom the students believed contributed to or hindered their learning. Two classrooms were chosen for the study because they were used for the same purposes on the campus. The rooms were similar in design in that they had amphitheater seating. They both utilized video conferencing for distance education delivery of those classes. Finally, they were both considered technology classrooms for distance education on that particular campus. The researcher requested a listing of the classes taught in each of the classrooms that utilized Picture-Tel and were similar in delivery method or were lecture based. Classroom A had two classes and Classroom B had four classes that met the specified criteria.

The ontological assumption, which questioned the nature of reality, was subjective and each participant, as well as the researcher, had different perceptions of what physical factors contributed to or hindered student learning in each specific classroom. It was the researcher's intent to respect each participant's opinion and give each participant a voice via focus groups and other mediums for collection of individualized data. In this case, individual drawings of his or her ideal classroom were collected from most of the participants. It should be noted that the perceived reality from

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the researcher's perspective was recorded in a journal so that the researcher's bias would not influence the participants' perceptions (Creswell, 1994).

In dealing with the epistemological assumption, which asked what is the relationship of the researcher to the researched, the researcher did know several of the students participating in the study (Creswell, 1994). One participant was a student in another class, not related to the study. There was no contact with this particular student or any of the participants that would be perceived as inappropriate or subject the student to any unethical or undue pressure to participate in the study. The only criterion for participation was that the students had to have a class in both classrooms chosen for the study during the spring semester for the 2001-2002 school year. Students who met the criterion were mailed a formatted letter, approved by the Human Research Committee (HRC) at Colorado State University (see Appendix A). This letter invited the students to participate in a study that would identify physical factors of designated classrooms that they perceived to have contributed to or hindered his or her learning. Unfortunately not enough students responded to the letter and permission was attained from the HRC to follow up the letter with a telephone call to garner more interest in the study. (A copy of the telephone spiel is attached in Appendix B).

The axiological assumption, which questioned the role of values, was understood in this research project to be value-burdened and biased, according to each participant's and the researcher's perceptions. The participants' perceptions and values were key to this study, and their input during each focus group was meticulously recorded for future analysis and comparison. Participants were also invited to create a wish drawing, which encouraged the participants to fantasize about their optimum classroom (Sanoff, 1994a).

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It should be noted that not all participants created a wish drawing and that some participants were far more vocal than other participants. In addition, building design and architectural documentation were researched, analyzed and pictures of the classroom facilities were shown to the participants when appropriate for easy recall of the particular classroom facilities. The researcher also, through a personal journal, answered the same questions posed to the participants and created her own wish drawing for comparison to the participants and to be cognizant of bias (Creswell, 1994). (See Appendix C for journal.)

The rhetorical assumption, which asked what was the language of the research, was quite informal and each participant was given a personal voice, via the focus groups and drawings. The questions were open in nature and gave each of the participants the opportunity to describe how they felt various aspects of the classroom contributed to or hindered his or her learning in that particular class (Creswell, 1994; Merriam, 1998).

Finally, the methodological assumption, which questioned the process of the research, was inductive in nature. An emergence of categories and patterns evolved from the transcripts of the participants' personal accounts of how each of the classrooms' physical environments contributed to or hindered their own learning process in that particular class (Creswell, 1994). Recurring themes from the wish drawings were also duly noted and were included in the findings (Sanoff, 1994a). Generalizations from the students' perceptions during the focus groups and drawings emerged to provide "...rich context-bound information" (Creswell, 1994, p. 7). This information was developed into patterns or theories that could explain the phenomenon of how a community college classroom affected student learning.

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Type of Design

This study was first identified as a case study. The research was conducted at a rural community college. It was designed to be a flexible method, which would evolve in response to the perceptions of participants as they described community college classroom factors contributing to or hindering their learning (Creswell, 1994). Upon further reflection, it was decided that multiple or comparative case studies for within-case analysis and cross-case analysis were the most applicable to this researcher's intent. The definition for a case study analysis was "...intensive, holistic description and analysis of a single, bounded unit" which conveys an understanding of a particular case (Merriam, 1998, p. 193). More important to this study, case studies "...are designed to bring out details from the viewpoint of the participants by using multiple sources of data." Case studies were more selective and focused on one or two issues that were key to understanding the phenomenon or system being examined. It was imperative that the researcher considered not just the "...voice and perspective of the actors, but also the relevant groups of actors and the interaction between them" (Tellis, 1997, pp. 1-2).

The decision was made to complete a multiple case study, utilizing cross-case displays. The researcher gathered data, via focus groups and drawings, from participants. Two separate classrooms were studied and the students observed how these particular classrooms contributed to or hindered their learning. Detailed descriptions of the physical attributes or environment of each classroom, in relation to a student's learning environment, were collected and themes from within each case were constructed. Thematic analysis across the cases, better known as cross-case analysis, was then

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undertaken. The researcher then constructed an interpretation of the meaning (Creswell, 1998).

The case study occurred at a community college that was not named to protect and ensure confidentiality with subset data collected. Focus groups were conducted with students who were presently enrolled in a course that utilized the state-of-the-art facilities on campus (Classroom B) and also enrolled and attended a course in the other classroom (Classroom A), which was comparable to Classroom B in usage, space, and design. These two classrooms were chosen because they were the only two on campus similar in design and usage but Classroom A had developed into a Picture Tel or distance learning classroom by mistake, more than intent, while Classroom B was designed purposely for this reason. Classroom A also had numerous complaints from students, faculty, and staff regarding the ambient features. Since Classroom B was a newer classroom, seemingly designed for ease of use by the faculty and students, it fit the intent of this study.

Participants were asked to reflect on the physical factors of each classroom and identify contributions and hindrances to their learning as a result of the identified factor. Participants were shown digital photos of the two classrooms chosen for the study, to aid them in recall of the classrooms' environments and physical factors. Their responses on classroom contributions and hindrances were recorded.

In addition to the focus groups, participants were given the opportunity to design their vision of the optimum classroom. These drawings were referred to as wish drawings and the responses were collected and synthesized to provide a profile of the participants' desires for classroom facilities (Richardson, 1994; Sanoff, 1994). It should be noted that

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not all participants contributed a drawing, since it was a voluntary exercise. (See Appendix D.)

Documents that pertained to either capital construction or capital maintenance requests were also reviewed, as well as the facility master plans in the attempt to gain a perspective of the institution values for classroom facilities and the facilities' usage. Historical archives were researched to gain a perspective on how the buildings and classroom facilities, specifically the two classrooms chosen for the study, were designed, remodeled, and what the original and present intent of each room was.

Case Description

One community college was selected for this study. Participants selected included students enrolled in that semester on that campus. A theoretical sampling was assembled, as the classrooms they frequented theoretically chose the participants invited to partake in the study. Two classrooms were chosen for this study because of similarities in technology, space, function, and usage. Classroom A was located in one of the original buildings on campus and had undergone several remodeling activities over the years. While its original intent was as a theater and speech classroom, it had been converted to a classroom with technological capabilities. Classroom B was located in a building that was previously utilized as the Physical Plant for this campus. Recent extensive remodeling of the building had provided a classroom now equipped with the latest technological equipment. A detailed accounting of this institution's history, starting with the building that houses Classroom A is included in chapter four. Descriptions of each classroom and features are provided for the reader below.

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Classroom A. Recognition for several state junior colleges was granted and funded after a lengthy battle with legislative bodies, while rumors of involvement by Ku Klux Klan members headlined the papers (Ross, 1940). One college's decision to construct an administrative building was passed by the governing board of that institution (name withheld for confidentiality of study) in January 1940. It was built of native stone, steel, and concrete. Administrative-classroom type activities were the original intent of this building. It was three stories in height, seventy-seven feet wide and one hundred twenty-eight feet long. The building housed nine classrooms, three of which were laboratories, with the others to be used as a mathematics room, a journalism room, a commercial room, a language room, a large lecture room, and one general classroom. It also contained a dark room for photography, a large speech arts room with a stage, a library, six faculty offices, a dean's office, a registrar's office, and the president's office. The building was completed and ready for use in April 1941 (Denbo, 1948).

The room, first identified as a large speech arts room with a stage, was one of the classrooms chosen by the researcher for this study. Students frequented it and it met the following criteria: 1) ample seating, 2) technology usage, and 3) comparable features. This classroom is referred to as Classroom A. While the original intent was for an auditorium-type facility, the room was utilized as a speech classroom, theater for drama productions, and as a basic classroom. It originally had hard, wooden seats, similar to those found in a movie theater; the bottom of the seat folded up into the back of the seat. The floor was wooden with no carpeting. It had numerous windows on the eastern and southern walls for plenty of natural daylight. The windows were glass panes with wooden trim and could be easily opened for ventilation. (See Appendix G.)

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Eventually the usage of the room was expanded and with the completion of a performing arts building with larger seating capacity and a larger stage, the room was no longer needed for drama productions. Technology was added sometime around 1987 or 1988 with the installation of a three gun ceiling mounted projector for usage with an Op-Tel video display conferencing unit. The room was refurbished in the late 1980s or early 1990s to its present state. (Researcher was unable to find exact dates in college's archives. Through numerous interviews, an approximate date of 1989 or 1990 was determined.) In 1995 Picture-Tel was available in this room. In the summer or fall of 2002, two new data projectors were installed with two new white viewing screens. These screens and projectors were not available at the time of the study.

Classroom A has the seating capacity of 66 room occupants. The seats were tiered and had a cloth padding on the back and bottom of each seat. Each seat folded from the bottom to the back, just like theater seats. An arm, available for occupants to write on, was located on the right hand side of each seat. The occupant lifted the arm straight up and then folded over to utilize a one-foot by ten inches wide writing area that was triangular in shape. (There were no seats with an arm on the left side for left-handed occupants.) The seats were all bolted to the floor and were arranged in rows in the six-tiered sections.

Classroom A was 26'9" wide by 55" long (this did not include space on the stage, since the stage was not utilized for classes). The stage's dimensions were 26'9" wide by 16' long. The room was 11'2" high in the front of the room and 7'10" high in the back of the room. From the first row of seats to the screen was a little over twenty-two feet and

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from the last row of seats to the screen was about 55' feet. A portable, 5' wide by 6' long, chalkboard was located at the front of the room.

Two heat temperature controls were in the room. Two large grates on the east wall, each measuring 7'5" long by 1'6" high, and three floor grates in the middle and back of the room measuring 1'3" long by 2'2" wide, were used to dispense heat throughout the room. A study of the room's temperature from March 2002 to December 2002 showed a range from 85° to 89° Fahrenheit. There were six ceiling fans throughout the room, which were controlled by a switch at the front of the room near the exit. No air conditioning was available in this room.

The original windows were still in use. Since the windows faced south and east, the room received morning sun in the east windows and afternoon sun through the south or back windows. There were shades on most of the windows to block the sun, but some of the shades had been damaged or torn down and not repaired. It was discovered that the wooden trim on the windows seemed to have swollen over a period of time and opening the windows to allow for ventilation was almost impossible. There were two doors in the back of the stage area; one that opened to the outside facing east and a door on the west wall that opened to another classroom. The main entrance to the room was an entrance with double doors. It was reported that usually only one door was unlocked. The other door was the door that gave the occupants access to the handicap ramp.

Aesthetically speaking, the room was somewhat dark, there was carpeting throughout the room, but it was not wall-to-wall carpeting. The area just in front of each seat was not carpeted, but wooden. There was light blue wallpaper throughout the room, but a section in the back of the room and also a section in the front of the room had fallen

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from the wall. Several other areas of the wallpaper were pulling loose from the wall. The areas exposed were stained with mold, mildew and water stains.

There were two light switches, one in the front of the room and one in the back. There were four switches that controlled: the ceiling fans, the lights in the front, middle, and back of the room. The fluorescent lights were either off or on, there were no dimming controls for the different lights in this classroom.

Finally, the instructor's desk was actually two rectangular folding tables, six feet long by two feet and six inches wide, situated in an "L" shape. The table that was adjacent to the east wall was used to house the computer and the light projector and the other table accommodated the instructor for placement of personal materials. Situated between the two tables was the Picture-Tel unit with a 39" screen television.

Classroom B. The second classroom chosen for this study was located in a building that was completely renovated and considered to be the technology building on that campus. The formal name of this facility was known as the Electronic Service Center. As stated earlier, the original intent of this building was for the physical plant/maintenance staff and equipment. It was completely renovated in 2000. This building includes a classroom, henceforth referred to as Classroom B, identified as the multi-media classroom because it was equipped with two-way video-conferencing equipment, 24-station capacity for lap-top computers, tiered seating, and lighting controls which were easily controlled by the instructor. Two large 8' x 8' data screens were easily controlled by the facilitator and could be raised for easy access of the whiteboards. Two ceiling-mounted video displays were also included in the room design. Furniture was considered state-of-the-art and supposedly easily adjustable for participant's comfort.

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Classroom B was approximately 28-½ foot wide x 39-½ foot long. There were four, 2'8" wide x 6'8" long, windows that were on the south wall and gave students a view to the outside of the building. One large window, 7'8" wide x 5'7" long, located at the back of the room gave a view of the hallway. All windows had a light blue pull-shade to shield the light entering the room or to block activity visible from the windows.

There were five tiers of seating and seating capacity was between 38 - 47 participants. The seating varied because there was not individualized desks, rather long dark blue countertops, with space to fit four to five occupants comfortably, were available to the students. The countertops were 2' x 9' long. There were also two microphones per row of student seating so that students could press a button to un-mute/mute their microphone for Picture Teleconferencing. Each row of student seating was bordered in a light wooden trim.

The first row of seats were approximately 12'9" from the screens or whiteboard with the last row approximately 36' feet from the screens/whiteboard. Behind the viewing screens, two standard-sized whiteboards had been installed for instruction. There were no climate controls in the room, but the temperature was maintained at 70-75° Fahrenheit. There were two light switches in the room, one located at the back of the room and one located at the instructors media control table. There were various settings available to the instructor, eight to be specific that controlled the fluorescent lighting element in the room:

1. All lights on.
2. All lights off.
3. Neon, which was a dimmed version of all lights.
4. Video 1-- this dimmed the lights on the left side of the room and turned off all lights on the right side, with a soft spotlight on the instructor.
5. Video 2 was the same setting as Video 1 for the other side of the room.

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6. Video 3 was a very soft, dim light over the instructor's media control table.
7. Lecture was soft lights in the room, so that students could view visual data on the screens without a glare and still read or write.
8. Lecture 1 was similar to Lecture but with a little brighter light over the occupants of the room.

The ceiling was a false drop ceiling with tiles to mute sounds. There was one set of exit/entrance doors to this classroom, located at the back of the room. There was a supply closet located to the side of the instructor's media control table. Classroom B was painted off-white with wooden trim throughout the room. The room was wall-to-wall carpeted in dark blue industrial-strength carpeting.

The instructor's media control table housed a computer that was within the desk with the monitor visible through a glass tabletop. Two video displays were also visible through this glass tabletop. Each monitor was used to view Picture Tel classes at other sites. The computer's keyboard was located on a roll-top shelf that easily slid in and out of the desk. There was a light table/projector located on the right hand side of the media control center. The instructor could wear a small tracking device attached to his or her clothes. This small device included a microphone and the tracking system allowed the Picture-Tel camera to follow the instructor without any manual control, making the instructor visible to other sites receiving the signal.

According to a 1997 Facilities Program Plan completed by this college, the Electronic Service Center also housed a production studio, a teleconference room, and bathroom facilities. Office space was available in this building with a large area dedicated to technician training and conferencing.

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Participants

Participants invited to partake in the study were students who had classes in the 2002 Spring Semester in both Classroom A and Classroom B. Working with the Dean of Instruction's Office, a listing of students enrolled in the two classrooms was requested. Since Picture Tel was used predominantly in these two classrooms, the researcher requested that the student class lists only be for those classes utilizing Picture Tel. The researcher was interested to learn how this technological factor affected student learning, in this case Picture Tel or distance education.

There were two classes in Classroom A and four classes in Classroom B that met the above criterion. Student class lists for each classroom chosen were provided and a cross analysis of students was generated. The cross analysis was created to determine how many students in that semester had at least one class in each of the classrooms chosen. Thirty-one students were identified as having met the criterion and were sent a letter inviting them to participate in the study (see Appendix A).

Five students agreed to participate in the study initially; three actually appeared. As a result, the researcher obtained permission to phone the other 23 students and solicit their assistance. A copy of the telephone script used is also in Appendix B. Five more students agreed to participate. Of the total eight participants, only two were male. None of the participants were minors, so it was not necessary to receive parental permission. Demographic information was not collected, so it was not possible to identify ages of the participants or other demographic data.

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Data Collection, Instrument, and Procedures

Since it was nearing the end of the spring semester and the researcher feared that there might not be enough participants to complete the study, she gained permission to conduct the first focus group with just the five participants. Unfortunately, only three students actually participated in the first focus group. This first group met on March 19, 2002 in Classroom B. A digital photograph of Classroom A was available, via the projector and screen, for students to refresh their memory of Classroom A's aesthetic attributes.

The second focus group was conducted on April 25, 2002, and five participants met in a different room than the classrooms being studied. (Unfortunately, the day and time that was available to all participants conflicted with classes utilizing Classroom A and Classroom B.) The researcher displayed digital photographs of both rooms, visible to all focus group participants, via the projector and screen. These pictures served to refresh student memories as they pertained to the aesthetics of both classrooms being studied. (See Appendix G for pictures of Classroom A and Classroom B.)

An explanation of the study and the role of the individual participant were identified at both focus groups. Participants were asked to describe how specific physical attributes of the classrooms, chosen for the study, contributed or hindered his or her learning. (See Appendix E.) The participants' responses, as applicable to thermal conditions of a facility, visual stimulation, audio stimulation, technology, and physical design, were collected, recorded, and later transcribed. It should be noted that the researcher collected the responses from the participants through note taking, but also obtained permission from them to tape record the focus groups.

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Participants were then asked to voluntarily draw a wish drawing and include those physical characteristics of a classroom that they felt contributed to their learning. These wish drawings were a means to expresses their desires or perceptions for the ideal physical factors within a classroom setting. Only five participants chose to partake of this opportunity.

The wish drawings were collected and comparisons between the students' wish drawings were synthesized. It was hoped that this form of gathering data would generate more spontaneous responses and allow for a freer form of sharing information. It was the intent to provide a profile of the school community's desires (Sanoff, 1994a; 1994b).

"When data from different sources or collected from different methods agree, the outcome is convergence" (Mathison, 1988, p. 15). The researcher found that the participants of the two focus groups offered similar statements to the questions asked, achieving a saturation point. It was decided at that point not to conduct a third focus group (Creswell, 1998).

Documentation that identified how administration valued its classrooms and facilities was also reviewed. The facility master plans were reviewed to develop a sense of the college's culture and determine that which was valued at this institution. Capital construction and capital maintenance requests were also reviewed. It was hoped that this would provide the researcher an insight into what steps were necessary for facility upkeep or new construction. These documents also helped identify how the institution and its administrators interacted with architects, faculty, and staff when developing or maintaining its facilities.

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In addition to the data collected from the buildings and students, the researcher kept a field journal or a reflective journal to document her perceptions regarding the research. This journal became the researcher's voice and assisted in maintaining objectivity during the study (Creswell, 1998). The researcher also created a wish drawing to compare with student drawings. (See Appendix C.)

Data Analysis

The researcher utilized multiple data sources, including focus groups, student drawings, documentation, and building floor plans and designs to conceptualize or give theoretic meaning to the participants' observations and perceptions (Miles & Huberman, 1994). The data were coded as open codes identifying initial categories, with select levels of impact and developed into a storyline from the emerging themes (Guba & Lincoln, 1981) and then a within-case display for each classroom (see Appendix F) was constructed to aid the researcher in understanding the flow, location, and connection of participant perceptions as to how the physical environment of each classroom contributed to or hindered student learning. A data display was used because it reduced text, was less cumbersome and was simultaneous rather than sequential, making it easier for the reader to see variables more clearly and easily. A data display reduced the bulk, without compromising the content (Miles & Huberman, 1994).

The within-case displays were developed as thematic conceptual matrices, with defined rows and columns. Each data entry consisted of short blocks of text, quotes, or vignettes that the participants shared with the researcher regarding their perceptions of the classrooms' physical factors and how they perceived each factor contributing or hindering their learning. Outcomes, of the perceived hindrance or contribution, were

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identified and included in the matrices. The entries were not in chronological order, but in the order of evolving themes as presented by the participants and interpreted by the researcher.

Cross-case analysis was utilized to analyze the data from the multiple cases. The researcher chose to utilize variable-oriented strategies to identify themes that were threaded through both cases (Miles & Huberman, 1994). Then a content-analytic summary table was constructed with the intent of moving toward a more conceptual theme rather than case identification of the data (see Chapter Four).

Cross-case or multiple-case analysis enhanced generalizability. In other words, what was relevant or how could what was learned in this study apply to other similar settings? The analysis was undertaken with caution, since the literature reviewed warned that cross-case analysis was "tricky." Simply summarizing the data across themes or main variables was insufficient. The literature reviewed urged the researcher to look carefully at "...complex configuration of processes within each case to understand local dynamics" before emerging patterns could be visualized in particular cases (Miles & Huberman, 1994, pp. 205-206; Merriam, 1998, p. 40).

Focus group data were gathered and a saturation point was reached. The data were transcribed and open codes were generated. These open codes identified initial categories of participants' perceptions and were categorized as having low, moderate, or high negative or positive impact to the student's learning. (Explanation as to the categorizations as included in chapter four.) These open codes were then transferred to axial coding. The axial codes identified the central phenomenon and explored causal or intervening conditions. These axial codes then classified as direct or inferred effects to

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the student's learning. (Again, rationale as to the classifications follows in chapter four.) Finally selective coding was utilized. The researcher attempted to identify a story line and tell the story, as seen through the perceptions of the participants, of how the physical environment of a community college classroom contributed to or hindered their learning (Creswell, 1998). (See Appendix I.)

Trustworthiness

A field journal, documenting the researcher's personal reflections, was kept as one method of trustworthiness and to reduce bias. Triangulation and multiple methods of data collection were also utilized in this study. Triangulation was achieved through various data sources and methods, which led the researcher to construct a theme or perspective on the cases being studied (Creswell, 1998; Mathison, 1988). The use of multiple methods and data sources enhanced the validity of the research findings. The triangulation methods employed supported the findings from the literature review in that certain physical factors of a classroom did in fact contribute to or hinder a student's learning (Miles & Huberman, 1994). More importantly, triangulation was a strategy that aided the researcher in reducing and hopefully eliminating bias and allowed for the discounting of plausible competing explanations of the phenomenon or event (Mathison, 1988).

Triangulation, in this particular study, was addressed by the two focus group studies, drawings collected from willing participants, digital pictures of the classrooms shown to the students to aid in recall of each classroom's physical attributes, archival data, which included pictures from old yearbooks, facility and construction reports, self-studies, and personal correspondence. Peer examination was another method that

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Creswell (1998) suggested. The researcher recognized the need to discuss and evaluate findings with peers, as well as experts in the field. The researcher established connections with field experts and sought their advice and direction.

Finally, Creswell (1998) listed rich, thick description as a method of trustworthiness. He explained it as a full background of information on participants and settings to allow others to assess transferability to other settings "because of shared characteristics" (p. 203). All of these factors employed point to the dependability of the study. The researcher attempted to provide an audit trail that would enable others to replicate the study.

Role of the Researcher

The researcher served as a narrator and facilitator in this study. It was the researcher's responsibility to create a comfortable environment for potential participants and explain their role in the study. The value of the research was conveyed to the participants at the beginning of each focus group and participant anonymity was assured.

The researcher undertook collection and transcription of the data from each focus group. The data was coded using the descriptive codes, categorized by impact, and developed into a storyline (Guba & Lincoln, 1981). It was the researcher's responsibility to decide how best to display the data for analysis and interpretation. A within-case display for each classroom was constructed to aid in understanding the flow, location, and connection of participant perceptions as to how the physical environment of each classroom contributed to or hindered their learning (Miles & Huberman, 1994). Then cross-case analysis was also utilized to analyze the data from the multiple cases. (See Chapter Four.)

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Each participant was allowed to tell his or her story of how the designated classrooms and the physical factors of each classroom contributed to or hindered his or her learning. Each student was given the opportunity to create a wish drawing so that his or her individual perceptions of an ideal classroom would be incorporated into the narrative.

The most important role of the researcher was to preserve the integrity of the research. Many critics of qualitative research have likened it to a "nonfiction novel" or a "slice-of-life case study" (Miles & Huberman, 1994, p. 298). The researcher compiled the data into factual accurate accounts and successive steps taken throughout the process were recorded and identified to preserve the integrity of the study.

Finally, this topic was chosen by the researcher as a result of years of frustration in the classroom. Neither the students nor the subjects taught were the actual frustration, rather the physical aspects of the classroom that were viewed as an impediment to learning by the researcher. Years of watching students struggle to do group work with immovable furniture, winters where it was necessary to lecture with a jacket and gloves on because the heater was not working properly, or summers having to bring fans into the classroom in an attempt to relieve the heat. The researcher felt that these physical factors made an impact on student learning, but did not have any hard data to validate the claim. This was the impetus for this particular study.

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CHAPTER FOUR: ANALYSIS OF DATA

Through a qualitative analysis design, research was conducted to investigate the perceptions of community college students interacting within classroom environments to identify factors affecting their learning. Each student was given an opportunity to voice his or her opinion and tell his or her own story. The contributions provided insight into the interplay that actually occurs between a student and the classroom's features. It should be noted that while each individual was unique and his or her perceptions were varied, the combined stories did reflect a common set of findings. These findings are presented in this chapter.

The findings will be presented by first providing a chronological summary of the events establishing this particular community college as interpreted from the archival data by the researcher. It was the intent of the researcher to describe the present facilities of this community college and their use, particularly with the classrooms included in this study. Next, the findings resulting from the analysis of the two cases will be presented for Classroom A and Classroom B. The findings were developed using both within-in case and cross-case displays (Miles & Huberman, 1994). The within case displays are presented in Appendix F and the cross case display is included in this chapter to assist the reader. Following these findings, the results of the student wish drawings are presented. Finally, the chapter ends with a summary of all findings.

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Findings: Archival Data

On April 20, 1925, Senate Bill Number 403 was passed by the state's legislation to establish a junior college (the name of the district has been omitted for confidentiality). The purpose of the institution was "...providing instruction in the arts and sciences and in such branches of knowledge as may be designated by the board of trustees of said institution so as to provide a junior college or school which should give instruction covering the first two years of the usual college course in the sciences and liberal arts..." (Denbo, 1948, p. 22-23). A tract of land was donated by the state for the site of said institution. An appropriation of twenty-five thousand dollars from the state's general fund was also given. Unfortunately, not much was done in the first seven years of the history of this community college. In fact, there was a lack of interest from the community according to one college document reviewed.

Although the college was established in 1925, it wasn't until September of 1926 that coursework equivalent to a one-year curriculum was offered. Enrollment for this period grew from thirty-seven students in 1926 to forty-one students in 1931. Since there was no building to house the new college, classes were held at the local high school and the faculty consisted of six instructors who were actually high school faculty (Ross, 1940, p. 173; Denbo, 1948).

The period of 1932 to 1937 was a growth period for the young college. The curriculum expanded to a two-year course of study with the high school instructors adding new courses to their load. The college curriculum was designated into four tracts: arts, sciences, and the social studies; teacher preparation; secretarial science; and "cultural subjects" (Denbo, 1948, pp. 30-40). This new curriculum tract correlated to an

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increased enrollment at the college. The enrollment figures for this period grew from sixty-six students for the fiscal academic year of 1932-1933 to one hundred fifty-four students in the combined day and night programs for the 1936-1937 fiscal year (Denbo, 1948, pp. 30-40; Ross, 1940, pp. 173-175). The college also saw an increase in public support.

In 1934 the high school became so overcrowded that the board of education voted against allowing any further post-graduates to be accepted. It was time for the community college to secure its own permanent institution. The board of trustees was fully aware of the financial constraints and was unable to secure funds to build on the site donated by the state. Property, with an adequate facility, was purchased and the college moved to its new quarters in September 1935. This building contained five classrooms, a library, and administrative offices (Denbo, 1948).

In May 1937 the state's Legislature passed the Junior College Organization Act and declared junior colleges an "integral part of the public school system not to exceed two years of training in the arts, sciences, and humanities beyond the twelfth grade of the public high school curriculum and/or vocational education" (Denbo, 1948, p. 46; Ross, 1940). Organization of a junior college district was approved by a special election on July 26, 1937, with a local levy of .75 mill approved in August 1937. The institution was granted the authority to operate with state and county funds. Under the rights of eminent domain, real estate necessary for the location and construction of a junior college was taken and held. Students could now transfer their junior college credits and be accepted by other state institutions of higher learning (Ross, 1940; Denbo, 1948, pp. 47-52).

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Extreme growth was evidenced by increased enrollment and curriculum between the period of 1937 and 1941. Vocational education and a commercial program were adopted into the curriculum. Attributable to the time and era several vocational education courses were included (Denbo, 1948, p. 54). The curriculum was increased in 1937 to include pre-professional courses of study and a terminal course of study in vocational education was introduced in 1938-1939. Summer 1941 was the beginning of a summer session of coursework at the college (Denbo, 1948, pp. 54-61; Ross, 1940, pp. 160-177). Enrollment between the periods of 1937-1941 ranged from 375 total headcount in 1937-1938 in the academic and vocational areas to 697 total headcount in the 1940-1941 academic year, with increases in the vocational department (Denbo, 1948, p. 71; Ross, 1940, pp. 177-178).

In August 1938 it became apparent that the institution was in need of more facilities. It had simply outgrown its present building. According to a school newspaper, on September 30, 1938, voters approved a bond issue leading to the erection of two new buildings at the site of the present facilities. Work commenced in Spring 1940. The buildings were built of native stone, steel, and concrete and the cost was estimated at $158,500. Building A was to house administrative and faculty offices, ten classrooms, a library, a large commercial room, and a room that would be used as a little theatre, referred to as Classroom A for this study (Denbo, 1948, pp. 73-74).

The first building, designated for administrative offices and classrooms, was three stories in height, seventy-seven feet wide and one hundred twenty-eight feet long. There were nine classrooms: three being laboratories and the others being mathematics, journalism, commercial, language, lecture, and general classrooms. The building also

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included a dark room for photography, a large speech arts room with a stage, also used as a theatre, referred to as Classroom A in this study, a library, faculty and administrative offices. The building was completed and put in to use in April 1941 (Denbo, 1948, p. 74). A College Facilities Master Plan stated that the second building, completed in September 1942, was the gymnasium.

The period of 1941-1945 was designated as the war period in the college's history. The college was faced with the problem of providing training that would assist the war effort. "By adding national defense courses to its curriculum and expanding its vocational department, the College was able to maintain its enrollment." Courses designated as mechanical training for national defense were offered (Denbo, 1948, pp. 76-94). Enrollment for this period was reduced in the academic departments, but the vocational department saw a constant and even increased number of students.

The 1945-1948 postwar era confronted the college with re-conversion. It was apparent that a simple return to pre-war status was unlikely with the needs and demands of returning veterans, financed with scholarship money available through the Servicemen's Readjustment Act (GI Bill), challenging the curriculum and function of this particular college (Denbo, 1948; Cohen & Brawer, 1996). The college responded with a greatly expanded adult evening school in Fall 1945 and by Fall 1947, thirteen departments were available. Enrollment dropped slightly in this era (Denbo, 1948, p. 117).

According to archival data reviewed, it was the general consensus of the college's administration, students, and community that additional facilities were necessary. Construction commenced in November 1945 for a new mechanical arts building. It was

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three stories high, housing classrooms and shops for the vocational department. The building was completed in Spring 1948. Three temporary structures were also erected in the Winter 1947 (Denbo, 1948).

According to a College Master Plan, in 1962 the college received North Central Accreditation and physical expansion was rapid during the 1960s and early 1970s. Buildings added to the campus included: four dormitories, a student union with a cafeteria, a permanent library, vocational building, a maintenance building, which now houses Classroom B, and a science building.

Archival data revealed a major drop in enrollment reported from 1968, (1,491 fall quarter full-time equivalency or FTE), to 1972, (1,101 FTE). The drop in enrollment resulted in a reduction to the revenue, causing a discontinuation of educational programs and a reduction in faculty. An ad-hoc committee was formed to determine what programs to curtail or discontinue with the least amount of loss to the students. Adequate financing became a problem and tight budgets were said to tax the ingenuity of those in leadership and management positions. Even with the limited funding, efforts were made in the continuation of improvement and maintenance of the physical facilities. It was believed that education was the very foundation of good citizenship. Therefore, it should be the principal instrument in awakening the individual to cultural values, preparing the student for professional training, and in helping the student to adjust normally to the environment.

According to a Self-Study Report and Master Plan, in 1974 the college reported an approximate day FTE of 975 with a total student headcount of 1,700. Surprisingly, the enrollment leveled off and actually increased slightly in 1975 and certain curricular

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offerings were restored with re-classification of part-time instructors to full-time status. By the 1978-1979 academic year 1,158.1 FTE was reported. This was generated from 1,621student headcount.

The College's 1974 Master Plan revealed that building space projections were configured in an attempt to determine the assignable area existing on the campus in each reported space. Commission guidelines for classroom sizes were used to prepare a course-by-course projection. The standards identified and used by the state's Commission of Higher Education in 1974 were 60 percent occupancy during 80 percent of available time. Space availability and usage seemed to be the only concern when it came to classrooms and their physical factors. There was never any mention in the 1974 Master Plan, the 1975 College Self-Study Report, or any other archival data reviewed as to how the facilities' utilization would impact student learning. The 1975 Self-Study did call attention to faculty survey results, which stated that 47 percent of the faculty agreed that maintenance of the physical facilities was considered to be good. It was documented how programs were transplanted from one facility to another to increase building utilization and to facilitate program needs. There was no mention as to exactly who made these decisions, faculty, administration, or a combination of such, nor could any student input be documented.

A 1972 college supplement documented that the student union, built in 1960, was renovated in 1973. The remodeling of this building included the construction of a larger bookstore, a new lounge for students, and new flooring throughout. One other building was added to the campus. This was a fine arts performing facility and it was completed in Fall 1980.

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By 1984 the campus consisted of fourteen major buildings, located on 17 acres. The 1994 Facilities Master Plan showed that eight of the fifteen buildings on this campus included a total of 206,118 square feet available for instructional purposes. A mining technology facility was completed in 1981. Although it was located in the same city as the college, it was off of the campus and provided an additional 15,000 square feet of instructional space. A 1981 and 1988 College Self-Study and 1994 Facilities Master Plan reported that the facilities provided adequate services to the population served. A 1984 Master Plan stated that the major thrust of the facilities was to provide safe, clean facilities that were conducive to a sound, learning environment. While an overall financial decline had been experienced by the institution, principally due to limitations of state funding and the impact of inflation, it had remained a cultural resource and was believed to be an economic center of the community. The strengths reported from the college's 1981 North Central Association evaluation list adequate facilities with an atmosphere conducive to learning.

While the facility space was adequate, it was reported that much of the space was in need of minor remodeling to meet current code, health, safety, and instructional standards. Applications were and continued to be submitted to the state's controlled maintenance and capital construction funds for monetary assistance in accomplishing these improvements.

Computer utilization became vital to provide support for classroom instruction and the administrative function in the mid-1980s. The 1984 College Master Plan avowed that students utilized the computer as a study tool and to augment traditional classroom teaching techniques. It was reported that the computer had been successful in improving

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several instructional programs. The creation of the Computer Center Directors' Committee by the state's Board of Community Colleges required all community colleges to prepare a detailed hardware and software plan for submittal. This plan was then utilized for implementation once approved by the Committee.

Classroom A was remodeled in the late 1980s. Unfortunately, a review of the archival materials did not list the exact date or cost. The remodeling included: partial carpeting of the room, wallpapering, removal of the wooden seats, new upholstered seating, and installation of ceiling fans and window blinds. The institution also received $53,515 for improvements to the mechanical system in the building which housed Classroom A and by Fall 1989 state-of-the-art telecommunications equipment made it possible to deliver a general education core course to an off-campus facility. It was the first such off-campus delivery at this facility and continued for some semesters. This equipment was known as Op-Tel, and it was housed in Classroom A. With the success of this first class, delivery of other courses of study to off-campus sites followed. A 1988 College Self-Study and 1992 College Academic Master Plan stated that it was the intent of the college to provide students with training and skills necessary ensure success in selected fields of endeavor and to equip the students with flexibility required to compete in the ever-changing work environment.

Since then the Op-Tel unit has been replaced with a Picture-Tel unit in Classroom A. Picture-Tel units and Internet courses in various locations on campus provided academic and vocational classes and programs to distant sites. A 1998 College Self-Study noted that uncertainty existed as to the appropriate scope of technology in the educational process. It questioned the impact integration of technology had on student learning, and

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to what level should the institution commit to this technological delivery method. Annual FTE reported at that time ranged from 1,105 in the academic year of 1987-1988 to 1,240 in the 1991-1992 academic year.

The 1994 document identified the college as a small to medium sized institution with 400 to 4,000 full-time equivalent (FTE) students. It was written that FTE was limited only by student demand, facilities capacity, and funding. Guidelines for room usage specified 60 percent use of 30 hours per classroom. It was reported that there was a surplus of forty-eight percent in classroom and service space and a fifty-four percent surplus in laboratory and service space. While the college had experienced growth in enrollment over the years, the existing facilities had been able to absorb the growth.

In 1997 a Facility Program Plan was written in direct response to the 1994 Facilities Master Plan. The intent was the re-allocation of space to correct surpluses and deficiencies in various functional categories and to move the college toward a smart campus environment to better serve its student body. It was also hoped that a multi-media electronic learning center would be established for its service area. The proposed project included the renovation of the physical plant, which was built in 1968, into an Electronic Center for the campus, and the relocation of the Facility Services to the vocational building, built in 1967.

It was estimated that the remodeling and relocation of services would cost 2.3 million dollars, and it was proposed that the project commence in Summer 1998 with construction to be completed in Summer 2000 and final equipment installation in Fall 2000. The project was approved and the college proceeded with the project.

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The 1997 College Facilities Program Plan stated that the Multi-Media Classroom's (Classroom B) area requirements were developed using allocation of space requirements for computer laboratories and computerized self-paced instruction. The document declared that the intent of the space was to encourage exploration and interaction with emerging technologies both among students and the community. It was believed that facility design needed to be inviting, accessible, and visible. Views into technical areas needed to be encouraged, and rooms flexible enough to change with the technology, but available in a non-technical capacity to encourage interaction by those intimidated by technologically. The key words later identified for this facility in the report were: expandability, adaptability, and flexibility.

Issues such as heating, electrical systems, lighting, plumbing, handicap accessibility, window conditions, interior and exterior walls, air handling systems, and so on were discussed extensively in the plan. It was decided that the classroom would be a tiered multi-media classroom to take advantage of the drop in floor elevation. The space would function as a classroom for specific instruction in multi-media production and also for multi-media explorations for other academic disciplines.

Major goals of the college listed in a 1992 document call attention to the environment of the college. These goals include the creation of child care facility on campus for the college's students, dormitory life, creation of a safe campus environment, centralized communication venues for students, office proximities and relationships, and signage. These same goals are addressed once again in a memorandum, which accompanied a copy of the 1993 Academic Master Plan from the president to his cabinet dated February 26, 1997. The classroom environment itself was never really addressed in

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the reviewed formal documents of the college or the personal communications of the college administration.

As this state's revenues decreased, funding became more limited. Yet, services provided by state institutions had more and more demands placed on them. It was written in a 1993 College Academic Master Plan that "...all system institutions will further develop and refine accountability measures and increase efficiency and cost effectiveness of operation..." It had been noted in various archived college documents that the state funded buildings were in need of maintenance and construction services, simply because of age, normal wear and tear, and facility update. Since the buildings were historic landmarks, the materials originally used in construction caused a further dilemma. It was far more difficult and costly to maintain and renovate these structures.

In reviewing archived documents it was discovered that state funds for capital construction or maintenance of state-funded buildings were appropriated by the General Assembly. Capital construction projects included new construction, improvements to existing buildings, and the purchase of major capital equipment through a statewide capital construction fund. Proposals were submitted to the staff at the state's Board of Community Colleges and prioritized for transmittal to the Commission of Higher Education for further action. A legislative committee reviewed specific capital construction projects and their recommendations were forwarded to the Legislature's Joint Budget Committee for final approval. A proposal had been submitted ever since 1987 for remodeling of the building that houses Classroom A. Whether this proposal included any remodeling or maintenance to this specific classroom was undetermined.

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Information from self-study surveys revealed the following: 78 percent of the faculty said that classroom and laboratory space allowed them to use various methods of instruction. Survey data collected in relation to physical plant and maintenance included: campus grounds, outdoors lighting, indoor lighting in classrooms and laboratories, and room temperatures. Data were only collected from faculty, staff, and administration of the college. No data were collected from students. Data pertinent to this study follows:

Table I

Adequate Indoor Lighting of Classrooms, Laboratories, and Office Space

Classification	Strongly Agree	Agree	Strongly Disagree	Disagree	Undecided
Faculty	10%	70%	2%	18%	
Administration	18%	64%	0%	6%	12%
Classified Staff	24%	70%	0%	6%	

Table II

Adequate Room Temperatures of Classrooms, Laboratories, and Office Space

Classification	Strongly Agree	Agree	Strongly Disagree	Disagree	Undecided
Faculty	0%	46%	25%	29%	
Administration	12%	52%	18%	18%	
Classified Staff	6%	47%	26%	18%	3%

There was not a survey question to support this finding, but the 1988 College Self-Study Report initiated concerns regarding the remodeling of facilities that produced classroom environments not conducive to instruction. There was no concern written in regard to student learning. It was assumed that this question was also asked of only faculty, administration, and classified staff.

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The 1995-1996 academic year heralded the merger between the college and a vocational school. The merger of the two facilities greatly enhanced the FTE of the college. The 1996 College Focused Visit Report stated that this merger added two buildings with an additional 47,475 square feet for instructional purposes to the college's property. Additions and extensive remodeling to this newly acquired facility have been completed since the merger. The first year of the merger the college received from the state a $200,000 facilities improvement project funding for immediate and necessary improvements. According to a 1998 College Self-Study Report, the college then applied for and received $347,000 from the state for design services to renovate the main building and to replace the second structure. An additional $4.6 million was requested from the state for design and construction funding for remodeling the main structure and for a 30,000 square foot replacement for the second structure. Finally, $196,000 was requested from the state to correct deficiencies defined under the American for Disabilities Act (ADA). These requests would provide an up-to-date facility totaling 60,325 square feet to support anticipated enrollment projections.

The 1998 College Self-Study proclaimed that all of the spaces indicated for both campuses were deemed adequate to provide an environment conducive to teaching and learning. It was agreed that most of the properties (original campus) were aged, but efforts to secure funds had maintained and upgraded the facilities, which confirmed that the institution had taken aggressive action to provide adequate, safe and appropriate facilities conducive to a positive learning experience. The document stated that funding had been aggressively pursued to preserve the infrastructure and to install computer networks and similar high-tech educational tools.

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The most recent addition to the college was completed in 2000 when students voted to add-on to the existing student union. A revenue bond issue was approved. While early plans called for a much larger addition, costs limited the addition. It cost approximately 1.1 million dollars to complete the project and was to be paid through increased student fees over the next twenty years. The addition included a multi-purpose room, bathroom facilities, offices, and a large lounge. When asked who had input into the design of the facility, the College Director of Student Life told the researcher that four students were part of the group. The students attended forums and workshops to learn designing principles for new facilities. Along with the students, two administrative staff members were also part of the committee. This was the only evidence in the history of this institution where student input could be documented when the issue of building/classroom design was reviewed.

Summary of Archival Data

To summarize the preceding material, this community college was established in 1925, but offered a limited curriculum after 1926. The classes were held at a local high school until 1935 when the college acquired its own facility. Enrollment growth determined the need for more facilities and from 1941-1981 construction consisted of fourteen major buildings, located on 17 acres. A recent merger with a vocational school has added another two buildings (from a different geographic location than the first campus) to the total list of real estate deeds by this community college. Remodeling and other cosmetic additions, addition of technology, and American with Disabilities Act compliances have also transpired in this institution's history.

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While there is no dispute on the need for additional instructional facilities to accommodate the enrollment growth experienced by this particular community college, there is a lack of evidence found in the archives to support input from individual and necessary stakeholders, particularly from the students and faculty, when planning, designing, and equipping instructional facilities on this campus.

To be specific, the two classrooms chosen for the study have been remodeled from earlier intentions of that space with little to no input from faculty and students. Classroom A is located in one of the original buildings and was intended to be a large speech classroom and theater. It still has tiered, theater-like seating but is not used as a theater. It is utilized as a lecture classroom with capabilities of distance education delivery via Picture Tel.

Classroom B has also been remodeled from a maintenance facility utilized by the Physical Plant to a classroom with distance education capabilities, also via Picture Tel. This classroom also features tiered seating, but the desks are actually large countertops with movable chairs.

Aesthetic factors are varied between these two classrooms and the findings from the case studies give voice to the participating students. The following cross case matrix identifies direct and inferred factors identified as a positive or negative impact on the students' learning and varies from a high, moderate, or low impact.

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Put cross case matrix here!

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Findings: Case Studies

Two classrooms were chosen for this study because of similarity in design and use. Originally designed to be used as a theater, Classroom A was remodeled to be used as a technology classroom. Over the years upholstered, comfortable seats replaced the hard wooden seats. These seats are bolted to the floor. The room retained its tiered seating structure and carpeting was added to the front of the room. Review of the archives supported the researcher's theory that neither student nor faculty input was solicited during the design phase.

Classroom B, located in the building formerly used for the physical plant operations, was remodeled extensively in 2000 to be a technology building. Its intent was to be the hub of the campus' technological services. This classroom was also used for distance education delivery and was comparable to Classroom A. Classroom B had tiered seating and carpeting. While there was no formal documentation to support the input of faculty or students, discussions with the Technology Director led the researcher to believe that faculty were asked for their input when designing what is referred to as smart classrooms on campus. No formal student opinions were solicited.

The students agreeing to participate in this study attended classes in the two rooms in Spring 2002. Two focus groups met to discuss how the students perceived the difference of each classroom's physical factors impacting their learning.

Levels of Impact

The text from the focus groups provided many student perceptions of the impact of the classroom's physical environment. These perceptions were analyzed, classified,

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and interpreted by the researcher according to levels of potential impact on learning. The levels included low, medium, or high impact.

Low impact factors were identified as those that did not impede or seem to contribute to the student's learning in any direct manner. Students recognized the factor and said it was "somewhat" of a contribution or hindrance, but not a memorable feature. For example, physical discomfort was a negative inferred effect of the furniture. This was not a great hindrance to the student's learning, per se, so it was classified as a negative low impact factor.

Moderate impact factors were identified as those classroom features that were more than a minor annoyance or contribution, but could not be classified as detrimental to the student's learning. Students became more alert when discussing these factors, but not overly emotional. An example of this would be placement of furniture allowing for more teamwork. This would be a positive direct effect.

Finally, the high impact factors were those factors identified as resulting in loss of instruction time, either by the student or teacher. An example of this would be the room arrangement could have a positive direct effect on interaction between students.

Direct and Inferred Effects

The data from the focus groups were also classified as being direct. This came from the participants' voice describing how the elements in the physical environment directly impacted them. In some cases, the researcher had to infer the impact from the comments given by the participants. For example, if a student said that the furniture arrangement made it difficult to see other students, then this was captured as a direct effect. However, the inferred effect of these would be difficulty in interpersonal interactions within the

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class. The interpretations or inferences are based on the participant comments, but the implication within a broader scope for impacting learning is inferred by the research. This differentiation is presented in the matrix structure. (See Appendix F.)

Participants in both focus groups were very vocal about what physical factors in the classrooms they perceived to be annoying, frustrating, and barriers to their learning. While they did not rate the level or value the factor's contribution or hindrance, based on their comments and emotional tone of these comments the researcher was able to categorize the factor as either low, medium, or high. The researcher then classified the impact as positive or negative, and then noted the direct impact and inferred impact. (see Appendix F for the case ordered meta-matrix). Following are the students' perceptions of the classrooms and their effects.

Classroom A

This classroom is located in one of the original structures on campus. Remodeling and restructuring of classroom space has altered the original intent of this room. First intended as a large speech/theatre room, it has now become a classroom for distance education delivery and general classroom use. The original stage is still a prominent part of the room.

Low Impact Factors

Factors included in this category are those classified only as annoyances by the students and many times not even noticed by the students while they interacted in the classroom. The only furniture item classified as a direct positive effects was the comfortable seats in Classroom A. Unfortunately a direct negative effect would be that they provided inadequate space for the participants to arrange their materials. One student

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stated it simply, "What I don't like in that room (Classroom A) is the desk space." When asked to explain another student broke in with, "You can't even open your book on that desk." Another student said he/she couldn't fit comfortably in the seat and still another said it was, "Hard to get organized...elbowing the person next to you." As a result, an inferred effect the participants voiced was that it took as much as three desks for them to organize their material. Usually the student sat in the middle seat and unfolded the arm of the desk to place his or her notebook; he/she used the desk to the left or right of them for the textbook, and the other desk for other materials. Other students agreed, but some said they sat in every other seat, rather than using three. In addition to the lack of space for materials, one individual complained that the seats caused physical discomfort, even numbness to her legs because of the cramped quarters, considered an inferred effect.

While the room was spacious, with ample room at the front for group work, if necessary, a positive direct effect, the students found the space detracted their attention from the instructor and the materials being presented, a negative direct effect. One student remarked, "...Classroom A is just too big. The teachers are just way too far away." Interaction between the instructor and students was hindered because of the space between the classroom occupants.

One inferred effect reported was that the stage became a focal point for some of the students. One student commented that she tended to watch the stage and found her attention wandering to it and others agreed. One student pointed to the "stage" in Classroom A and said it, "... seems to like draw my attention a lot of the times." She pointed to the pictures of the two classrooms and said, "...the stage ... its kind of set far back. This (Classroom B) is like enclosed and a little bit more personal." When asked if

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it distracted her and others from the class and the teacher, "Yes!" was emphatically stated.

Technology provided a slight distraction in that viewing students at other sites caused the local students to lose their focus. This was classified as a direct negative effect because it was difficult for the students to watch off-site participants have conversations among themselves or even leave the room at times. One student's comment was very direct, "... to me it is really a distraction and irritating ... when you can see the other classes. If they don't like what the instructor is doing, they get up, they leave, they are talking – whatever and that is distracting because you have to see them. They are right in front of you. You see them making fun or whatever they are doing. That is not appropriate. So, your mind is on that ..." Yet other students commented that they liked being able to see students at a distance and they felt it contributed – "somewhat" so they found it could be a direct positive effect. An inferred effect noted was that the on-site students found themselves not paying attention or focusing because of the off-site dynamics.

This particular classroom seemed to have noise leakage from the hall, even with the door closed. Noise overflow from the offices located directly above the room and caused by the blinds "banging into each other" was also a distraction for some students. Some instructors opened the windows for ventilation, but the noise from the blinds was interference for some of the students. One student remembered how the noise from "falling wallpaper" disrupted his class. When asked, he explained that a section of the wallpaper in the room had fallen during class, disrupting the whole class. These stories indicated a direct negative effect on the students in the classroom. As a result, students

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commented that these noises broke into their concentration and distracted them, which seemed to be an inferred effect. While mostly an annoyance some noises did make a greater impact and those will be discussed under the moderate impact section.

A direct negative effect was the lighting in the classroom. Students' description of the room was "dark and gloomy." The most common comment was that it was an environment conducive for "snoozing" not learning. When asked if the dark room bothered the students, one student replied, "...no, it seems that I'm always tired or something..." The discussion then turned to the windows in the room. There were large windows in the room with closed blinds. The windows sat high above the seats and even if the blinds were open, students would just see trees and sky. One student did comment that windows were necessary, "That way you don't feel enclosed." Another suggested, "...maybe looking out the window and then back at the instructor would help you not be so tired." As a result of the darkness, an inferred effect identified was sleepiness and a harder time focusing on the course work. When asked if there were multiple settings for the lights, the students remarked, "Yes -- off or on." The overall ambience of the room seemed to be dismal and depressing, in the students' opinion. The darkness, contributed with the color schemes, was "gloomy."

In addition to the dim lighting, oppressive heat was a common complaint by all participants and classified as a direct negative effect. While there were temperature controls in this room, the room temperature seemed to be "hot or hotter" making it hard to focus on the lesson. One student summed it up, "It's just really hot in there (Classroom A). Even with the fans on sometimes it still so hot in there. Right when you walk into the room, you just feel like, 'Oh, it's so hot in here,' so you think about it the whole hour,

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you know. You're just dripping sweat and feeling uncomfortable." An inferred effect would seem to be the sleepiness students related they felt was a result of the heat. No one actually stated that they fell asleep as a direct result of the heat, however. The overall consent was that the excessive temperatures were very uncomfortable and distracting to the students, but not detrimental to their learning.

As previously stated, the negative low impact factors did not have any real impact on a student's learning. These factors caused discomfort and the participant's attention to be re-directed on the factor, temporarily, rather than on the instructor or on the lesson. Contrarily, the positive effects, while a nicety, (being able to see other site participants, comfortable furniture, and lots of room to interact with at the front of the room), did not contribute to the student's learning in any particular way. It could be said that these positive factors were facilitators, not necessary, but an added feature. For example, being able to see other sites could facilitate discussion; being able to regroup in the front of the room could facilitate group work.

Moderate Impact

Moderate impact factors moved beyond an annoyance for students and entered the realm of disturbances and breaks in the student's concentration or focus that may sacrifice their learning ability to some extent. Besides the discomfort provided by the chairs and lack of room for classroom materials in Classroom A, students remarked that the bolted desks impinged on their interaction with other students. This was classified as a direct negative effect. As a result, it inhibited interaction between the room's participants, which is classified as an inferred effect because students had to adapt their surroundings, sometimes drastically, to participate. In some cases the students were

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assigned group work, and it became necessary for them to move out of their seats and relocate to the floor or the stage so that they could interact with others. Not being able to move the furniture was a deterrent to group activities. In some cases, the students stated that their instructor ended up moving the class into the hall, since there was not enough room on the floor to arrange groups. As one participant stated, "... you can't arrange a table or you can't rearrange any furniture so you guys can face each other. You guys are all facing one direction..." and another participant finished the thought by saying, "...unless if you can turn your head like the exorcist." The researcher wondered privately if the room's furniture altered the instructor's lesson plan in any way. Perhaps the bolted furniture restricted the instructor's plans for group activity, which would be an inferred effect of the furniture.

The room arrangement had a moderately negative impact because the students had difficulty seeing the visual aids. This partially had to do with the vast amount of space between the seats and the screens, but in some instances it was caused by the instructor's poor choice of visual aid tools. It would seem that some instructors failed to use the large screens situated at the front of the room to display visuals. Rather, some utilized the 39" television positioned at the front of the room. Those students fortunate enough to sit in front of this television could view the visuals easily. "...I sit on this side of the room and ... they just had a little T.V. on the last time. It was very hard to see. The instructor put up some of her own notes that we didn't have, so you couldn't see them unless if you were right there by the screen." Another said, "I don't know, but in my class that Pic-Tel unit, right there ... only comes on on the little T.V. Can't see T.V. – can just see little square." When asked where the student sat in class, the researcher was told, "I

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sit right there in the fifth row." The researcher asked the student if he/she could see the visuals and was told, "Well, I couldn't see the T.V. I could just see a little, you know, the little tiny square." An inferred effect identified was a student's attention wandering. The students related that they found themselves not pay attention in class. One student stated, "We don't even pay attention because we can't see the little T.V. All I know is I do other things beside what that class is about." In this instance, the researcher felt it unfair to totally blame the room arrangement for this encroachment on student learning. The inference made could be the result of inadequate training on equipment usage, improper usage of equipment, not to mention other variables affecting student learning.

Other factors identified in this category were the positioning of the chalkboard. It was a portable chalkboard and some of the respondents felt that the positioning of the chalkboard made it difficult to see what was written on it, which is a negative direct effect. The only inferred effect this seemed to induce was frustration with the room's tools. Participants also added that they much preferred whiteboards to chalkboards because chalkboards left a residue when erased and was sometimes difficult to decipher new writing. Whiteboards gave the instructor the opportunity to use multiple colors, making it easier for students to follow the instructor's notes and they erased completely. When asked to explain a student commented, "Sometimes when you have color on the whiteboard it draws your attention more to what you are talking about. If you are one topic you use one color, but then two or more topics you use a different color to draw your attention on the one topic. On the chalkboard it is just distracting. You can lose your place if you can't, if you're not paying attention because you are trying to write something down really fast and you aren't looking up."

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Technology use in the classroom was a positive direct factor for some of the students. They appreciated the ability to see the visuals and to be able to interact somewhat with off-site students. One positive side effect inferred by the researcher was the sense of satisfaction some participants related they enjoyed when the sites interacted with each other. They also commented on their appreciation of the visuals displayed on the large screens. One student contributed, "My class this semester used the computer to do slide show presentations. We can see the other students in the class (over Pic-Tel) when we are watching and I'd say that contributes ..."

When the instructors utilized the equipment properly, the general consensus was that it was a positive factor to be able to see the visuals. Unfortunately, an inferred effect was the ability for students to interact with each other or to do other things, since their instructor was off-site and not always aware of their actions. A student related, "I don't like Pic-Tel in the classroom." When asked to explain the student stated, "Because she (teacher) isn't here ... the teaching environment is all confusing." Another student agreed saying, "...I'll do other things because it is just so hard to pay attention. The whole class is doing other things. I know people around me aren't paying attention." Yet another added, "When we don't have an instructor lecturing in front of us, the other students start talking or whatever. There is no instructor talking to them, except through the Pic-Tel ... they can't hear us anyway because the mike is on mute, so blah, blah, blah."

Technology was recognized to be a negative direct effect when the instructor spent more time interacting with the equipment, the various sites and other students. They felt that some instruction time was lost at this point. Instructor training was not adequate, in the students' opinion. One student summed it quite effectively, "I think the instructors

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that are going to use it need to have ample time instead of one hour before or set their own time with the person to go over the instrumentation... My instructor had to do it on her own; set up her own time with the guide to actually learn and still I don't think she totally knows." The students' frustration seemed to be more with the human interaction, rather than the facility functionality at this point, which was classified as an inferred effect in this category.

As before, the frustration from the acoustics in this room was pointed out. At one point the students related a story of the "pop man" coming in to fill the vending machines and how time was lost, a direct negative effect, in class because of the noise he made out in the hall every time he came to service the vending machines. Others recounted stories of hearing what seemed to be "high heeled shoes" or furniture being moved from an overhead office, or conversations in the hallway disturbing the class. Frustration at a lack of control was the only inferred effect commented on. Closing the door did not resolve the issue and students had to try to block out the noise, breaking their concentration, which is an inferred impact.

The lighting, climate control, and interior ambience were distractions to the student's learning and classified as direct negative effects. If the instructor chose not to open the blinds, the room was very dark and conducive to sleep more than learning. Several students sheepishly admitted to falling asleep in class, which is a high direct impact and was included in that category. The heat in the room was vehemently discussed by all of the participants. It was noted that no matter what the season, the room's heat was such that it became stifling and the students became visibly agitated when discussing this factor. Students complained that it was, "... a hot, hot room" and

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one frevently added, "... oh, I hate that room" when discussing the uncomfortable climate condition. As one student recapitulated, "It's warm, number one, and number two, depending on who is lecturing and the lighting is kind of dim, more opportunities to snooze." An inferred effect of these factors was frustration and anxiety. One student told how her instructor would open the door leading to outside to stimulate air flow, and she stated that some ended up "watching the door" instead of paying attention. This student also remarked that opening the door might be a reason why she became fixated with the stage in the room, since the door was located at the back of the stage.

The moderate negative impacts of the room were more than minor annoyances for the students. They felt that their concentration was broken and in many cases they had a difficult time re-focusing their attention on the lesson at hand. Many of the side effects are negative and become more emotionally substantial: frustration, aggression, and a feeling of helplessness or lack of control, causing the student to re-direct his or her attention on other projects or elsewhere.

Only one student commented on a positive direct effect in this room, and it was the ability to see the visuals. The general consensus was that the room lacked in design those features necessary for a positive learning environment. Rather the room contained many factors that negatively impacted the learning environment. There was a cause and effect parallel: inability to see/hear visuals seemed to result in the students doing other things in class besides the lesson, inability to hear instructor off-site also seemed to encourage students to do other things, and excessive heat and low lighting in the classroom induced some to nod off to sleep. While most of these factors did not cause a total loss of instruction time (sleeping through class was categorized as a high impact

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negative factor, as well), they caused a negative inferred effect, such as shifting the student's attention, for sometimes extended periods of time, lethargy, frustration, aggression, and sometimes a sense of anxiety, also known as stress inducers (Evans, 1982).

High Impact

While many of the factors were perceived to be high impact to the student learning, the researcher categorized the factors into this area if instruction time was actually lost as a direct result of the physical factor. Only three factors were categorized into this area: room arrangement, technology, and lighting.

The room's arrangement became a direct negative effect because it actually impeded some students' learning in that the location of the equipment necessitated that the student leave his or her chair, walk to the front of the room, "wave their hands" and un-mute the microphone to gain the instructor's attention. As one student put it, "It's ridiculous where the microphones are in there (Classroom A)." Another broke in, "I find myself not even asking questions in Classroom A because you have to get up from your seat, move in the front of all the people, hit the mute button because none of the instructors want to hear the rest of the classes so you have to be on mute. You have a question then go down, hit the mute, and then you can ask your question, then hit the mute again. I don't even ask questions. Just forget it!" Many chose to forego the exercise and not ask question(s) because they felt, "...that put pressure into not asking because your going to take up too much of their time relaying back and forth..." sacrificing their learning and understanding of the subject at hand. As a result, or inferred effect, the

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students chose to "tune out" and not pay attention and frustration was evident in their stories.

The technology utilized in the classroom was another heated topic. The students related that the technology "cut in and out" many times over the course of the semester, easily classified as a direct negative effect. (It should be noted that the students blamed the weather for the instability of the equipment, not the equipment itself.) One student summed it up, "You'll be in the middle of a lecture and all of the sudden your teacher will freeze up on you and there's twenty minutes between the time that they last spoke and the time they come back on and you've missed out on that much more of the lecture. Then you go back and they don't want to go back. Or they do, but it takes away from the time that they have left." Another student explained, "We missed two hours on stuff that was covered for the exam and we never even know." The students further explained that by the time the instructor noticed that a site was lost, too much chaos ensued trying to explain at what point in the lecture the signal was lost. This further wasted time in class and frustrated (inferred effect) the instructor, the students on site, and the off-site students.

An interesting inferred effect discovered was instructor's anxiety level when attempting to interact with the equipment. It was not known at the time of the study that several students participating had the same class, on different nights, in the two rooms. They were able to measure the comfort level of that particular instructor in both rooms as the instructor interacted with the equipment. When discussing arrangement of equipment on the furniture, the students felt that, "... it restricts the teacher though. They are not allowed to move." Remembering a disturbing incident the student explained, "....the

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other sites are complaining they can't hear or they can't see. So, she had to basically just stay like this and not touch anything because she will get told off by other people." Another student joined in, "Or by the other instructor on the other side." Still another student added, "...because they can't hear or see what she is doing..." The student then went on to say, "They (the other instructor) treated her like a child." The individual then added that the students started to also treat her (the instructor) as a "child" and at one site students actually walked out during class or worse yet some fell asleep and it was visible to the students in Classroom A. The students blamed poor training of the instructor, but were taken aback by the experience and felt the instructor lost "face" with the off-site students.

Poor lighting was believed to be a contributing factor to some students falling asleep in Classroom A, thus classifying this factor as a direct negative effect. While this was just the opinion of some of the participants in this study and other outside variables may be the actual cause, sleeping through the instructor's presentation was not conducive to learning. An inferred effect was the students' frustrations at not being able to adjust the lights for a brighter room.

Room arrangement, technology, and lighting are factors that could and should have been easily controlled. It is believed that these classroom factors inhibited the learning environment. Interaction, by way of questions and comments, was restricted by poor arrangement of furniture causing students to "not even ask a question" because the equipment was too far away. The "down-time" resulting from technology instability (because of weather) also lost valuable instruction time, almost two hours, which was never recaptured. Finally, the room's ambience, a combination of the lighting and interior

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design, stimulated students to sleep rather than focus on the instructor, another sacrifice to their learning.

As expressed previously, the inferred effects were mostly of an emotional content: frustration, aggression, a feeling of helplessness, resulting in not paying attention in class, but one new emotion surfaced -- empathy. The students were empathetic to the instructor's inability to interact with the equipment and what they felt was her "loss of face" with the other sites. This seemed to unbalance the students as they told their story.

Classroom A Summary

This is a brief summary of the impacts identified by the students in this classroom. Low impacts that were positive direct effects were the comfortable furniture with a large room, space at the front of the room and technology that allowed the students to visualize other sites. Negative direct low impact effects were: inadequate space provided by the furniture, since the room was so large in the front students did not interact with the instructor, it was a distraction to see other sites when they were clearly doing other things besides what the class entailed, too much noise outside of the classroom that could be heard in the classroom, a dark interior described as "gloomy, dark, and depressing" and heat that was oppressive. As a result of these impacts, the following inferences were made: students encountered physical pain because of the furniture, unable to arrange and organize materials for class properly, felt many distractions in this room from the additional space at the front of the room, the heat, the noise from outside the class, and the interior ambience of the room.

While many of the factors were first identified as a low impact factor, they then were identified as moderate impacts because they affected the student(s) beyond the

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initial annoyance or distraction level. Those factors identified as positive direct effects included: the space in the front of the room became an area where students could move to for group work (although they had to sit on the floor or on the stage) and some remarked that they were able to see visuals very well. More direct negative impacts were identified. These included: could not manipulate furniture to allow for teamwork or group work, the space in the front of the room was too distant and some had difficulty seeing the visuals, instructor unable to interact with equipment or off-site students, couldn't hear audio from Picture-Tel, room was too dark and very hot (some said they were "dripping with sweat"), extra manipulation of room's factors (opening doors or windows) by instructor and darkness of the room shifting students focus. As a result of these direct impacts, inferred effects were categorized and include: poor furniture impeded interaction between students for teamwork and group assignments, students lost their focus and attention wandered because of inability to see and hear visuals. Emotional content portrayed frustration, aggression, and in some cases hopelessness ("I just do other things beside what the class is about.")

High impact factors classified in this room with a negative direct effect were: students did not ask questions because they found it too difficult to interact with equipment, down-time as a result of the instability of technological equipment, and loss of instruction time because the student fell asleep in this classroom. Inferred effects as a result of these negative direct effects were again somewhat emotional in content. Students spoke of their frustration with the equipment and their attempts to interact in spite of the equipment. Often times the students admitted to not paying attention because they felt they had lost control of the situation, an inferred effect. Also discussed how the

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instructor's inability to interact with the equipment resulted in a reprimand from another instructor and how it indirectly affected their concentration.

Classroom B

This facility was recently remodeled, and it was a point of interest to the researcher that the intent of the designers and the institution was expressly identified. It was hoped that exploration and interaction among students, faculty, and the community would occur within this facility. Large windows into the classroom and other technical areas encouraged guests to view the areas from the hallway. (See Appendix H.) All of the rooms were designed to be technologically flexible. The 1997 College Facility Program Plan used words such as: expandability, adaptability, and flexibility, to identify this facility.

Low Impact

Again, these were factors identified as minor annoyances, sometimes not even perceptible until pointed out or questioned. When discussing furniture in Classroom B, the students appreciated the desk space available to them and space availability was classified as a direct positive impact. The desks were actually large, 2' x 9' long, dark blue countertops trimmed in wood, with space to fit four to five occupants comfortably. Two microphones per row of student seating were available for easy student access during video conferencing classes, also referred to as Picture Tel. Plug-in ports for access to the Internet were also available at each station. Thirty-seven blue executive chairs using a microfiber fabric, featuring built-in lumbar support, armrests, and a spider base with rollers for easy movement were available throughout the room. (See Appendix H.)

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Another direct positive impact was the ability to see from any location in the room. A student explained, "... like when you come in it's slanted down. So, when you walk in, you just see everything, and you like are kind of fixed on the teacher already, because the way the room is." As a result of the moveable furniture and space, one inferred effect remarked on was ability to interact with other students easily. Another positive side effect was the ability to organize material, resulting in a more positive emotion. One student even used the word "excellent" to describe the furniture in this room. Only one student complained that the chairs were not adjustable for his height (he was over 6'5"), it was categorized as an inferred effect.

The only complaint with the technology noted as a low impact factor was the humming from the Picture-Tel unit. It was classified as a negative impact because it was distracting to several of the students and they actually seemed to focus on the sound as a disturbance. As a result, students seemed annoyed and distracted by the sound, thus leading the researcher to categorize these emotions as inferred effects.

The acoustics in this room seemed to absorb most of the noises outside of the classroom. The room was fully carpeted and also absorbed any noise from the room's occupants (a direct positive effect). Unfortunately, there was sound leakage from the hall. As one student explained, "This class here (Classroom B) it's really echoey in the hall..." Another student finished the thought saying, "...you always hear doors back there slamming on the outside. People from the Multi-media Department – they're always out there talking. That is distracting." This was classified as a direct negative effect of the acoustics in this room. This was found to be a distraction to the students' concentration, and really an inferred effect of the room's acoustics.

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The lighting in the room was found to be agreeable and a positive direct effect. Since the instructor had lighting controls at his or her fingertips and there were multiple settings, depending on the visuals used, it was easy to vary the lighting to the teaching method employed. The only negative direct effect was the windows. A few students stated that they found the windows distracting. One student voiced her opinion saying, "...if anything it is just a distraction to look outside." Another added, "You see people walking by." They felt windows in the classroom drew their attention away from the instructor and class, thus classified as an inferred effect. Most of the participants agreed that they preferred fluorescent lighting to natural lighting from windows. One student summed it up, "As long as I can see enough to write and read, I don't care where the light comes from."

All agreed that the temperature was usually comfortable in this room, which was a positive direct effect. One or two students remarked that it was cold in this room. When asked, there was no temperature control in the room. The temperature was controlled by an outside source. A student remarked, "Some days ... like in the summer time... it's a little too cold." Another student added, "I'm always cold." Still another, "I think it gets cold." Yet, other students described the room as, "...it's just right." An inferred effect noted: inability to adjust the room's temperature disturbed some students. This was not found to be an impediment to the students' learning, however, but a minor annoyance. The researcher inferred that the students did not appreciate having the control of his factor restricted from them.

When asked about the interior ambience of the room, the students agreed that it was pleasing to the eye with the lightness of the color scheme, use of wood, and colors

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throughout the room. One student remarked that it was a room "...conducive to my learning. It seems like it is set up particularly for it. The seating and the spacing is a lot better...that makes it easier" and another said, "... it has a lot more color to it." When asked to explain, others added, "lighter colors have a calming effect, I think, on the mind and..." another broke in to add, "Brighter colors keep you awake." This factor was categorized as a direct positive effect. The researcher deduced that this room was not a threatening environment to the students and that they felt comfortable in this setting.

The only negative direct effect commented on was the noise leakage from the hall, causing the students' concentration to be broken and categorized as an inferred effect. The other factors identified in this room were only positive direct effects: arrangement of the room and furniture made it easy to see all visuals, carpeting and other materials absorbed most distracting sounds, lighting that is controllable and easily adapted to presentation style, climate that was never too warm, and comforting interior ambience. Side or meta-level effects identified in this low impact factor included: better interaction with others because of the furniture; a non-threatening environment; distractions provided by "humming" equipment; breaks in concentration because of noise leakage; inability to control climate; and distractions provided by factors outside the classroom. Interestingly enough, the researcher noted that participants did not describe the side effects emotionally or with any differences in voice tone.

Moderate Impact

As previously described, factors that were defined as moderate impact to participants were those that were recognizable as more than just an annoyance to the students and actually contributed or inhibited the student's learning in a moderate

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fashion. The furniture drew positive remarks from the student and was listed as a positive direct effect to student learning because there was more space for student's materials. A student spoke up saying, "This room actually has got tables to write on..." and another added, "You can write comfortably on them." Students were able to move the chairs to interact with each other when necessary and teamwork among the students was a possibility in this environment (although not a requirement in this course). An inferred effect was the room available to the students to organize their materials and not infringing on someone else's space.

Student remarked that the room arrangement allowed all students to see the visual aids used, whether via Picture-Tel or on the whiteboards, which is a definite positive direct effect. Unfortunately, a direct negative effect was the inability of students at the off-site classroom to see the writing on the whiteboard. One student explained, "I've seen them (instructor) use the whiteboard. The only distraction there or hindrance to learning there is when it is on Pic-Tel, we could pretty much see it fine in here, but when it comes to the Pic-Tel over there they can't see it. And then they start with '...we have to start all over...' and '...try to write it bigger...' because they don't have any kind of a control on the opposite end, so to make it bigger or smaller." As an inferred effect, disruptions from the other sites "complaining" about the whiteboard and not being able to decipher the notes caused a break in instruction and frustration was evident in the participant's tone. Some also felt that the use of whiteboards with multiple colored pens made it easier to follow instructor's notations, which was classified as an inferred effect.

The interaction between the instructor and the technology was found to be more successful in this room than in Classroom A and was classified as a direct positive effect.

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There was no "down-time" associated with the instructor and the equipment because all of the controls were within reach and accessible, thus not inhibiting their learning waiting for the instructor and the equipment.

As stated before, the lighting controls were accessible to the instructor from the back of the room, as well as at the instructor's desk or podium, and this was classified as a direct positive effect. These controls enabled the instructor to dim the lights to various settings to allow the students better sight of different visuals. For example, the lights were all turned up when the instructor lectured or used the whiteboard, but the instructor dimmed the front of the room when he/she wanted to use the "light table" or what is more commonly referred to as the overhead projector. An inferred effect was the ability of students to comfortably view visuals, no matter what presentation style the instructor utilized. In the students' opinion it did make a difference. One student's voiced his opinion saying, "I've noticed that they can adjust that lighting... They can do the spot lighting, which helps you view the screen better at the front...or you can have the big lights ..." Another added, "It has better lighting."

There was only one factor that had a direct negative effect and that was the inability of off-site students to see visuals written on the whiteboard, causing a disturbance in instruction time. The room's dynamics had positive direct effects on the students: they were able to work more readily in groups and teamwork was a possibility, furniture was more accommodating, no matter where the student chose to sit within the room he or she had clear access to the visuals, no distractions or interruptions were encountered waiting for the instructor to interact with equipment or lights, and multiple light settings stimulated easier viewing of visuals. As a result of these direct effects,

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inferred effects were: better organization of participant's materials, easier to follow instructor's presentations because of the use of varying marker colors on the whiteboard, and easier access to visuals with less glare or other barriers to participant's sight.

High Impact

High impact factors are those factors identified as having a detrimental effect on student learning. The students actually lost instruction time, in their opinion, because of the factor. Only two factors were identified as high impact in this room. Room arrangement and technology were the only factors, in the researcher's opinion, that directly impacted the students' learning.

Students commented that the room arrangement and equipment placed at their fingertips allowed for more interaction. Categorized as a direct positive effect, the room's arrangement allowed for more interaction between the sites and/or off-site instructor because students felt the design of the room allowed for easy access to microphones. This enabled the students to ask questions of the instructor without having to visibly move from their chairs. One student stated, "You have a button right there and when you push the button you can ask the question." Each table had two microphones that allowed the students to depress and speak to the students or instructors off-site. In this room they did not have to visibly move to interact with the equipment.

An inferred effect noted, as a result of the positive direct effect, students said that their attention did not wander in this room. There was still a dislike for use of technology. When asked to explain, one student explained, "...because there is a delay ... when you start talking into the microphone, there is a delay to when you actually ask your question. Then you have to repeat it, because they (instructor) didn't hear it, because they were still

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talking." While the room's arrangement was more accommodating, some students still disliked the use of the videoconferencing technology. As one student responded, "Just don't like it. Had to ask questions in too little time."

The students also commented on the interaction between the instructor and the equipment. A student explained, "I think it does make a difference whenever the instructor is lecturing, because she feels more comfortable. It's (pointing to the technological equipment at the podium) set up for her, it's easy, right there at that little podium. So that makes it easier for her to lecture us." This was perceived as a direct positive effect because instruction time was lost waiting for the instructor to interact with the technology and equipment. They found the instructor to be more visibly comfortable in this room (an inferred effect) and they in turn seemed to be more comfortable when discussing this factor in this room. Students again voiced their opinion on teacher training. One student commented, "I think the instructors that are going to use it (technology) need to have ample time instead of one hour before ...to go over the instrumentation." Several students agreed and stated that their teacher had received her training, "right before the lecture."

A negative direct effect noted was the "down-time" caused from losing the "signal" in the Picture-Tel unit. Instruction time was lost and distress was voiced by many of the students. Comments such as, "Half the time the other group sites don't know if they are on or not. Or, they don't know that you are off. Unless we phone them and say, "You need to...' they just don't know. They have no idea we have gone off." Another added, "And they don't know you're off, so they keep going on with the lecture. When you get back on line and you say, 'Well, we didn't hear the last ten minutes.' By

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the time you are done asking one question you have spent fifteen to twenty minutes already." Still others students felt that, "There's not much opportunity to ask questions..." or "You don't feel comfortable..." As a result or inferred effect, students voiced their distress and frustration with the technology. When asked about technology, one student chimed in, "I just don't like it." They felt cheated out of valuable instruction time.

Classroom B Summary

It would seem that this classroom was more conducive to student learning. Students categorized the following as positive direct low effects in the room: room arrangement, that gave easy access to the visuals, no matter where the student was seated in the room; acoustic safeguards, such as wall-to-wall carpeting, that seemed to absorb most noises in the classroom; adjustable lighting, that did not impede a student's ability to see visuals, no matter what the medium employed by the instructor; a climate that was somewhat chilly, but usually comfortable; and an interior ambience that was enjoyable, non-threatening and seemed to enhance learning.

Several low negative effects were identified as being the humming of the Picture-Tel unit and noises that leaked from the hall, disturbing the students and breaking their concentration (inferred effect). The inability to control the room's temperature, open the windows, or adjust the furniture was also inferred effects.

Moderate effects identified were the ability to work in groups or teams, because of the furniture arrangement and ability to see visuals (this started as a low impact, but moved to the moderate impact because of the inference), thus allowing students to follow lecture more easily. The adjustable lights also progressed from low to moderate impact,

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because since the controls were at the instructor's fingertips, there was no fumbling or time lost trying to interact with the factor and at all times the visual was clearly readable. One other moderate positive impact was no lost time waiting for instructor to interact with equipment; it was all literally at the instructor's fingertips. The only negative direct effect was the inability of off-site students to see material written on the whiteboard. Inferred effects identified from the moderate impact factors were all positive: students felt more organized, they could follow the lectures more easily; the whiteboard with the multiple colored pens made it easier for them to follow the instructor's notes; and the visuals were much easier to read, whether from their seating location or the multiple light settings.

High positive impact factors were identified as: more interaction with other sites because of the ease of interaction with the equipment by the student and the technology was easier to interact within this room not only for the instructor, but the student as well. Inferred positive factors were: students did not find their attention wandering as much waiting to interact with the off-site students and they (students and instructor) were more comfortable in this room. The only negative high impact factor was the instability of the technology causing students to "tune out" or attention to wander when signal lost (inferred effect).

Findings: Student Wish Drawings

As part of the data collection, students were asked to voluntarily draw their ideal classroom. Only five students returned their drawings. (See Appendix D.) In addition to the students' drawings, the researcher also constructed a "wish drawing." (See Appendix C.) While the drawings were crude and did not have any specific dimensions, the most

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obvious conclusions were that students want to be able to focus on the instructor, on each other, and they want to be comfortable during the learning process. Three of the five student drawings utilized circular shapes for the students' seats, as did the researcher. Only two of the students created their ideal classes with rectangular shaped tables, instead of individual desks. When asked to explain their drawings, these two students stated that the room would have tier seating so that all in the class could visually access the instructor. In most of the drawings, it should be noted, that the instructor's desk was the focal point.

Two students and the researcher noted the need for comfortable chairs that were adjustable. One student and the researcher noted the need to have microphones at each individual station. Two students and the researcher identified good lighting and comfortable temperatures in the classroom as necessary in the optimum classroom. Only one individual drew windows in his or her optimum classroom and every drawing, including the researcher's, had at least one whiteboard in the room.

Summary of Findings

Four classes of purpose for case study evaluation were identified by Guba and Lincoln (1981): 1) to chronicle or develop a register of facts or events in some chronological order, 2) to render or characterize situations under scrutiny, 3) to teach, instruct, provide knowledge and/or contrasts, and 4) to test, prove or try to prove a theory. While the first class is laden with factual materials, the second has an interpretation element in it and the third requires judgmental analysis. Using the typology of case studies developed by Guba and Lincoln, the researcher examined the facts presented by the archived materials, collected original data from willing participants and

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related those facts to the theory that the physical factors in a classroom contribute to or hinder a student's learning. Weighing these facts and interpretations, the researcher made the following judgments based on data collected.

There was a lack of evidence in the archived material to support any claim that student input was solicited prior to or during the earlier building and remodeling process at this institution. Specifically, the room that had been identified, as Classroom A was, in fact, a theater that was later remodeled to accommodate a classroom. While classroom space was generated through the re-structured use of the room, an environment conducive to learning was not evident. No evidence was apparent to support any claims of student and/or faculty input during the remodeling process of the classroom.

Recent documents and conversations attested to the notion that student and faculty input was solicited during the remodeling of the building, which housed Classroom B. A quote from a 1997 College Facility Program Plan led the researcher to believe that there was a commitment by the institution to produce a technological classroom that was adaptable, comfortable, and encouraged participation among the room's participants, "... to encourage exploration and interaction with emerging technologies both among students and the community, ...be inviting, accessible, and visible" in addition to being flexible and encouraging interaction between the participants.

This study found that physical factors, such as lighting, furniture, room arrangement, technology, acoustics, climate control and the interior ambience of room were perceived by students to contribute to their learning environment. The level of impact was varied, however. These factors had multiple levels of impact on the students

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and the students varied in their perception of the factors and effects, if any, on their own learning. Factors that seemed like a mild annoyance to some students, i.e., noise in the classroom or outside of the classroom, moderately impacted other students.

Physical factors that students identified as low barriers to their learning include the following: inadequate space in the available furniture to arrange materials and encourage interaction between and among the students, the arrangement of room materials which impedes interaction between the occupants, the distraction technology provides by accessing other sites visibly not participating in the class lecture/discussion, distracting noises inside and outside the classroom which break a student's concentration, low lighting which is more conducive to rest and relaxation and not to a learning environment, and temperatures in the classroom that are excessively warm, can actually be classified as oppressive, and foster aggression or lethargy in the room's occupants. Finally, the students felt that the interior ambience of a room does contribute somewhat to the student's learning by providing a light, cheerful atmosphere as compared to a gloomy or depressing atmosphere, which could be perceived as threatening.

Factors identified as moderately impacting student learning were as follows: furniture which allowed the students to work in groups and foster teamwork and which also allowed for better organization of their materials. Room arrangement that permitted all occupants to view visuals irregardless of the location of the on-site or off-site students. The use of other learning tools, i.e., chalkboard or whiteboard was also a consideration. Use of a whiteboard with varying colors assisted students in identifying the key elements of the presentation. Interaction with technology by the instructor and students at the different sites was a distraction to many. Poor interaction between the instructor and the

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technology led to off-site students virtually ignoring the presentation and in some instances leaving the off-site classroom. This caused a moderate impact to the on-site students. The acoustics in a room can interrupt learning if the student cannot adequately hear the presentation. Lighting needs to be accessible to the instructor to moderate the illumination for various classroom tools, i.e., overhead projectors, whiteboard/ chalkboard, overhead screens, and lecture. The climate control of the room needs to be accessible to the instructor so that the occupants may control temperature. Excessive temperatures led the instructor and students to attempt to manipulate the classroom's physical features, causing further distraction, i.e., opening the door to an outside exit led students' attention to stray to the open door and not the presentation and opening windows caused distracting noises by the "banging of blinds". The excessive heat was a subject that induced passion and aggression, as noted by the researcher, in participants' explanations. This heat did not have a high impact on learning rather it was an annoyance. The lack of interior ambience can be somewhat credited for student relaxation and sleepiness. Students admitted to "snoozing" better in a darkened room, as opposed to a classroom that was well lit and pleasant to the eye.

Finally, only certain factors impeded student learning to a high degree. The researcher identified these as factors, which caused the students to sacrifice their learning. The room arrangement in one classroom actually impeded students from asking questions because of the distance between the students and the equipment necessary to interact with an off-site instructor. As a result, students' questions went unheard and unanswered. While the technology in a classroom can be viewed as a contribution, in some instances it was a major impediment to the students' learning. Loss of the satellite signal caused

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One other factor that the researcher noted as high impact was the lighting in the classroom. Students related to the researcher that the lack of lighting in one classroom seemed to induce sleepiness and their body reacted by actually falling asleep. This would seem to be a major impediment to student learning.

It has been shown that poor planning and designs of a classroom and its physical factors can and does impede or enhance student learning. Whether the factor is a mild annoyance or of major impact to the individual student, designers, architects, and community college leaders must plan a facility with the impact to student learning foremost. That can only be accomplished with input from students and instructors.

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CHAPTER FIVE: DISCUSSION

This chapter will again highlight the focus of the study and present a discussion utilizing the student's perceptions of the classroom factors that impacted (low, moderate, and high) his or her classroom experience. The role of student and faculty participation in the classroom design process is discussed. The chapter ends with recommendations for community college administrators and future researchers and a brief conclusion.

Focus of Study

The classroom has taken on many forms and meanings to various individuals. In fact, historically the classroom has evolved from the carefully tended fires of cavemen, which became the center of their community and a place they congregated to organize, divide tasks, hold meetings, follow rituals and profit from the wisdom of their elders or teachers, to the sophisticated models of technologically advanced classrooms of this generation (Englich & Remmers, 1998). The development of the classroom from this most basic environment to its present status has been a learning process in itself – with many of the questions still unanswered. Literature reveals that the classroom is at the center of the educational activity (Tinto, 1997) and has been shown to influence student and teacher behavior (Morris, 1997; Sanoff, 1994; Scott-Webber, et al., 2000).

The purpose of this qualitative study was to discover what physical classroom factors were perceived by community college students to contribute or hinder their learning. While it is true that the classroom is not the only determining factor of student success, it is a precursor to basic human behavior and student behavior in the classroom.

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Discussion of Findings

The study revealed that students are very sensitive to factors within their learning environment, such as thermal conditions, lighting, and furniture/equipment. They might not be fully aware to what extent the built environment is contributing to their learning, but they realize that it is impacting physical aspects of their comfort, interactions with the instructor and other students, and their own concentration and ability to focus on the subject at hand. The researcher labeled the factors into low, moderate, and high impact categories. The low categories were factors that the students identified as minor annoyances and areas that the students had not really classified as an impediment, just a distraction; the moderate categories were factors that the students considered enough of a distraction that their focus was actually taken from the instructor or materials displayed. These were also factors that impeded the students' ability to interact with the instructor or other students. High impact factors were those classified as actual loss of instruction time as a result of the variable.

Discussion of Low Impact

Several findings from the study were labeled as low impact, because they did not impede a student's learning. These factors were mild annoyances and caused distractions or minor inconveniences to the student(s). Uncomfortable or inadequate classroom furnishings of Classroom A shifted the student's focus from the instructor or materials being presented to arrangement of materials in limited spaces. This does not suggest any consideration in selection and quality of classroom furnishings to provide a non-restrictive work environment (Duke, 2001; Englich & Remmers, 1998).

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In this study, too large of a room with the arrangement of furniture distancing the instructor from the student inhibited student interaction with the instructor and limited interaction between the room's occupants. Further, Classroom A's lack of movable furniture impeded students abilities to interact with other students and the instructor and clearly did not support social interaction. Aspects of the room's physical components shifted students' attention from the instructor and materials to the impediment, in this case a stage. "We have been dominated by needs for privacy and community, to which certain space must be allocated ... while individual work could possibly take place, decentralization, socialization and the creation of the identity in the community have to have a firm location (Englich & Remmers, 1998, p. 10).

Technology was a distraction when the instructor was unaware of off-site dynamics. Students at a distance-site facility provided distractions for students in the on-site classroom if the students were not paying attention, talking to others in the off-site classroom, or leaving the off-site classroom. Thus, not a setting full of support or one that inspired interaction between the two sites in either classroom (Duke, 2001). Distance education has reduced the need to build and maintain college campuses and offers a new level of communication with students, but in many institutions there is a lack of training. It is very labor intensive and time consuming and must provide a wide range of activities to anticipate the needs of the isolated student(s). One major drawback is sufficient student contact (Matthews, 1999, pp. 54-67).

Noises in a classroom are distracting, but noises outside of the classroom are a disruption. Inability to compensate for outside noises was frustrating for the students and

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the disruption caused a break in their concentration. "Studies have shown that classroom behaviors such as aggression, interaction, attendance, questioning, and attitudes like satisfaction can all be influenced by the classroom environment." One of those factors included is noise (Banning, 1992, p. 24).

It has been said that the visual environment affects an individual's ability to perceive visual stimuli and affects his/her mental attitude, and further an individual's performance. The lighting, or lack of adequate lighting in Classroom A, was felt to induce sleepiness in some of the room's occupants. In many cases, students found it difficult to focus on the presentation as a result of low-level lighting. This led the investigator to agree with researchers who felt that the ability of individuals in school to concentrate on instructions was strongly influenced by factors, such as lighting (Jago & Tanner, 1999). Caring should be reflected in classroom design to provide adequate lighting, ventilation, and temperature control (Duke, 2001).

Oppressive heat made it very difficult for students to concentrate on the instructor or the presentation in Classroom A. Inability to adjust heat was a frustration for the students and their stories were colored with specific examples of their discomfort. It has been found that extremes of heat and cold can have a dramatic effect on people. Heat can impair complex mental tasks, impair motor tasks, and may impair or enhance vigilance (Bell, Fisher, et al., 1990).

Discussion of the interior ambience of the classroom revealed that students were cued by the colors and interior design when their feelings of threat were discussed. They felt less threatened in the light colored room of Classroom B with good lighting than in Classroom A, described as "...gloomy, dark, and depressing." This would support the

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findings that color selections have been found to increase productivity by five to ten percent, reduced absenteeism, and helped morale of the room's occupants. Color does have a definite psychological impact upon students. The color selections of a room can transform a depressing and monotonous atmosphere into a pleasing and exciting one to promote positive feelings about the school and the classroom environment (Papadatos, 1973).

Discussion of Moderate Impact

Moderate impact factors to student learning were those factors that became more than just a mild annoyance to the student; they caused the student to lose focus, contributed to or inhibited interaction within the classroom. The furniture and its arrangement were found to be rigid and unchanging and did impede student-to-student interaction and student-to-instructor interaction in Classroom A. Bolted chairs in uniform arrangement were a limitation and barrier to these exercises and sharing of ideas. Students felt that adequate space assisted them to organize their materials in Classroom B and they felt more in control of their space. "The appropriate architecture for education is no longer isolated, rigid, and unchanging, but a learning environment that is adaptable and influenced by the community" (Brubaker, 1999, p. 14).

Classroom A's arrangement impeded students' ability to see visual aids and the visual aids themselves were easier to distinguish depending on the medium utilized. Improper use of the equipment by the instructor was one variable encountered when students recounted their stories of not being able to see visual aids. Simpler controls, centrally located devices, and training would allow presenters to interact with equipment. "The ability to relate to elements within a room affords a degree of self-empowering

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through scale that is relative" (Lang, 1996). Location of furniture, visual aids, furniture, and technology should empower the student and the faculty (Niemeyer, 2001).

Whiteboards aid students in interpreting the material presented. The whiteboards clean easier and more completely, so that no residue is left when erased. Students felt that colored markers help them follow the presentation and distinguish lesson items. Surprisingly, research found that 70% of faculty preferred black chalkboards. This was only because of the frustration encountered when markers dried out. Students complained that it was difficult to see the portable chalkboard provided in Classroom A. It is agreed that whether the medium be a whiteboard or a black chalkboard, provide enough space for easy readability of lecture notes (Niemeyer, 2001).

Proper use of technology was seen as a positive factor for some and not for other participants. While the students appreciated the ability to visualize the technological presentations, others were agitated and felt that instruction time was lost waiting for the instructor to interact with the technological equipment and off-site classes in Classroom A. Pedagogy should drive design and room design should focus on user-friendly approaches with attention to simple control and signage. Instructors should not have to fumble with poorly labeled controls or crawl undignified on the floor while interacting with the technology (Niemeyer, 2001).

Classrooms with poor acoustical insulation caused students frustration. Students were unable to hear the instructor and audio from the technological equipment. When the audio from the instructor or technology was unable to be heard, students' attention shifted to other matters and away from classroom activities. Noise has been proven to have detrimental affects after prolonged exposure, but it also affects individuals in periods of

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sporadic exposure and frequency. Noise may decrease teaching time forcing continual pauses in the instructor/student interaction. It may also make it difficult for the student and the teacher to hear one another. As a result, personal feelings of control are unbalanced, as well as levels of arousal (Lackney, 1999).

Adaptable lighting was a positive factor in the classroom. Some felt that the ability to adjust the lighting for the various presentation techniques was necessary. Location of lighting switches to the instructor's desk/table was also remarked on. Classroom B allowed the instructor to control the lighting and adjust according to his or her need: full lights for lecture and dimmed lights in the front of the room for display of visuals, such as overheads or PowerPoint presentations, with adequate lighting for students and note taking. As Lang (1996) wrote, "...locations of light sources as well as their method for diffusion within the classroom play an important role in the comfort for the student and teacher for the purpose of learning" (p. 2). Natural lighting is seen as a positive factor because it has been found to actually affect feelings, behavior, concentration, and learning, (Morris, 1997).

Thermal conditions in Classroom A were a distraction to student learning. Students became very passionate about the excessive heat experienced in a classroom and how it disrupted their concentration from the subject at hand to their lack of personal comfort and desire to change their location. In addition, manipulation of the classroom's factors caused further distraction, i.e., opening the door or windows caused excessive noises or distracting focal points for the students. Research has indicated that teachers more often than students are upset by temperature fluctuations within the classroom, but flexibility for manipulation of the system for participant's comfort is key. If the teacher

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must make accommodations for the lack of thermal control in the classroom, for example opening windows or doors, then the system is self-defeated and the teacher is probably agitated (Lang, 1996; Tanner, 2000).

Classroom A's interior ambience or lack of, caused some students to lose instruction time. The darkness and "gloominess" of the classroom seemed to be more conducive to asleep. While the interior design cannot be fully blamed for the students' sleepiness and subsequent "snooze time," it was identified as a contributing factor. Behavioral responses of a room's occupants must be considered when designing the classroom environment. It should be the intent of the designers and institution to provide "an environment that impacts motivation, concentration, and performance by affecting comfort, control, attention, access, and enjoyment" (Scott-Webber, et al., 2000, p. 18).

Discussion of High Impact

Factors identified as high impact are those that were interpreted as causing a loss of actual instruction time. One such factor was room arrangement and location of furniture within the classroom. This factor either enhanced or dissuaded student interaction. Technological equipment that is perceived as "too distant" caused some students to forego classroom participation. The students stated that they would not ask questions in Classroom A, because the location of the equipment was a perceived barrier. In this instance, technology did not "provide a supportive backdrop" for the student learning (Herman Miller, Inc., 2001). Convenient positioning of equipment for ease of use by the instructor and students alike was perceived to encourage more student interaction in Classroom B.

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Instruction time perceived to be lost from unstable technology was noted as a high impact factor in both classrooms. One criticism of technology in the classroom was the limited and often unreliable technological infrastructure with numerous equipment failures (Matthews, 1999). While unstable technology was one variable named, so was the inability of the instructor to interact properly with the equipment, causing a loss of instruction time, supporting the literature's caution for extensive training of presenters before actual interaction with the technology (Matthews, 1999). Controls easily accessible to the instructor were noted to be very beneficial. There was not as much downtime if the instructor was not maneuvering around various tables and cables and all controls were at his or her fingertips, again supporting the literature's findings of spaces created with the end-user in mind (Niemeyer, 2001). This supports the theory that physical settings and factors can motivate or discourage us (Lackney, 1999).

The thermal conditions combined with the low lighting were perceived to be more conducive to sleeping than learning. Several students admitted to falling asleep during the class and many blamed the darkness of the classroom. Loss of instruction, because the student was asleep, is perceived as a factor that needs adjusting. This supports the findings that "physical or social stimuli in the environment directly affect the emotional state of a person, thereby influencing his behavior in that environment" (Mehrabian & Russell, 1974, p. 8). Rather than aggression, Classroom A's interior ambience and thermal conditions were more conducive to rest and relaxation than alertness and learning.

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Discussion of Participation in the Design

The foregoing discussion clearly indicates that students are aware of the physical conditions of the classroom and can voice this awareness within the context of learning. However, this voice was not sought in the design of Classroom A. The archival data indicate that no student or faculty input was solicited during the re-conversion of Classroom A from a theatre/speech room to a distance education delivery classroom. As a result, basic features proven to enhance the learning environment were omitted from the design, i.e., adaptable lighting, thermal controls, furniture and equipment that stimulates student interaction. In listening to the students' stories, the term "hostile environment" seemed to describe this classroom.

Classroom B, on the other hand, was supposedly designed with the end-user's needs foremost in the design. Unfortunately data is lacking to verify that students and/or instructors were involved in the classroom's design. This room features the basic necessities listed in the literature: lighting control, an ambient thermal condition, comfortable and adaptable furniture, equipment that stimulates interaction, and a non-threatening environment.

Summary of Discussion

This study found that physical factors, such as lighting, furniture, room arrangement, technology, acoustics, climate control and the interior ambience of room did contribute to the learning environment of a student. The level of impact was varied, however. These factors had multiple levels of impact on the students and the students varied in their perception of the factors and effects, if any, on their own learning. Factors

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that seemed like a mild annoyance to some students, i.e., noise in the classroom or outside of the classroom, moderately impacted other students.

Physical factors that students identified as low barriers to their learning include the following: inadequate space in the available furniture to arrange materials and encourage interaction between and among the students, the arrangement of room materials which impedes interaction between the occupants, the distraction technology provides by accessing other sites visibly not participating in the class lecture/discussion, distracting noises inside and outside the classroom which break a student's concentration, low lighting which is more conducive to rest and relaxation and not to a learning environment, and temperatures in the classroom that are excessively warm and can actually be classified as oppressive, fostering aggression or lethargy in the room's occupants. Finally, the students felt that the interior ambience of a room does contribute somewhat to the student's learning by providing a light, cheerful atmosphere as compared to a gloomy or depressing atmosphere, which could be perceived as threatening.

Factors identified as moderately impacting student learning were as follows: furniture which allowed the students to work in groups and foster teamwork and which also allowed for better organization of their materials and room arrangement that permitted all occupants to view visuals irregardless of the location of the student – on-site or off-site. The use of other learning tools, i.e., chalkboard or whiteboard was also a consideration. Use of a whiteboard with varying colors assisted students in identifying the key elements of the presentation. Interaction with technology by the instructor and students at the different sites was a distraction to many. Poor interaction between the

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instructor and the technology led to off-site students virtually ignoring the presentation and in some instances leaving the off-site classroom. This caused a moderate impact to the on-site students. The acoustics in a room can interrupt learning if the student cannot adequately hear the presentation. Lighting needs to be accessible to the instructor to moderate the illumination for various classroom tools, i.e., overhead projectors, whiteboard/chalkboard, overhead screens, and lecture. The climate control of the room needs to be accessible to the instructor so that the occupants may control temperature. Excessive temperatures led the instructor and students to attempt to manipulate the classroom's physical features, causing further distraction, i.e., opening the door to an outside exit led students' attention to stray to the open door and not the presentation and opening windows caused distracting noises by the "banging of blinds." The excessive heat did not have a high impact on learning; rather it was an annoyance. The lack of interior ambience can be somewhat credited for student relaxation and sleepiness, sometimes inducing sleep.

Finally, only certain factors impeded student learning to a high degree. The researcher identified these as factors, which caused the students to sacrifice their learning. The room arrangement in one classroom actually impeded students from asking questions because of the distance between the students and the equipment necessary to interact with an off-site instructor. As a result, student's questions went unheard and unanswered. While the technology in a classroom can be viewed as a contribution, in some instances it was a major impediment to the students' learning. Loss of the satellite signal caused students to lose approximately two hours of classroom instruction – which for whatever reasons, was not repeated by the instructor. It was a general consensus that the problem

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was not in the technology itself, but the weather. Inclement weather at either site caused the signal to be lost. Many times the instructor was not aware that a site was "frozen" or lost and continued the lecture, not knowing that all of the students were not receiving the data. By the time the instructor was made aware of the broken connection and told where the exact time of the signal loss was in the lecture, the class was over, and the connection broken permanently by the host computer.

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It has been shown that poor planning and designs of a classroom and its' physical factors can and does impede or enhance student learning. Whether the factor is a mild annoyance or of major impact to the individual student, designers, architects, and community college leaders must plan a facility with the impact to student learning foremost and this can best be accomplished with input from students and instructors.

Recommendations

Community College Leaders

If the function, role, and mission of a community college is truly focused on providing a curriculum that adapts to "ever-changing civic, social, religious, and vocational needs of the entire community" then community college leaders must respond to the need to provide learning facilities that encompass this vision (Cohen & Brawer, 1996, p. 4).

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A yearly self-study or facilities management plan should be part of the administration's strategic plan to:

1. assess the school's culture. Determine what is valued at the school and behaviors of its occupants.

2. assess the school's response to providing students with opportunities for self-exploration and its effectiveness at providing facilities that promote that self-discovery.

3. assess the facilities regularly. This assessment can be as simple as a tour of the facilities, with students, faculty members, and administrators. It is suggested that a formal building checklist be used, such as the *Six Factor School Building Checklist: A Walking Tour* by Markus (1993). This checklist evaluates the building on context, massing, interface, way finding, social space, and comfort. A classroom environment rating sheet should also be included in the assessment and ratings from students should be collected on an on-going basis. David (1982) created a Classroom Environment Q-sort that has been effective for K-12 studies, but would be easily adaptable to the community college environment.

4. Facilitate dialogue between faculty, students, and administration to create classroom environments that promote student's self-discovery, group interaction, and partnerships between the institution and its users.

5. Adapt the facilities, as necessary, with student and faculty input (Sanoff, 1994).

Future Research

In retrospect, while the voice of the student was finally heard, a mixed-method study would be beneficial to gauge the students' perspective on how each factor contributed to their learning. A quantitative survey device accompanied with a student journal and culminating in either student focus groups or interviews would be very helpful to facility designers and planners.

As institutions adopt differing teaching/learning strategies, it would be beneficial to measure the effectiveness of the facilities and/or classrooms for each specific strategy.

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An example of this would be to measure the effectiveness of the classroom's physical factors as a contribution or hindrance to the "learning community" strategy.

Brain-based learning research should also be incorporated in future classroom studies to gauge the impact a classroom's environment has on student learning and brain stimulation. Scientists are discovering environmental inputs/factors that are perceived as stressful lead to aggression, a feeling of helplessness, and sometimes even violence (Kotulak, 1996). Assessing a classroom's arrangement, furniture, equipment, thermal conditions, and even ventilation system for comfort, adaptability, and brain compatibility would reduce a student's stress, stimulate participant interaction, energy, and mental growth (Chan & Petrie, 1998; Lackney, 1999b).

Conclusion

The physical factors of a classroom do influence student participation, attentiveness, and ability to learn. While the influence and outcomes are of varying degrees, the fact remains that a student's surroundings can affect his or her comfort level, concentration, and ultimately learning. For that reason classroom design should not be undertaken without input from both faculty and students who have utilized or will be using the facilities. This study has revealed, through the voice of students, what factors to consider.

The literature stressed the importance of empowering the faculty through careful consideration of furniture and equipment. This study found that students agree that the instructor must feel comfortable and in command of the classroom resources, but the need to consider the students' role in the classroom was also stressed. If a participatory environment is to be encouraged, then classroom resources need to be easily accessible

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and/or adaptable to the students as well. Furniture selections need to be comfortable, interchangeable, and moveable to allow for various classroom exercises that may range from individualized work to team or group sessions. The furniture must allow for easy organization of a student's material, with consideration for a student's proxemic zone. This study found that students are protective of their intimate zone and resentful when presented with a room that did not accommodate their needs for privacy, material organization, and comfort.

The equipment must also be accessible and visible to the students. Again, not only should the equipment empower the faculty, it should encourage student participation, not discourage student input and questioning because of its location, complexity, and perceived threat. The room should also be designed for visibility of all presentation materials by all of the room's occupants. If videoconferencing methods are to be utilized, then the classrooms, especially those receiving instruction from an off-site source, must utilize large enough screens that are visible and discernible by all in the room. Placement of chalkboards, whiteboards, and screens and the distance of such from the room's occupants must be carefully considered.

While factors such as colors, interior design, and lighting of a classroom seem of no consequence to the facility planners, they are of great value to the student and his or her perception of the environment. Students revealed that a "dark and gloomy" room does affect their productivity adversely, while a room that is perceived as brighter, with better light, helped them maintain their alertness and attention. A classroom designed with multiple light settings to support multiple teaching tools is also imperative. Students take cues from their surrounding environment and will act accordingly. A dark and gloomy

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classroom will induce sleep while a bright and eye-pleasing classroom induces a positive response and alertness from its occupants.

Aural factors, or noise, do affect a student's concentration, feeling of control, and induces stress. As the literature revealed unpredictable noise, while annoying, is also detrimental to a student's behavior and possibly to learning. Whenever possible, room design should include sound absorptive materials and special attention should be to the placement materials utilized on opposing walls to mitigate disturbing echoes or sounds. Materials used in the classroom should also be carefully considered. For instance, curtains instead of blinds might be better for a classroom that must utilize windows for climate control. The noise from a fluttering curtain would not be as intrusive as "banging blinds."

Ambient conditions of temperature, humidity, and ventilation are of extreme importance in classroom design. This study revealed that these factors influenced individual behavior toward aggression, lethargy, and vulnerability. Comments, such as "I hate that room..." and "I feel so tired..." support the first two descriptions and realization that the students were committed to a classroom without any climate controls to manipulate comfort alluded to the sense of vulnerability. These findings supported the literature proving that thermal comfort does influence performance, concentration, and levels of student discomfort. It is imperative that classrooms be designed with accessible climate controls that may be manipulated to accommodate the room's occupants.

Institutions spend countless dollars to equip classrooms with the latest and greatest technological advances, yet often overlook the obvious. Unfortunately, the advice of "experts," better known as the students and faculty, is usually not solicited.

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Given the countless number of studies, including this one showing the importance of the classroom's physical environment in the teaching/learning process, the design of future classroom facilities will be best served by taking into account this research and involving the faculty and students voices in the design process.

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REFERENCES

Ahrentzen, S., Jue, B. M., Skorpanish, M. A., & Evans, G. W. (1982). School environment and stress. In G. W. Evans (Ed.), *Environmental Stress* (pp. 225-255). Cambridge, MA: Cambridge University Press.

Altman, I. (1970). Territorial behavior in humans: An analysis of the concepts. In I. Pastalan & D. Carson (Eds.), *Spatial behavior or older people* (pp. 1-24). Michigan: The University of Michigan-Wayne State University.

Arnold, A. C., Britton-Simmons, M., Williams, R., Brewbaker, R., Ranson, S., Tomasik, M., et al. (1993, February). Designing classrooms with students in mind. *English Journal*, 82, 81-83.

Babey, E. (1992). [The classroom: Physical environments that enhance teaching and learning.] (pp. 3-6). Personal study. Unpublished raw data.

Baker, G. A. (Ed.). (1994). *A handbook on the community college in America: It's history, mission and management* (pp. xii, 60-62). Westport, Connecticut: Greenwood Press.

Banning, J. H. (1992). The connection between learning and the learning environment. *Children, Learning & School Design -- The First National Invitational Conference for Architects and Educators*, (pp. 20-39).

Banning, J. H. (1999, August). Facility. *Journal of the National Association of College Auxiliary Services, 22*, 4, 17-19.

Banning, J. H. (2001a). Ecology in the lecture hall. *NEA Higher Education Advocate, 18*, 5.

Banning, J. H. (2001b). The teaching role: an ecological perspective. *NEA Higher Education, 18*, 6-7.

Banning, J. H. & Cunard, M. R. (1996, August). An ecological perspective of buildings and behavior. *Journal of the National Association of College Auxiliary Services, 19*, 38-41.

Bell, P. A., Fisher, J. D., Baum, A., & Greene, T. E. (1990). *Environmental Psychology* (3rd ed.), (pp. 128-382). Ft. Worth, Chicago, San Francisco, Philadelphia, Montreal, Toronto, London, Sydney, & Tokyo: Holt, Rinehart and Winston, Inc.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Bell, P. A., & Greene, T. S. (1982). Thermal stress: Physiological comfort, performance, & social effects of hot and cold environments. In G. W. Evans (Ed), *Environmental Stress* (pp. 75-104). Cambridge, London, New York, New Rochelle, Melbourne, Sydney: Cambridge University Press.

Biehle, J. T. (2000, January). Designing safer schools. *American School & University, 72, 1,* 44-45.

Bogart, Q. J. (1994). The community college mission. In Baker, G. A. (Ed.), *A handbook on the community college in America* (pp. 60). Westport, Connecticut, London: Greenwood Press.

Brase, W. (1988). Design criteria for effective classrooms. *Planning for Higher Education, 17,* 1, 81-91.

Brubaker, C. W. (1999, November). Designing schools for the 21st century. *Principal, 79, 2,* 14.

Butin, D. (2000, July). Classrooms. *National Clearinghouse for Educational Facilities.* Retrieved November 12, 2001 from www.edfacilities.org

Calcara, J. R. (1999, April). Shaping campus facilities. *American School & University, 71, 18,* 34F-34H.

Caldwell, B., & Hoyt, K. (1990). Final report: Classroom aesthetics survey: student and faculty opinions. Unpublished raw data.

Chan, T. C. C., & Petrie, G. F. (1998, November). The brain learns better in well-designed school environments. *Classroom Online, 2,* 3. Retrieved on November 2, 2001 from http://www.ascd.org/readingroom/classlead/9811/2nov98.html

Cohen, A., & Brawer, F. (1996). *The American community college.* (3rd ed.), (pp. 3-166). San Francisco: Jossey-Bass.

Cohen, S. & Weinstein, N. (1982). Nonauditory effects of noise on behavior and health. In G. W. Evans (Ed.), *Environmental Stress* (pp. 45-74). Cambridge, London, New York, New Rochelle, Melbourne, Sydney: Cambridge University Press.

Conway, K. (1996). Master classrooms: Classroom design with technology in mind. *Institute for Academic Technology.* Retrieved April 1, 2002 from http://www.unc.edu/cit/iat-archive/publications/conway/conway1.html

Coppola, J. F., & Thomas, B. A. (2000). A model for E-classroom design: Beyond "chalk and talk". *T.H.E. Journal, 27, 6,* 30-36.

Corwin, T. (1996, December). Blues season. *The Augusta Chronicle Online: Features@ugusta.* (pp. 1-2). Retrieved on October 16, 2002 from http://augustachronicle.com/stories/121796/blues.html

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Creswell, J. W. (1994). *Research design—Qualitative & quantitative approaches* (p. 7). Thousand Oaks, London, New Delhi: SAGE Publications.

Creswell, J. W. (1998). *Qualitative inquiry and research design—Choosing among five traditions* (p. 203). Thousand Oaks, London, New Delhi: SAGE Publications.

David, T. (1982). Functional dimensions of classroom environments. In J. C. Baird and A. Lutkas (Eds.), *Mind Child Architecture*. Hanover, NH: University Press of New England.

Davies, T. (Author/Presenter), Schwind, J. (Producer), & Quick, D. (Associate Producer). (1996). *Community colleges: Foundations* [Videotape]. (Available from Colorado State University, Ft. Collins, CO 80523).

Denbo, P.G. (1948). *The History of* (name deleted for anonymity of institution) (pp. 22-117). Unpublished master's thesis, Western State College, Gunnison, Colorado.

Dickson, G. W., & Segars, A. (1999, January). Redefining the high-technology classroom. *Journal of Education for Business, 74, 3*, 152-156.

Duke, D. L. (2001). The Jefferson Center Principles of Good Educational Design. Thomas Jefferson Center for Educational Design. University of Virginia. Retrieved November 11, 2002 from http://archone.tamu.edu/~crscenter/programs/Rowlett99/DesignPrinciples.html

Earthman, G. I. (1997, September). Does design make a difference? In A. B. Morris (Ed.), *A conference sponsored by the American Institute of Architects Committee on Architecture for Education.*

Eaton, J. S. (1994). Seven streams in the historical development of the modern American community college. In G. A. Baker (Ed.), *A Handbook on the Community College in America* (pp. 3-16). Westport, Connecticut, London: Greenwood Press.

Eells, W. C. (1931). *The Junior College*. Boston: Houghton Mifflin.

Englich, G., & Remmers, B. (1998). *Conferencing, discussing learning...Interior and specifiers handbook for communication areas* (p. 10). Germany: Wilhahn, Wlikening: Hahne: BmbH+Co.

Endler, N.S., & Magnusson, D. (1976). Toward an interactional psychology of personality. *Psychology Bulletin, 83, 5*, 956-974.

Epstein, Y. M. (1982). Crowding stress and human behavior. In G. W. Evans (Ed.), *Environmental stress* (pp. 133-150). Cambridge, London, New York, New Rochelle, Melbourne, Sydney: Cambridge University Press.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Estabrook, M. (1990). [Recommendations for improving the aesthetics of the classroom environment.] Unpublished raw data.

Evans, G. W. (Ed.), (1982). *Environmental Stress* (p. 1). Cambridge, London, New York, New Rochelle, Melbourne, Sydney: Cambridge University Press.

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

Evans, G. W. & Lepore, S. J. (1993). Nonauditory effects of noise on children: A critical review. *Children's Environments, 10, 1.*

Every, T., & Walborn, M. (1999). (Webmasters). Cornell University. Retrieved on November 12, 2002 from http://www.cit.cornell.edu/computer/instruct/classtech/design

Fanning/Howey Associates, Inc. (1999). School buildings: The silent partners in education. *Impact on Education, 1.* (Advertisement).

Feenberg, A. (1999, September). No frills in the virtual classroom. *Academe 85, 5.*

Fielding, R. (2000, June). Lighting the Learning Environment. *Design Share,* 1. Retrieved on November 12, 2002 from http://www.designshare.com/Research/Lighting/LightingEnvr1.htm

Firestone, W. A. (1987). Meaning in Method: The Rhetoric of Quantitative and Qualitative Research. *Educational Researcher, 16, 7,* 16-21.

Garms, W. (1976). *Financing community colleges.* (Reprint: UMI Books on Demand).

Gliner, J. A., & Morgan, G. A. (2000). *Research methods in applied settings.* Mahwah, New Jersey & London: Lawrence Erlbaum Associates.

Gores, H. B. (1968). The crucial years are now. In F.G. Parker and M.S. Smith (Eds.), *Planning community junior college Facilities—A look into the twenty-first century* (pp. 1-7). East Lansing, Michigan: Board of Trustees of Michigan State University.

Griffin, T. (1990). The physical environment of the college classroom and its affects on students. *Campus Ecologist, 8, 1.* Retrieved on November 10, 2002, from http://isu.indstate.edu/wbarratt/dragon/ce/v8n1.htm

Grocoff, P. N. (1995, December). Electric lighting and daylighting in schools. *Breaking News & Issues: IssueTrak Briefing Papers,* 1-5. Retrieved on October 15, 2002 from http://www.cefpi.org/issue1.html

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Guba, E. G., & Lincoln, Y. S. (1981). *Effective Evaluation*. San Francisco, California & London: Jossey-Bass, Inc.

Hall, E. T. (1969). *The hidden dimension* (pp. 119-128). Garden City, NY: Anchor Books.

Herman Miller, Inc. (staff). (2001). *A research summary from Herman Miller, Inc. environments for learning* (p. 3). Michigan: Herman Miller, Inc.

Helgesen, S. (1995). *The web of inclusion*. New York, London, Toronto, Sydney, Auckland: Currency/Doubleday.

Heschong Mahone Group (1999, August 20). [Daylighting in Schools—An investigation into the relationship between daylighting and human performance.] Condensed report submitted to G. Loisos and The Pacific Gas and Electric Company on behalf of the California Board for Energy Efficiency Third Party Program. (pp. 2-111). Unpublished raw data.

Jago, E., & Tanner, K. (1999, April). Influence of the school facility on student achievement—visual (lighting and color). University of Georgia. Retrieved on October 15, 2002 from http://www.coe.uga.edu/sdpl/researchabstracts/visual.html

Klein, J. (2001, July). [Sunshine and skylights. Building Design and Construction.] Unpublished raw data.

Koos, L. V. (1924). *The junior college*. Minneapolis: University of Minnesota Press.

Kotulak, R. (1996). *Inside the Brain*. Kansas City, Missouri: Andrews and McMeel.

Lackney, J. A. (1998, June). 12 design principles based on brain-based learning research, 1-7. Proceedings of the CEFPI Conference workshop, Minneapolis, Minnesota. Retrieved on November 12, 2002, from http://www.designshare.com/Research/BrainBasedLearn98.htm

Lackney, J. A. (1999a, September). Assessing school facilities for learning/assessing the impact of the physical environment on the educational process: integrating theoretical issues with practical concerns. NJIT Conference, Newark, New Jersey. Retrieved on November 12, 2002, from http://www.edi.msstate.edu

Lackney, J. A. (1999b, September). The relationship between environmental quality of school facilities and student performance. Congressional Briefing to the U.S. House of Representatives Committee on Science Sponsored by the Environmental Energy Study Institution (EESI). Retrieved on November 12, 2002, from http://www.edi.msstate.edu

Lackney, J.A. (2000, November). Thirty-three educational design principles. Electronic paper found on the National Clearinghouse for Educational Facilities Web site sponsored by the U.S. Department of Education, p. 30. Retrieved on November 12, 2002, from http://schoolstudio.engr.wisc.edu/33principles.html

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Lang, D. (1996). Essential criteria for an ideal learning environment. *Center for Architecture and Education,* 2. Retrieved on November 15, 2002, from http://www.newhorizons.org

Lewis, L., Snow, K., Farris, E., Smerdon, B., Cronen, S., Kaplan, J., et al. (2000, June). *Condition of America's Public School Facilities: 1999.* Statistical analysis report presented to National Center for Education Statistics. Retrieved on November 15, 2002, from http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2000032

Markus, T. (1993). *Building and Power.* New York: Roultedge.

Mathison, S. (1988, March). Why triangulate? *Educational researcher: A publication of the American Educational Research Association, 17, 2,* 13-17.

Matthews, D. (1999, September). The origin of distance education. *T. H. E. Journal, 27, 2,* 54-67.

Maxwell, L. E., & Evans, G. W. (2001, March). *Design of Child Care Centers and Effects of Noise on Young Children.* Design Share Publications. Retrieved on December 12, 2002, from http://www.designshare.com/Research/Lmaxwell/NoiseChildren.htm

McDermott, I. (1998). Solitaire confinement. *Computers in Libraries, 18, 1,* 22-27.

McGlothlin, C. (1998). Personal study and memo.

Mehrabian, A., & Russell, J. A. (1974). *An approach to environmental psychology* (p. 8). Massachusetts & England: The MIT Press.

Merkel, C. (1999). Folkloristics of educational spaces: material lore in classrooms with and without walls. *Library Trends, 47, 3,* 417-438.

Merriam, S. B. (1998). *Qualitative research and case study applications in education. Revised and expanded from case study research in education* (pp. 40-193). San Francisco: Jossey-Bass Publishers.

Merriam-Webster's Collegiate Dictionary (10^{th} edition). (1993). Springfield, MA: Merriam-Webster.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative Data Analysis.* (2^{nd} ed.), (pp. 205-298). Thousand Oaks, London, New Delhi: SAGE Publications.

Miller, N. G., Erickson, A., & Yust, B. L. (2001). Sense of place: The relationship between personal objects and job satisfaction and motivation. *Journal of Interior Design, 27, 1,* 35-43.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Morris, A. B. (Ed.) (1997, September). Does design make a difference? A conference sponsored by the American Institute of Architects Committee on Architecture for Education.

Murphy, T. J. (2001). Developing snapshots of mathematics classrooms. *College Teaching, 49, 1,* 9-13.

Myrick, R., & Marx, B. S. (1968, March). An exploratory study of the relationship between high school building design and student learning. Washington, D.C. Bureau of Research: Office of Education: U.S. Department of Health, Education, and Welfare. Project No.: 5-8006.

National Center for Education Statistics. (2000). Projections of Education Statistics to 2010: Chapter 2. Retrieved on November 11, 2002, from http://www.nces.ed.gov/pubs2000/projections

National Clearinghouse for Educational Facilities. (1999, May). *Design principles for planning schools as centers of community* (p. 5). Presented at the National Symposium on School Design sponsored by the U.S. Department of Education in October, 1998. Retrieved on December 11, 2002, from http://www.edfacilities.org/ir/edprinciples.html

Niemeyer, D. (2001). Consulting: Smarter college classrooms home page. Retrieved November 11, 2002, from http://classrooms.com/consulting.html

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

Parker, F. G., & Smith, M.S. (1968). (Eds.), *Planning community junior college facilities—A look into the twenty-first century* (pp. ix-xi). East Lansing, Michigan: Board of Trustees of Michigan State University.

Pascarella, E., & Terenzini, P. (1991). *How college affects students.* San Francisco: Jossey-Bass.

Porras, J. I., & Robertson, P. J. (1992). Organizational development: Theory, practice, and research. In M.D. Dunnette & L.M. Hough (Eds.), (p. 273). *Handbook of industrial and organizational psychology.* (Vol. 3). Palo Alto, CA: Consulting Psychologists Press, Inc.

Porteous, J. D. (1977). *Environment & behavior - planning and everyday urban life.* Massachusetts, California, London, Amsterdam, Ontario, & Sydney: Addison-Wesley Publishing Company.

Ranson, R., Arnold, A.C., Britton-Simmons, M., Williams, S., Tomasik, M., & Proctor, K (1993, February). Designing classrooms with students in mind. *English Journal, 82,* 81-83.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Rapoport, A. (1982). *The meaning of the built environment - A nonverbal communication approach.* Beverly Hills, London, & New Delhi: Sage Publications.

Ratcliffe, J. L. (1994). Seven streams in the historical development of the modern American community college. In G. A. Baker (Ed.), *A Handbook on the Community College in America* (pp. 3-16). Westport, Connecticut, London: Greenwood Press.

Reicher, D. (2000). Nature's design rules—Leading the way toward energy-efficient schools. Retrieved November 12, 2002, from http://www.asbj.com/lbd/2000/00inprint/00reicher.html

Rhoads, R. A., & Valadez, J. R. (1996). *Democracy, multiculuralism, and the community college.* New York & London: Garland Publishing, Inc.

Richardson, L. (1994). *Writing: A method of inquiry.* In N. Denzin & Y. Lincoln, (Eds.), Handbook of qualitative research (pp. 516-530). Thousand Oaks, CA: Sage Publications.

Roodman, D. M., & Lenssen, N. (1994, November). Our buildings, ourselves. *World Watch, 7, 6,* 21-29.

Rosenfeld, S. (1999, May). *Linking Measurers of Quality and Success at Community Colleges to Individual Goals and Customer Needs.* Paper presented at the meeting of the Independent Advisory Panel for National Assessment of Vocational Education.

Ross, W. R. (1940). *The History of (name withheld) Junior College from 1869 to 1939* (pp. 160-178). Unpublished doctoral dissertation, Colorado State College of Education, Greeley, Colorado.

S.A.D. (2000, November). SAD Information Sheet. Retrieved January 5, 2003, from http://www.outsidein.co.uk/sadinfo.htm

Sanoff, H. (1994a). *The School Building Assessment Manual.* New York: John Wiley and Sons.

Sanoff, H. (1994b). *School Design.* New York: Van Nostrand, Reinhold.

Schroeder, H. E. (1991). (Ed.). *New Directions in Health Psychology Assessment.* New York: Hemisphere Publishing Company.

Scott-Webber, L., Marini, M., & Abraham, J. (2000). Higher education classrooms fail to meet needs of faculty and students. *Journal of Interior Design, 26,* 16-34.

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

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Smith, D. G. (1989). The Challenge of Diversity: Involvement or Alienation in the Academy? ERIC Digest. *Association for the Study of Higher Education.* Retrieved November 11, 2002, from http://www.ed.gov/databases/ERIC_Digests/ed317145.html

Stokols, D., & Altman, I. (1987). *Handbook of Environmental Psychology.* New York, Chichester, Brisbane, Toronto, Singapore: John Wiley & Sons.

Strange, C. C., & Banning, J. H. (2001). *Educating by design* (pp. 13-120). San Francisco: Jossey-Bass.

Stricherz, M. (2000, December 2). Bricks and mortarboards. *Education Week on the Web.* Retrieved November 14, 2002, from http://www.edweek.com/ew/ewstory.cfm?slug=14facilities.h20

Stueck, L. W., & Tanner, C. K. (1996, April). *The Design of Learning Experiences: A Connection of Physical Environments.* Paper presented at the annual GASCD conference, Athens, Georgia.

Sturgeon, J. (2001a, July). Taming the tangled Web. *College Planning and Management,* 24.

Sturgeon, J. (2001b, August). When outscoring isn't the answer. *College Planning and Management,* 24.

Tanner, C. K. (2000, April). Essential aspects of designing a school. Architectural Principles of School Design and Planning Website. Retrieved on April 16, 2002. Available at http://www.coe.uga.edu/sdpl/research/principlesofdesign.html

Taylor, A. (2000, May). *Programming and Design of Schools Within the Context of Community.* Paper presented at the Stein Institute Lecture Series, Cornell University, Ithaca, New York.

Tellis, W. (1997, September). Application of a case study methodology. *The Qualitative Report, 3, 3.* Retrieved January 3, 2003, from http://www.nova.edu/ssss/QR/QR3-3/tellis2.html

Tinto, V. (1997, November). Classrooms as communities. *Journal of Higher Education,* 68.

Townsend, B. K. (Ed.) (1995). *Gender and power in the community college.* San Francisco: Jossey-Bass.

United States Department of Education. (2000a, April 3). Impact of inadequate school facilities on student learning. Retrieved November 1, 2002, from http://www.ed.gov/inits/construction

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

United States Department of Education. (2000b, June 27). The urgent national need for school construction and modernization. Retrieved September 15, 2002, from http://www.ed.gov/inits/construction/urgentneed.html

United States General Accounting Office (1995). *School Facilities: States' Financial and Technical Support Varies* (GAO/HEHS-96-27 School Facilities: State Involvement). Washington, DC: U.S. Government Printing Office.

United States General Accounting Office (1996a). *School Facilities: America's Schools Report Differing Conditions* (GAO/HEHS-96-103 School Conditions Vary). Washington, DC: U.S. Government Printing Office.

United States General Accounting Office (1996b). *School Facilities: Profiles of School Conditions by State* (GAO/HEHS-96-148 School Facilities: State Profiles). Washington, DC: U.S. Government Printing Office.

Wachs, T. (1983). The use and abuse of environment in behavior genetic research. *Child Development, 54*, 396-407.

Wachs, T. (1987). Developmental perspectives on designing for development. In C. Weinstein and T. David (Eds.), *Spaces for Children* (pp. 291-307). New York: Plenum Press.

Weinstein, C., & David, T. (1987). *Spaces for children*. New York: Plenum Press.

Will, G. F. (1998, April 13). Disorder in the schools. *Newsweek,* 84.

Wohlwill, J., & Heft, H. (1989). The physical environment and the development of the child. In D. Stokols & I. Altmand (Eds.), *Handbook of environmental psychology, 1* (pp. 175-204). New York: John Wiley & Sons.

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APPENDIX A:

LETTER TO THE PARTICIPANTS
INFORMED CONSENT TO PARTICIPATE
IN A RESEARCH PROJECT FORM

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Date of letter

Participant Name

Address

Dear _____:

My name is Sandra K. Veltri and I am a doctoral student at Colorado State University. I am currently working with my advisor, James H. Banning, Ph.D., on a study to gather data pertaining to how a classroom's physical environment at a community college contributes to student learning. I recently received permission from the president, _____, to conduct my study at _____ Community College.

I am writing for several reasons:

- Would you be willing to be part of a focus group? The focus group should last about one to two hours. This group would be asked to describe how they felt particular classrooms on this campus contributed to their learning. Your identity would be kept confidential. I would set up a time at your convenience and not during instructional time.

- You might be asked to participate in an individual interview. The interview would last about one hour. You would be asked to expand on your thoughts and perceptions you listed in the focus group. Again, your identity would be kept confidential and I would set up a time at your convenience.

- You might also be asked to author a "wish poem" or draw a "wish drawing" that identifies what you wish your classroom's physical environment included to better enhance learning in that class.

I have attached a copy of a participant consent form. If you would be willing to participate, please inform me by returning the signed consent form to me in the self-addressed, stamped envelope. I will call you to make arrangements for your participation in this study.

I thank you in advance for your assistance in this matter.

Sincerely,

Sandra K. Veltri
Colorado State University
Student

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Colorado State University
Informed Consent to Participate in a Research Project

Title of the Project: A Case Study: The Perceived Role of the Physical Classroom in Student Learning

Principal Investigator: James H. Banning, Ph.D.

Co-Investigator: Sandra K. Veltri

Contact Name and Phone Number for Questions/Problems – Sandy Veltri (719) 846-3117

Sponsor of Project: N/A

Purpose of the Research: Conduct a focus group and interviews with students to solicit their opinions on how the classroom's physical environment at a community college contributes to student learning.

Procedures/Methods to be Used: Participants must have attended classes in the two classrooms chosen for the study. Participants will be part of a focus group. Some participants of the focus group may wish to be interviewed individually as a follow-up. The focus group meeting and interviews will be tape-recorded and those tapes shall be transcribed and analyzed. Questions will deal only with the student's perceptions of the classrooms' physical environment and how they feel it contributes to student learning. Interviews will be conducted on campus, but not during instructional class time.

Participants will also be asked to author a "wish poem" and/or a "wish drawing" detailing physical aspects they wish their classroom contained that contributes to student learning. Participation in this part of the study is again voluntary.

It is estimated that participants may spend anywhere from two to six hours, depending on the proposed activities of the study they chose to participate in.

Tapes, poems, and drawings will be destroyed upon the completion and approval of the project. Participation is on a voluntary basis.

Risks Inherent in the Procedures: There are no known risks to the participants.

It is not possible to identify all potential risks in research procedures, but the researcher(s) have taken reasonable safeguards to minimize any known and potential, but unknown, risks.

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Benefits: There are no known benefits directly associated for you as a participant in the study. It is hoped the information gained from you will help community college campuses better understand the role of the classroom's physical environment in student learning.

Confidentiality: Your individual identity will not be associated with your responses. Quotes from the interviews will be used to support general themes, but these quotes will be only associated with pseudonyms. Research materials (interview tapes, poems, and drawings) will be stored in a safe place and destroyed upon the completion of the project.

Participants will be directed to keep all information heard during the focus group in confidence. Again, although no references to individuals will be used in the project materials, confidentiality can be guaranteed only to the degree participants respect this direction.

Liability: The Colorado Governmental Immunity Act determines and may limit Colorado State University's legal responsibility if an injury happens because of this study. Claims against the University must be filed within 180 days of the injury.

Questions about participant's right may be directed to Celia S. Walker at (970) 491-1563.

Participation: Your participation in this research is voluntary. If you decide to participate in the study, you may withdraw your consent and stop participating at any time without penalty or loss of benefits to which you are otherwise entitled. As previously stated, your time commitment to this study could be anywhere from two to six hours.

Your signature acknowledges that you have read the information stated and willingly sign this consent form. Your signature also acknowledges that you have received, on the date signed, a copy of this document containing four pages.

Would you be willing to disclose your local phone number and email address for the purpose of contacting you to schedule the focus group at a time convenient to you and the other participants?

_____ Yes (complete attached form, please) _____ No
Please place your initials next to your response.

_____
Participant name (**printed**)

_____ _____
Participant signature Date

_____ _____
Witness to signature (**project staff**) Date

 Subject Initials _____ Date _____

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Obtain parental permission ONLY if you are under 18 years of age.

Parental Signature for Minor

As parent or guardian you authorize _____ (print minor's name) to become a participant for the research described on the previous pages. The nature and general purpose of the project have been satisfactorily explained to you by _____ and you are satisfied that proper precautions will be observed.

_____
Minor's date of birth

_____
Parent/Guardian name (printed)

_____ _____
Parent/Guardian signature Date

 Subject Initials _____ Date _____

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Colorado State University
Personal Data Sheet

Title of the Project: A Case Study: The Perceived Role of the Physical Classroom in Student Learning

Principal Investigator: James H. Banning, Ph.D.

Co-Investigator: Sandra K. Veltri

Contact Name and Phone Number for Questions/Problems – Sandy Veltri (719) 846-3117

I, _____, have given my consent for the co-investigator in the above named research project to contact me via phone or email for the purpose of scheduling the focus group or any other part of the study that I may chose to participate in. Following is that information:

_____ _____

Local phone number Email address

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APPENDIX B:

TELEPHONE SCRIPT

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Script for telephone conversation:

Hello. May I speak with (student's name)? My name is Sandra K. Veltri and I am a doctoral student at Colorado State University. I am currently working with my advisor, James H. Banning, Ph.D., on a study to gather data pertaining to how a classroom's physical environment at a community college contributes to student learning. Last month I sent you a letter asking for your assistance. You are currently enrolled in classes that meet in the _____ Building and also in the _____. I wrote to ask if you would be willing to meet with me and other individuals who meet the same criteria to discuss if there is a difference in a classroom's environment and how it contributes to a student's learning – your learning to be more precise. Did you receive this letter?

I am requesting your permission to include you in a focus group discussion that should take no more than an hour. If you wanted, you could meet with me individually to discuss how the different classrooms have contributed to your learning. This would take no more than an hour. You would also have the option to author a poem or complete a drawing that explained what your ideal classroom would include. Your participation in the study can last anywhere from one – four hours, you decide how involved you would like to become.

I am hoping to meet with the focus group at the end of April. Would you be willing to participate in this study? Do you still have a copy of the consent form? If not, I can send another copy to you.

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APPENDIX C:

RESEARCHER'S JOURNAL

RESEARCHER'S WISH DRAWING

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April 9, 2002

Panic now!! I cannot get a response from my letters. I had to email Dr. Banning yesterday to ask for his help. I would like to call the people I sent a letter to, but I can't do that without Human Subjects approval. Oh, God. Here I go again.

I did call Linda Kovar from Human Subjects and she suggested I send up the script for both the telephone call and a letter. So, I'll do a script for a telephone call and a script for a follow-up letter and see what happens. This is what I get for thinking everyone would be thrilled to participate in my study. Linda is really a nice individual though.

April 16, 2002

I don't have a response from as many participants as I would have liked, but I've decided to go ahead and have my first focus group. Five people are supposed to participate. I have scheduled it for 3/19/02 at 4:00 p.m., in the Classroom B. We will meet in the technology classroom. I have taken pictures of both rooms and I will make sure that the pictures from Classroom A are displayed on the big white screen for their referral.

April 18, 2002
I have answered the questions that I will use in my focus group and following are my perceptions:

- When I say the "interior design" of a classroom, what do you think that includes? The interior design of a classroom is all the items that produce the room's ambience. For instance, wall coverings/decoration, lighting used and how it is used, color schemes, furnishings and colors of such, use of wood and coloring of the wood, type carpeting and coloring of such. It isn't the items that are changed on a daily basis. There has been careful thought and planning put into these items, including how the items will wear.

- What about the "physical environment" of a classroom? The physical environment is the moveable objects of the room. Furnishing arrangements, technology and equipment and where it is placed, where the chalkboards are (even though I know these are not moveable objects anymore), screen placements for visuals, and actual placement of the teacher's desk.

- How do you think the "environment" of the Classroom A and the Classroom B Technology classroom contributed to your learning? I have never taught in Classroom A, but I have had to sit in there for seminars, workshops, and in-service meetings and it is horrible. You feel squished in those seats and the little arm for writing is so tiny, you have to put your materials in your lap and then use the little miniscule desk for writing. In addition to that it is hotter than he—in that room most of the time (or at least all of the times I have been in there.) I find myself very bored in that room and anxious to leave – the old saying, "Do you have ants in your pants?" Really fits this room.

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I have taught in Classroom B (am teaching in that classroom this semester) and I love it. It is so light and airy (Something you can't say for Classroom A.) There are moveable chairs and if you need to you can work in little groups. I love having control of the whole room at my fingertips: technology, lights, etc... The only thing it doesn't have is a temperature control and I wish it did. That room gets a little cold, but I'd rather be cold than hot any day. The only other thing with Classroom B is the noise interference from the studio and the hall. I was teaching in there the other day and all of the sudden someone started playing a guitar solo (in the studio next door) and I had to let class go because they couldn't hear me over his solo that he played over and over again. That really ticked me off and I had to go talk to the building director right after class. My students are paying for my time, not to hear a heavy metal guitar solo (It wasn't even a soothing song he was playing!)

- Did this "environment" in anyway hinder your learning? How? Classroom A didn't really hinder my learning, it just made me really anxious to leave. I could hardly wait to go. It is bad enough having to sit through a boring lecture, but then with the heat and those uncomfortable seats, it is unbearable!

- Comparing the two classrooms, I'm going to go over a checklist. I want you to tell me if any particular item made a difference in your learning and if so, I'll need you to explain it to me:

  Seating – Classroom A – very uncomfortable. It might be even worse because I am pretty tall, but not being able to move the seats and trying to write in such a little area is near impossible. Classroom B – there is room to spread your materials out and it is very comfortable. The chairs are the high back executive seat chairs and they are wonderful!!

  Lighting – Natural vs. man-made
  Natural vs. man-made doesn't matter to me, I just want good lights that I can control – like in Classroom B. One of the classes that I presently teach in does not have blinds for the windows and when I want to use the overhead or show a film there is a glare on the screens that students complain about. I wish I could use some other medium, but the overheads seem more effective to me.

  Temperature Control – Classroom A is horrible. It is always hot in there, whether it is summer or winter. You literally roast in there! I get really tired in that room and I wish I could just lay down on the floor and take a snooze like a kindergarten student. Classroom B is a little chilly and I end up taking a sweater, but I'd rather be able to adapt to the surroundings then swelter in them. I don't know why the administration doesn't do something about the heat in the building where Classroom A is – we have the same problems in a lot of the classroom. In the classroom I teach in now, last winter (in

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November) we had a cold spell and I swear you could see your breath when we talked in that class. I had to wear my gloves and my jacket to that class. I felt sort of sorry for some of my students who didn't dress appropriately. They froze in that class. The next day the heat was on and it was horrible, it was so hot.

Smells – Smells bother me. I have a very keen sense of smell. I can pick up when somebody has been drinking, smoking cigarettes or other things, and body odors. In my classes, I can usually pick up certain things about my students just on their smell.

Chalkboard/Whiteboard - I prefer the chalkboard, but I have used the whiteboard and it is a pain to have to worry about carrying around dry markers. Sometimes they don't have erasers for the marker boards and it is hard to erase those things with paper towels. I usually carry a rag, just in case. The chalk from the blackboard isn't too wonderful to deal with though either. Personally, my handwriting is so bad, I prefer to use overheads as much as possible. That way my students don't complain that they can't read my handwriting.

Sounds – acoustics
This is a touchy subject for me. I am sick and tired of all the construction that is always going on around my classrooms. If it isn't saws, it's a motor outside, or noise in the hall. It is very distracting and it drives me nuts. My family thinks I am just too sensitive, but I really need quite to concentrate. Looking at my students, they seem to enjoy noise (They wear those stupid headphones until I tell them to take them off in class.)

Classroom arrangement
I like to assign group projects. One of my classrooms makes that impossible, just like it would be in Classroom A. I teach in a room that has long tables – bolted to the floors. Why did they bolt them to the floor? Who did they think was going to steal one of those heavy tables? It makes it very difficult for my students to adapt for group work. Classroom B was much easier to assign group work in.

Carpeting - I never thought of it one way or the other. I do feel bad in one of my classes when I give tests and I have high heels on. As I walk around my footsteps seem amplified on the hard wooden floor. Classroom A is mostly carpeted and I think the spots that aren't carpeted could give off some sound. Classroom B is totally carpeted and I think the carpeting absorbs some of the sounds from the other rooms in the building.

Color scheme used in the classroom (paint, wallpaper, etc…) I think this makes more of a difference then people think. I think we take cues from our surroundings and surroundings that are pleasing to the eye put the occupants

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in a better frame of mind. My present classroom is pretty blah. I've tried to enliven the room with the bulletin board, but there is only so much a person can do. (I even decorate for the holidays and the students seem to like it.)

Technology – Why don't they ever ask the teacher what tools we want in the classroom and where we want it???? I have this huge TV monitor that turned up one day in the corner of my classroom and I have smacked myself on it a couple of times. I am a fairly tall person and if I wear high heels I do not clear the mounting brackets. A couple of times I saw stars and thought I had cut my forehead. (My students didn't want to laugh, but hey, how can you not laugh when your instructor about knocks themselves out.) I tried to use this "technology" and I hated it. If I wanted to show PowerPoints I could only put about eight words on a slide or the people in the back wouldn't be able to see what it said. Do you know how many slides I'd have to use for an accounting presentation? Too many!

I have to say that the technology in Classroom B is fantastic! Everything is right there at your fingertips, you don't have to switch back and forth with all these remotes (like you do in Classroom A) and the students can see PowerPoint beautifully because the screen is so HUGE!!

Air circulation - I really can't tell in my present classrooms. The air in Classroom A does seem to be stale, but that could just be because it is so hot in there.

April 19, 2002

Only three participants showed up and one of the participants didn't seem to be too thrilled with the whole process. They all perked up and became very passionate about some topics. They really don't like the Classroom A and they picked that room apart. They hate the seats; it's too hot in there usually; it's noisy and has many features that are distracting to their learning process. They almost sound hostile about the room – this would seem to be a hostile environment to them.

The use of Pic-Tel in either room was not favored. They didn't like the delivery method and in some instances I think they felt cheated out of an education because of it. It was not a consistent delivery method. One student was very vocal and passionate about her dislike of Pic-Tel. She said she would make sure others in her class participated in this study because they felt as strong or stronger than she did about Pic-Tel. I had to be careful that the focus didn't shift to only Pic-Tel related issues. I was glad that I had a set of questions to re-focus on.

I was surprised that the students had issues with windows in a classroom. They found them distracting. I need windows in a classroom or else I feel closed-in. Colleagues that I have spoken to that teach in rooms without windows hate it.

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It was an interesting process.

April 24, 2002

Just emailed Linda Kovar back. Actually, she and I have had some very friendly conversations. Go figure! She isn't the ogre I envisioned. She is prone to migraines and I was able to give her some ideas on how to help reduce migraine attacks, since I've had a history of migraines in my past. Who would have thought.

By the way, I do have approval to make phone calls to potential participants using my telephone script. Wa-hoooo!!

April 25, 2002

I'm not letting any grass grow under my feet. I made phone calls last night and I have five people that said they will participate. (Two of them were actually supposed to be in the first focus group, so they aren't new participants – I'll take what I can get!) So, we are meeting this afternoon to complete the focus group study. I will not be able to conduct the study in one of the rooms being studied, like I did in the other focus group. So, I will make sure that I have pictures of both rooms on the big white screen for their reference.

Well, my original two showed up and we waited for a little while. I just had to start asking them the questions and pray that the others would show up. They did show up late, I didn't know they had a class that didn't end until 3:15 and I scheduled the study for 3:00. So, I had to re-start the study, but that was good because it gave the original two a chance to think more about the questions and one of the participants really made a good point in the difference between interior design and physical environment. At least I thought it was a good differentiation. We'll see.

This group was very vocal and I only had one participant that I feel I had to pull information out of. They also dislike the Classroom A – for the most part. They complained quite a bit about the seating, the heat, the noise, and the technology. They also had some complaints about the Classroom B classroom though.

They made me laugh when someone said, "You'd have to be the exorcist to be able to do any group work in the Classroom A." They said something like that, anyway. Point being that it isn't conducive to group work because the seats are immovable.

So far nobody has come forward with a wish poem or a wish drawing from this first focus group. They have said they will, but I'm seriously having my doubts and I won't bother them for it. So, with this group, I asked if they wanted to do one and if so, they could do it before they left. They all created a drawing. That made me feel good. Now, I'll just need to see how it gets added in to all the data.

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July 15, 2002

Well, guess what. The data isn't transcribing itself. I've had to really buckle down and I've started to transcribe the data. It's going to be a longer process than I expected. Even though I took my own notes in shorthand, there are some things that I missed that is on the tape, but it is hard to decipher because some of the participants were very soft-spoken. I'm only on the data from the first focus group.

August 22, 2002

Finally!! My data is totally transcribed. Now here comes the fun part – coding and putting it in some order that means something. I'm going to hit the books from the qualitative classes again to refresh my memory on coding strategies.

August 25, 2002

Well, that didn't sound too good. I emailed Dr. Banning my beginning codes – just to make sure I was doing it right and he emailed back that he is a little confused about what I am trying to do. He does say that he isn't saying I am doing it wrong, he just doesn't understand what I am doing. (This doesn't give me a good feeling.)

Well, I looked over my notes and I think I see why he is confused. I've reviewed that big gray, qualitative book (I know it has a name), and I think I am trying to do things backwards. Okay, I know I'm doing things backward. Instead of letting the themes emerge themselves, I'm trying to label them upfront. I'm totally going against what qualitative research is for. (At least I think I am.) I'll email Dr. Banning.

September 13, 2002
Well, Dr. Banning left a message on my answering machine. I emailed him back and we will meet next Friday when I go up. Hopefully what I have been doing is correct.

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RESEARCHER'S WISH DRAWING

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APPENDIX D:

PARTICIPANTS' WISH DRAWINGS

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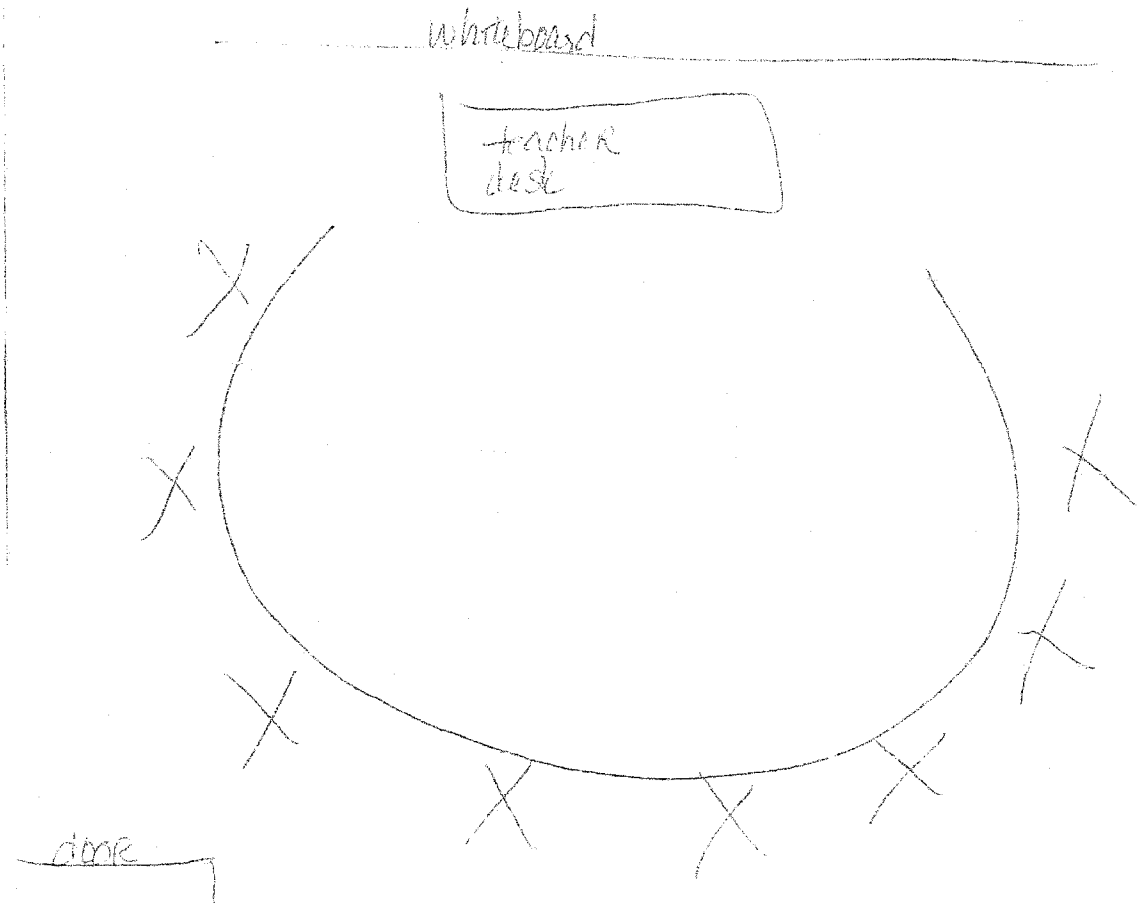
WISH DRAWING ONE



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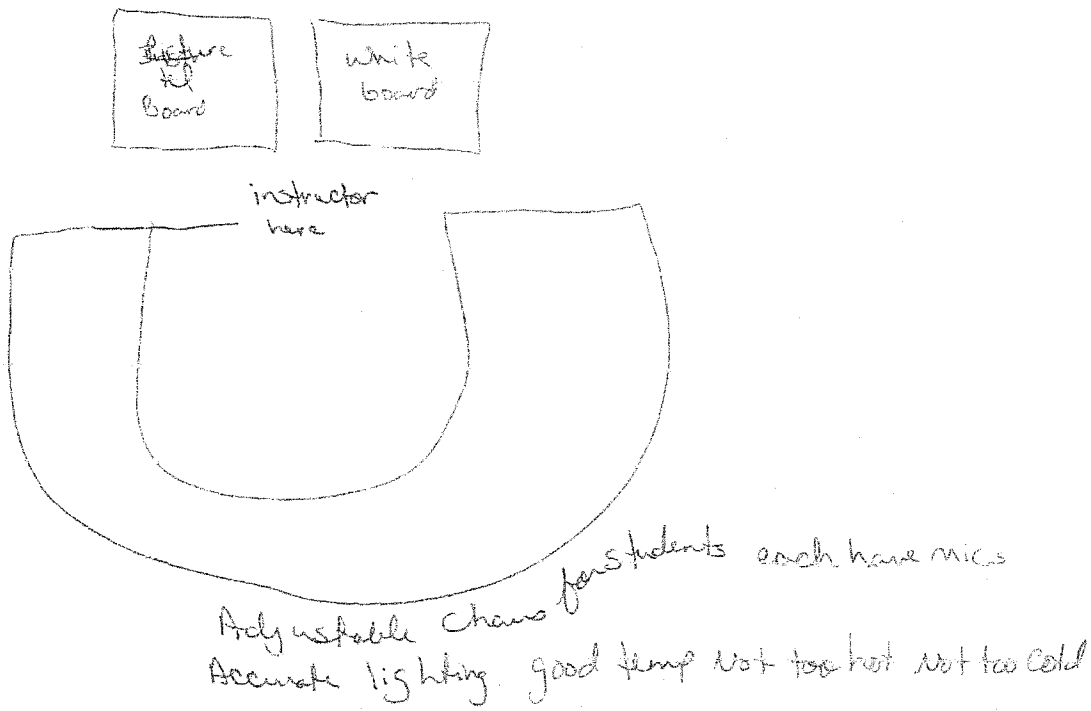
WISH DRAWING TWO



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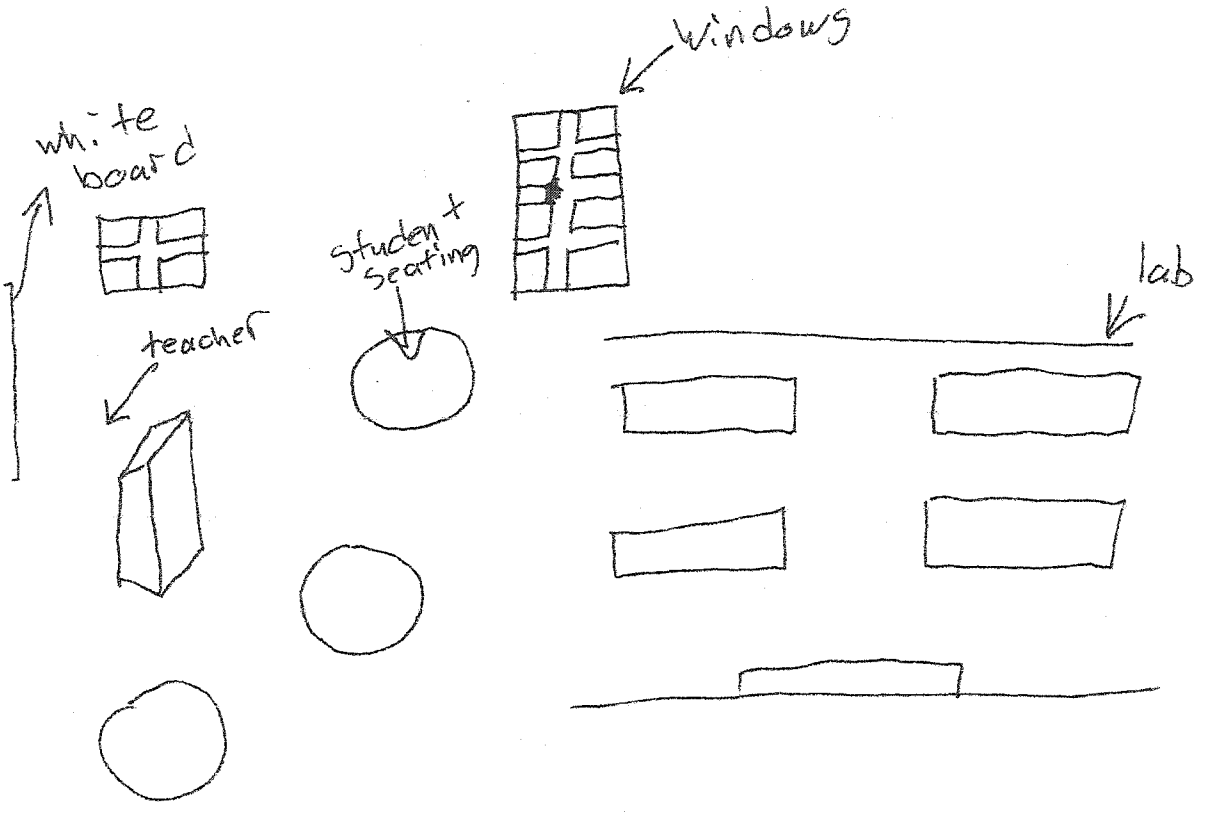
WISH DRAWING THREE



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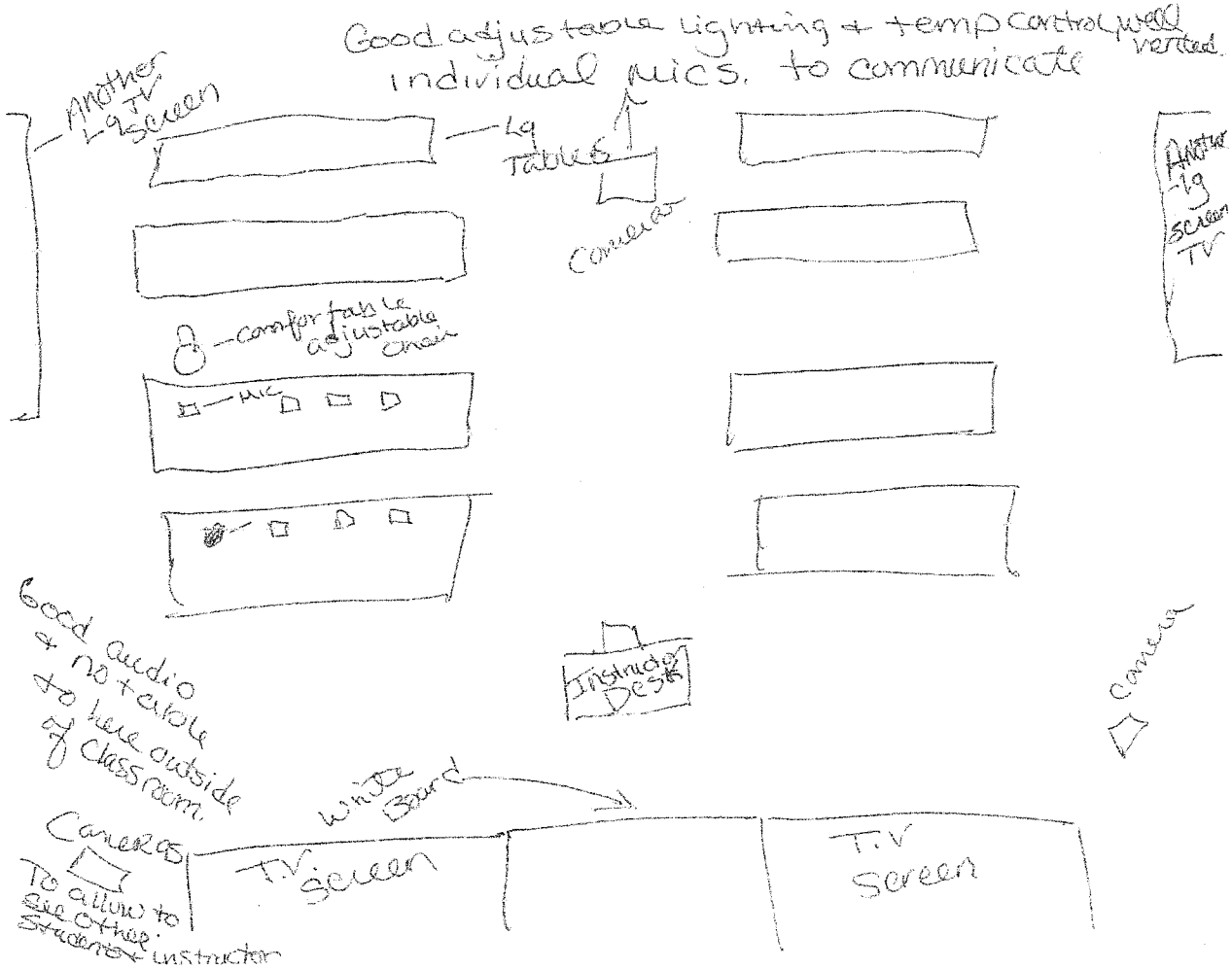
WISH DRAWING FOUR



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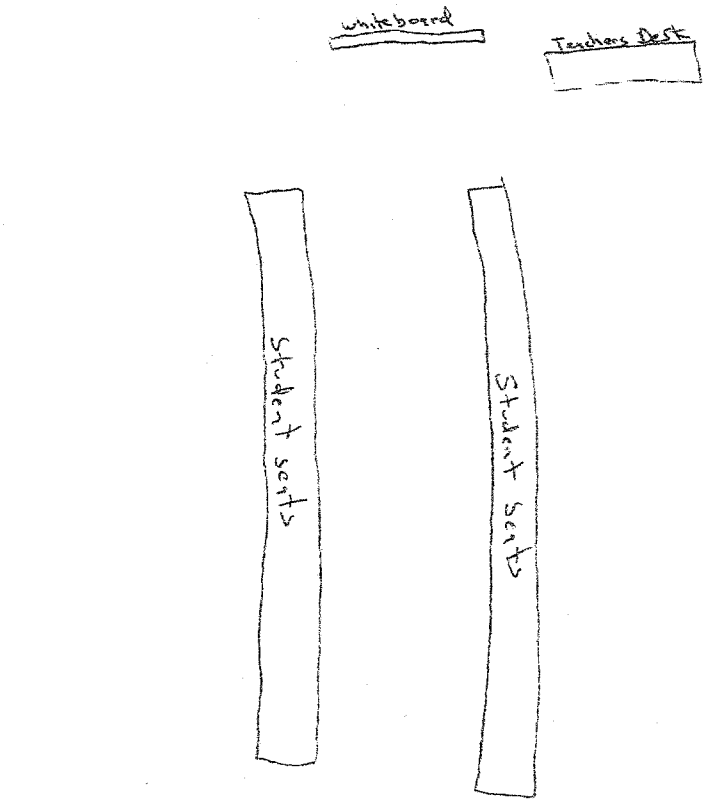
WISH DRAWING FIVE



Making sure all students can focus on teacher.
Making sure all students can look and focus on student talking.

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APPENDIX E:

FOCUS GROUP SCRIPT

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FOCUS GROUP SCRIPT

This script was read to each of the focus groups and used in questioning their perceptions of the classrooms.

I am interested in how you feel the physical environment and the interior design contributed to or hindered your learning. I am particularly interested in your comparison of the physical environment and interior design of Classroom A and Classroom B.

- When I say the "interior design" of a classroom, what do you think that includes?
- What about the "physical environment" of a classroom?
- How do you think the "environment" of Classroom A and Classroom B contributed to your learning?
- Did this "environment" in anyway hinder your learning? How?
- Comparing the two classrooms, I'm going to go over a checklist. I want you to tell me if any particular item made a difference in your learning and if so, I'll need you to explain it to me:
  1. Seating
  2. Lighting – Natural vs. man-made
  3. Temperature Control
  4. Smells
  5. Chalkboard/Whiteboard
  6. Sounds - acoustics
  7. Classroom arrangement
  8. Carpeting
  9. Color scheme used in the classroom (paint, wallpaper, etc…)
  10. Technology
  11. Air circulation

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APPENDIX F:

WITHIN CASE DISPLAYS

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Research Question: What classroom factors did a community college student perceive as a contribution and/or hindrance to his or her learning?

Within Case Display

	Factor(s)	Contribution(s)	Hinderance(s)	Outcome(s)
Room A	Chairs/desks	Comfortable chairs	Inadequate space, too small and close. Uncomfortable and numbs legs. Chairs bolted to floor - can't rearrange.	Can't organize materials because of lack of space. Unable to work in groups, inhibits student-to-student interaction. Restrictive learning environment.
	Arrangement of classroom furniture/visuals.	Large screen in front for visuals.	Stage detracts from instructor. Positioning of chalkboard is poor. Can't see equipment properly. No room for group activities. Can't access equipment easily. Can't arrange furniture for group interaction. Some instructors don't utilize all technology--use small TV instead of large screen. Room is "too big--teachers too far away. Not a classroom--originally a small theater. Chalkboard leaves residue-hard to read.	Students attention wandering. Positioning of technological equipment restricts student usage "...won't even ask questions--have to get up from seat, move in front, hit mute, ask question, then mute again..." Some "...don't even pay attention because can't see the little TV." Unable to see information on chalkboard restricts students' learning.
	Technology	Visual access to other sites was a positive factor--sometimes.	Improper use of technological tools--used small TV instead of large screen. Instructor intimidated by technology. Distracting to see other sites--especially other sites talking to one another or leaving room. Poor location of equipment. Instructor is in a "shambles" when lecturing because of poorly located equipment. Equipment "cuts in and out" -- weather hampers reception.	Students unable to focus on lecture and materials because of distractions provided by instructor as they attempt to interact with equipment, other sites, and local students. Can actually see students not paying attention or leaving distance site. Time is lost when signal is lost. Many times instructor at other site not aware signal is gone.

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Research Question: What classroom factors did a community college student perceive as a contribution and/or hindrance to his or her learning?

Within Case Display

	Factor(s)	Contribution(s)	Hinderance(s)	Outcome(s)
Room A	Acoustics		Room does not have good insulation from outside noises. Students can hear activity out in the halls, from an upstairs office, and construction in other areas. Room not totally carpeted, can hear noises in classroom more readily.	Students have a hard time focusing on instructor, and/or visuals because of noises from inside or outside of the classroom.
	Lighting	Does have windows for natural lighting.	Blinds are usually shut. Room is very dark and "gloomy". Can't adjust lighting--"either off or on"	Students unable to focus in classroom and stated that they "felt more tired" in this room. "Dim lights make it easier to snooze."
	Climate control	Does have ceiling fans. Ventilation provided by door that opens off of the stage and main classroom doors.	There is no air conditioning. No climate controls in room. Room is very hot. "...sometimes I'm dripping sweat..." Windows open, but some instructors don't open them.	Open door on stage distracts some students. Oppressive heat (especially in late spring/summer) causes fatigue.
	Interior ambience		Gloomy and dark interior.	Darkness causes students to relax and actually fall asleep in class.
Room B	Chairs/desks	Good seating and spacing. Can write comfortably on desks. Tiered seating provides good visibility.	Can't adjust chairs.	Able to organize materials easily. Able to move chairs for student-to student interaction. Inability to adjust chairs restricts comfort. Could be a distraction for students.
	Arrangement of classroom furniture/visuals	Able to see whiteboard easily. Use of colors on whiteboard allows students to better follow lecture. Space is "personal and enclosed". "Seems to be set up for learning."	Other sites unable to see visuals when whiteboard used.	Students attention not wandering. Positioning of technological equipment contributes to student usage and interaction in class and with other sites.

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Research Question: What classroom factors did a community college student perceive as a contribution and/or hindrance to his or her learning?

Within Case Display

	Factor(s)	Contribution(s)	Hinderance(s)	Outcome(s)
Room B	Technology	Easy access to technology by instructor/students. Easy accessibility of controls for instructor/students. Instructor is visibly more comfortable with the technology in this classroom.	Technological unit hums and is distracting. Equipment "cuts in and out" -- weather seems to be a factor in it's dependability.	Students able to focus on lecture and materials -- not distracted by instructor attempting to interact with equipment. Time is lost when signal is lost.
	Acoustics	Can close door to "shut out" sounds from hallway.	Can hear noises from hall, adjoining studio, other departments in the building, and noise is "echoey." Room is totally carpeted to absorb sound.	Noise distracts student learning. Carpeted classroom absorbs some of sound - reducing distraction.
	Lighting	Instructor can control lighting from podium or back of room. Multiple light settings. Windows in room for natural lighting.	Cannot see out of windows.	Students felt that activity outside of classroom could be distracting, so having natural light without the distraction was a positive aspect.
	Climate control	Room is normally comfortable.	No access to temperature control. Windows do not open. Sometimes too cold in room.	Temperature of room and ventilation did not detract from student learning.
	Interior ambience	Color scheme with light colors and wood seemed conducive to a positive learning environment.		Color scheme provided a non-threatening environment conducive to learning.

APPENDIX G:

PICTURES OF CLASSROOM A

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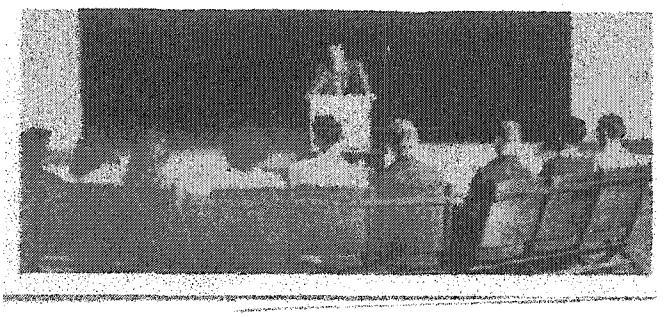
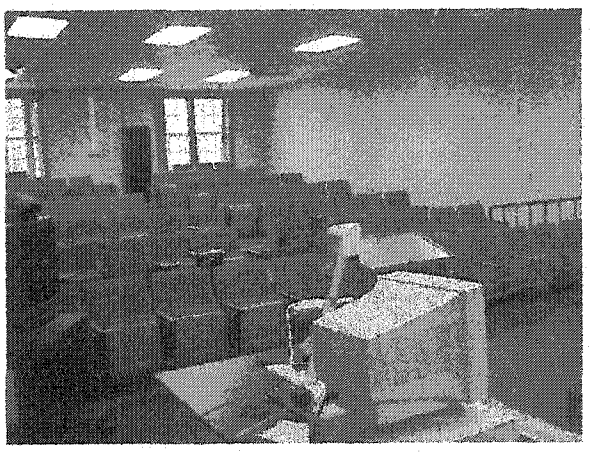
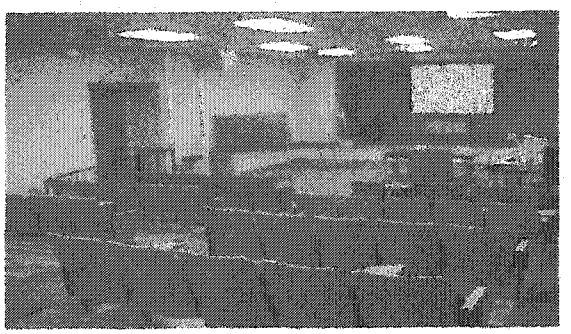
DRAMATICS

These pictures were scanned from a 1945 yearbook and they depict a drama production and a speech class. These were the original uses of this classroom.





The room still has the tiered theatre seating, but has been remodeled throughout the years. Technology has been added, the old wooden seats replaced, carpeting installed, as well as a ramp for disabled individuals.



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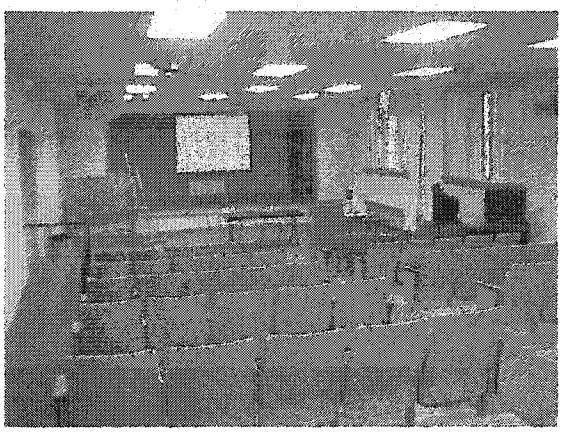
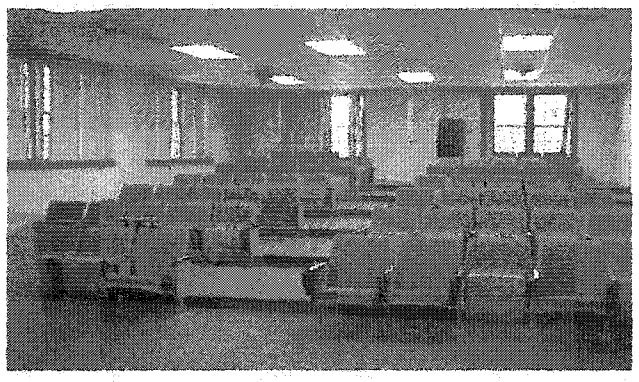
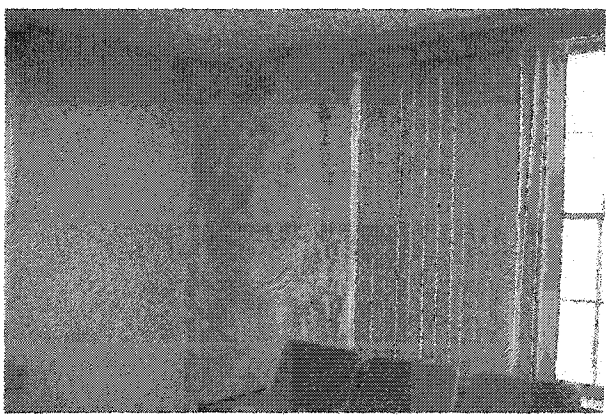


This picture depicts the room's arrangement, as it was at the time of the study. Two large screens were added during the summer of 2002 and they now cover the stage.

Water damage has loosened the wallpaper and some sections have started to fall, revealing a molded section of the wall in the back of the classroom. Several other sections of wallpaper at the front of the room are also starting to loosen and seem ready to fall from the wall.





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APPENDIX H:

PICTURES OF CLASSROOM B

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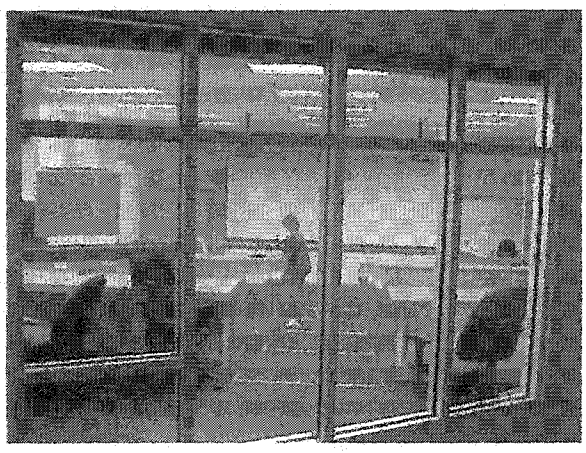
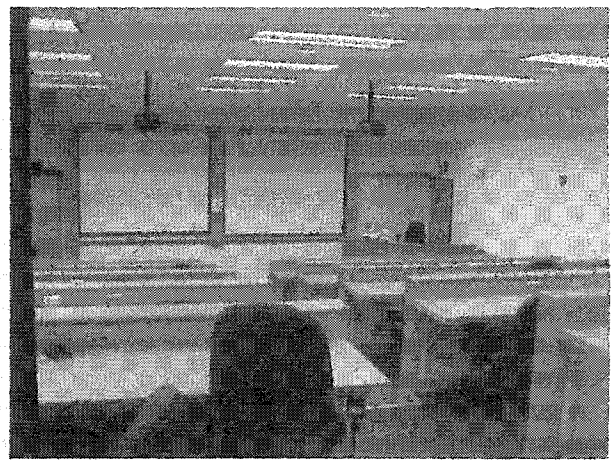
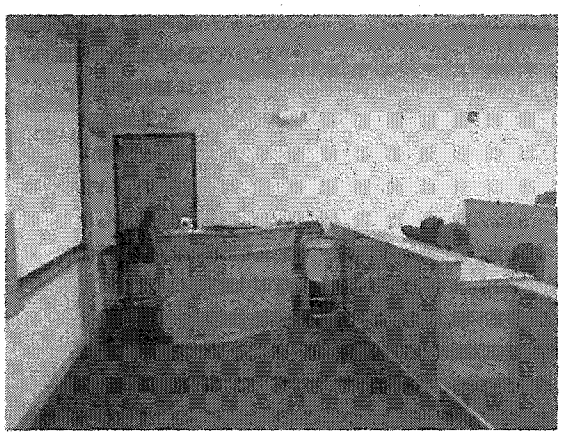
CLASSROOM B



This is a picture taken from the hall, which depicts the large picture window looking into the classroom. Windows are also within the classroom and two can be seen on the left side of this picture.

Entering the classroom, steps lead down to the front section of the classroom. The instructor's table is shown in the right hand section of this picture, you can see a chair for the instructor behind what looks like a podium. The instructor's station is more visible in the picture below.





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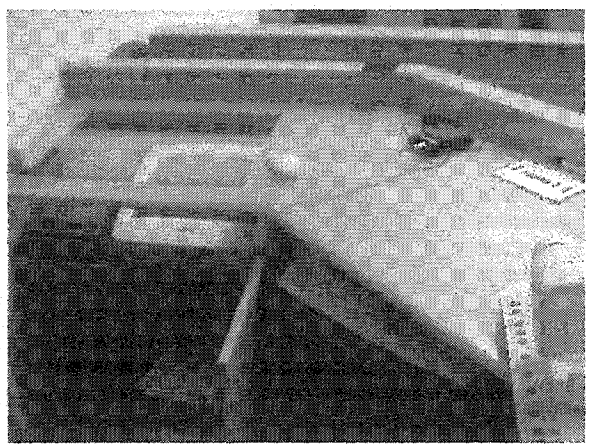
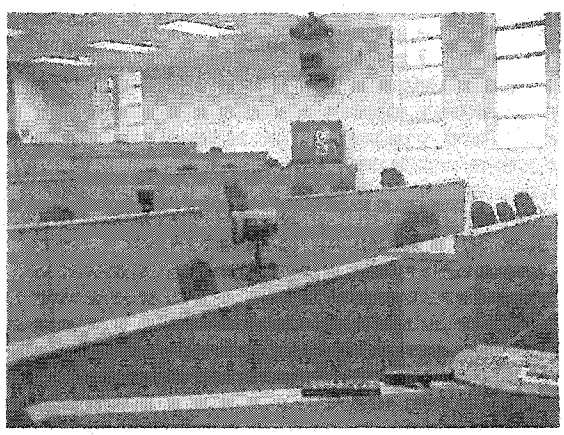
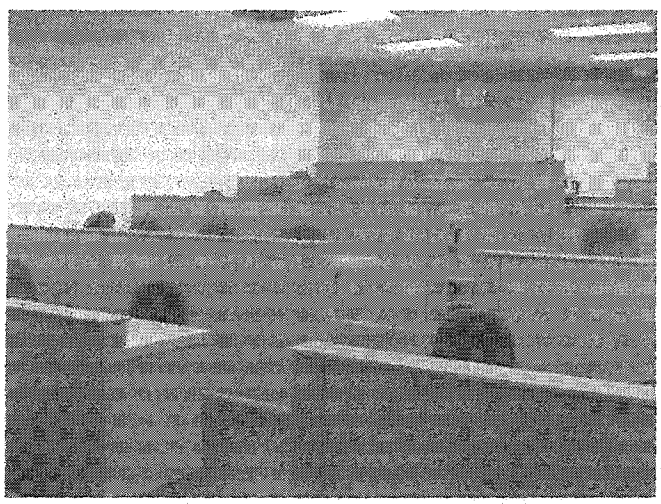


This picture shows the various technological devices at the instructor's fingertips. In the mid-right section of this picture there is a flat panel with rectangular boxes, this controls the lights in this classroom.

This is the view from the instructor's station looking out to the students and also giving the instructor a view of the television that shows the off-site classroom.



This view is from the middle of the room, seen by the instructor as they lecture. The instructor can wear a tracking device so that the cameras will follow them throughout the room without having to have someone manually manipulate the system.



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APPENDIX I:

CODING STRATEGIES

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Categorical Aggregation*
Open Codes and Themes Generated From Two Similar Classrooms at a Rural Community College

Interior Design

Size, space, and arrangement of chairs and desk in classroom
How much room you have.
Distance from the visual.
Everything you can see in the classroom.
The way the seats are set up to look at the teacher and vice versa.
Placement of items in classroom, i.e., blackboard.
Acoustics, lighting, and temperature of classroom.
Comfort of seats.
Way classroom is set up - how people designed it.
Way the classroom is set up.
Tools that are in the classroom -- room for books, etc.
How the environment is set up in the classroom -- nice colors, comfortable chairs, calm environment.
Can't be changed, permanent stuff.

Physical Environment

How hot or cold room is.
Desk space.
Similar to interior design -- temperature, seating, lighting...
Stuff in the classroom, like microphones, fans, podium.
Can be changed, like desks or seats.
Temperature
Lighting/windows

Classroom A

Inadequate desk space

Can't even open book on desk
Need three desks.
Stage draws participants' attention.
Stage detracts attention from teacher.
Waiting for something to happen on stage.
Dark room.
Always seem tired.
I think you need windows. Won't feel so enclosed.
Might help to look out a window and then at instructor
Desks too close and small
Positioning of chalkboard is poor

Classroom B

Other sites can't see information when light board used.
Can see whiteboard better

Color on whiteboard draws attn.
More personal and enclosed
More conducive to learning
Seems like it is set up for learning.
Pic-Tel unit hums and is distracting

Can hear doors slamming on the outside.

Seating and spacing is better
Better positioning of chalkboard

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Can't fit in desks comfortably

Hard to organize because of lack of room

Have to have an empty seat between occupants
No room for disabled students
Door to handicap ramp not open
Can't see little TV on Pic-Tel unit
Watch center screen (larger than little TV)
All of my classes use the little TV
Positioning of chalkboard is poor
Chalkboard leaves residue.
Wind banging blinds is distracting.
Chalkboard is distracting
Can hear construction
Hot, hot room
...just dripping sweat and feeling uncomfortable
Don't notice temperature
Can't control temperature
Using fans
Must open windows.
Some instructions open door off stage.
Open door makes participant look at stage.
Pic-Tel only comes on little TV
Can't see TV – just a little square
Some classes use center screen.
Can't see instructor's note on little TV
No room for group activities.
No controlled groups—lacked space
Groups of more than 2 or 3 tough – no room
No movable chairs.
Classroom A is gloomy all the time.
Won't ask questions on Pic-Tel, technology not easily accessible to students.
Won't even ask questions - have to get up from seat, move in front of all the people, hit the mute button, ask question, and then mute again.
Don't use big screen in Classroom A. Just use little TV.
Don't even pay attention because can't see little TV.
Technology contributed somewhat. Used big screen.
Helped a little to see other sites
Distraction to see other sites. If they don't like what instructor is doing, they get up and leave or talk.
People around me aren't paying attention.
He doesn't use the big screen.
Instructor is in a "shambles" when lecturing because desk is here, podium there...

Can see whiteboard and sits in back of the room
People from other depts. always talking – distracting

Has a marker board

Mark board erases totally
Better for Pic-Tel. Controls more accessible

"Echoey" hall
Ending up closing door a lot to shut out sound

Color scheme better is Classroom B
Sometimes too cold
Can't control temperature
Room has more color init
Room has more wood – liked it.

Instructor more comfortable. It's set up for her at the podium (all controls)

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General comments - not about one room in particular
Don't like Pic-Tel. Distracting.
Mike is muted so we talk to each other instead of paying attention to Pic-Tel.
Instructor poorly trained on Pic-Tel caused downtime in classes.
Equipment and training at fault.
Weather causes Pic-Tel to go "down".
Some students had same instructor, same class in both rooms. One class met on Mondays in
Classroom B and Thursdays in Classroom A.

Factors Identified From Above Include:
Physical Factors
Technology
Furniture
Interior Designs
Climate Control
Visual factors
Spatial arrangement/physical design
Acoustics

Moved these codes to a within case display to analyze positive and negative effects of each classroom. Then moved to the cross case analysis for comparison of two rooms.

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