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THE ANALYSIS OF AIR CONDITIONING AN EXISTING SCHOOL

by
Dennis M. Vespe

A Master's Thesis

Submitted in partial fulfillment of the requirements of the
Master of Arts Degree in The Graduate School of
Rowan University
April 15, 2000

Approved by _____
Professor

Date Approved April 15, 2000

ABSTRACT

Dennis M. Vespe,

The Analysis of Air Conditioning an Existing School
2000

Dr. V. Doolittle

The Graduate Program in Educational Leadership.

The intern wants to learn the cost and electrical feasibility of air conditioning an existing school, as well as to determine if students' learning is enhanced by the presence of air conditioning in an educational atmosphere. The intern will use the interview procedure along with the review of material culture data, and action research techniques. The intern will research case studies on the improvement of student achievement in a climate controlled atmosphere, as well as interview faculty members that have taught in climate control environments and non - climate controlled environments to develop an air conditioning plan for the Black Horse Pike Regional School District.

Studies have shown that students in schools where special attention has been given to the physical environment experience a greater degree of success in the academic realm of the curriculum as well as attendance, discipline and health. Educational consultants, architects and administrators should be apprised of the importance attached to the compatibility of physical environment, learning and other characteristics regarding students living in the contemporary school facility.

MINI - ABSTRACT

Dennis M. Vespe.

The Analysis of Air Conditioning an Existing School
2000

Dr. V. Doolittle

The Graduate Program in Educational Leadership.

Most schools do not possess a proper physical environment. Schools with an appropriate physical environment experience greater success in academics, attendance, discipline, and health.

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Chapter I

Introduction

Focus of Study:

In the first few decades of this century, actions taken to address the learning environment issues were slow. Efforts to improve the learning environment has become more active in recent years. Before this time, many people still believed that physical discomforts in learning could be overcome by strong determination and keen learning desire. However, the fact is that, only few students could perform well under a poor learning environment. Unquestionably, the learning environment has an impact on learning activities. There is a need to improve students' learning environment to meet the physical needs of learning activities. Disregarding the improvement of the learning environment is totally ignoring the physical difficulties of learning.

In recent years, with a better understanding of the environmental impact on the learning process, scholars began to develop their knowledge by verifying their experiences on the site. In some recently completed school buildings, the planners' intent to improve the learning environment is obvious. Not only was attention drawn to lighting, acoustics, thermal control and air ventilation but much effort was also concentrated on achieving an overall design effect to meet the educational needs of the students. This is an important trend of development because a good learning environment results in higher student achievement.

Living environments and surroundings have always been considered a part of our learning environment. However, investigation on living conditions started a long time, before attention was given how the learning environment affects children. In fact, not until the early twentieth century that Americans began a systematic and scientific research on the physical aspect of the educational environment covering all the equipment and facilities that serve to support education.

The rise of educational facility research is attributed to several factors: First, research on educational facilities helps to resolve questions about how educational environment impacts the teaching and learning behaviors of human beings. Second, educational facility research provides a basis on which decisions on energy conservation, building utilization, and building efficiency can be made. Third, educational facility research reveals the obsolete conditions of school buildings due to educational program updates. Fourth, educational facility research supports a master planning effort to accommodate the fluctuation of school population.

Since the 1930's, the effort of the educational facility researchers has been verified by the continuous improvement of school environments. Some earlier research dealt with lighting and air ventilation of school buildings (Turner, 1848; Stockard, 1926). Research methodologies were very simple. Later on, the scope of research was extended to many areas among which open space, space utilization, energy conservation and cost efficiency have been the more popular topics (Wilson, 1963; Connors, 1983; Ryan, 1991). In design, most of the earlier research was descriptive in nature. In recent years, research design in educational facilities has been refined to include experimental and good learning environment types. The research has been much facilitated by the use of statistical studies and computer networking. The experiments and results for thermally controlled environments are being used by engineers and architects in the design of new schools. The information

being accessed from the internet provides cost analysis of doing the air conditioning during construction as opposed to going back at a later time and installing the air conditioning. The internet is also providing Boards of Education easier access to data that supports the use of a thermally controlled environment for both the student and the year round use of the school building. This data is being processed by the Boards of Educations and being reproduced in informational pamphlets during school budget election time for the different communities (Maiden, 1998).

The effort to improve the learning environment has become more noticeable in recent years. It was believed that physical discomforts in learning could be overcome by strong determination and keen learning desire. However, the fact is that only few students perform well in a poor learning environment (Peccolo, 1962). There is a need to improve students' learning environment to meet the physical needs of learning activities.

In some recently completed school buildings, the planners intent to improve the learning environment is obvious. Not only was attention drawn to lighting, acoustics, thermal control and ventilation but much effort was also concentrated on achieving an overall effect to meet the educational needs of the students. This is an important trend of development because a good learning environment results in higher student achievement.

Research from experiments conducted by the Educational Facilities Laboratories in 1971, Dr. Charles Peccolo in 1962, and Dr. T. C. Chan in 1996 emphasizes that a school building's condition affects student achievement and behavior and that certain facility design elements can improve the learning climate. Reasons cited for advocating a climate controlled classroom are: (1) the improvement of learning and teaching efficiency, (2) effective use of the educational plant for a greater part of the year, and (3) more efficient use of space through compact building

design. Further - Five climate control techniques are cited as providing optimum teaching - learning environments: (1) control of individual classroom temperature within prescribed limits, (2) dilute odors to an acceptable minimum, (3) cleanse the air of dust, pollen, etc. (4) provide an acceptable and uniform air pattern, and (5) hold relative humidity within practical comfort standards.

At present, many researchers including professional organizations involved in educational facility planning include the Council for Educational Facility Planning, American Association of School Administrators, Association of School Business Officials, Illumination Engineering Society, American Institute of Architects and Educational Facility Laboratory are involved with educational facilities, generating a considerable amount of projects and theories. However, the research effort has been dispersed without much coordination. In addition, all research based universities in the United States are taking active roles in promoting facility research activities that will lead to improving the learning environment of school children.

Today existing school buildings have a lack of climate control in the classrooms. During the early fall and late spring months, the temperature of the classrooms can reach the high ninety's. These temperatures create a very difficult learning environment. When a classroom reaches a temperature of ninety or above, the teacher and student, especially during the afternoon hours, lose their interest and energy for the lesson. The climate control, specifically, air conditioning in the classrooms will provide a healthier atmosphere for both the student body and faculty.

Purpose of study:

The purpose of this project is to determine if students' learning is enhanced by the presence of air conditioning in an educational atmosphere, as well as developing the cost and electrical feasibility of air conditioning an existing school. Research

through the years has shown that student achievements are much higher in a climate controlled atmosphere (Stockton and Mayberry, 1976; Brown, 1978; Arter, 1991). The students in improved thermal environments have made significantly fewer errors and required less time to complete their tasks than did pupils in the regular classroom. Students in a thermally controlled environment displayed a greater attendance rate as well as completing a larger portion of their curriculum (Peco, 1962; Wilson, 1963; Stewart and Curtis, 1964).

The classroom without a good learning environment has problems maintaining a productive educational atmosphere. The conditions of high temperatures, high humidity, and poor air quality do not contribute to a functional and productive learning environment. Teachers and students lose hours of instructional time on task because of these environmental conditions, resulting in a significant loss of completing the curriculum and activity goals for any specific academic year (Chan, 1996).

Converting an existing school into a climate controlled environment will create a better learning atmosphere for the student and teacher. The climate controlled environment will allow the teacher and student to get through a greater portion of the curriculum as well as a maintain a higher level of performance throughout the entire school year (Chan, 1996).

The climate controlled environment will also create an opportunity for the district to use the school year round for different in service workshops along with different types of programs for the community and student body.

Definitions:

A Good Learning Environment - Is an environment that has four basic qualities: visual, acoustical, aesthetic and thermal environments.

Acoustical Environment - Is a well designed environment free from external noise disturbance.

Aesthetic Environment - Is an environment that focuses on an appropriate use of pastel color to accommodate student learning activities.

Environmental Psychology - Is the study of how humane behavior, thinking, feeling and attitude change under different physical environments.

Thermal Environment - Is an environment that includes adequate air conditioning, heating and air ventilation in the classroom.

Visual Environment - is an appropriate lighting system in the classroom to facilitate students in focusing their tasks.

Limitations of the study:

The limitations of this study include the financial commitment of the district, along with developing an electrical schematic plan for the building in the district. The district has only so much money it can spend above the thorough and efficient cap without having to go to the public for a vote, and with the history of the Black Horse Pike District, a vote would not be the first option. Also, because Triton is an older building, any substantial infrastructure change would have to be approved by the State using current day codes. These new codes are very strict and could raise the cost even higher. This study will be confined to Triton Regional High School, but the

study can be used for any district as a guided format. The only changes a district will need to make from this study is the electrical schematic design for their building or buildings.

Another limitation of this study is being able to accurately assess students learning in and out of an air conditioned environment. There are too many uncontrollable factors to conclude that the achievement or lack thereof of a student is solely dependent on the thermal environment.

Setting of the study:

The Black Horse Pike Regional School District has an enrollment of approximately thirty - seven hundred students and a current school budget of over thirty - eight million dollars. The district is made up of three sending districts: Bellmawr, Gloucester Township, and Runnemede. The sending districts comprise the following percentages of enrollment: Gloucester Township 80%, Bellmawr 10%, Runnemede 10%.

The Black Horse Pike School Board is made up of nine members, equally divided for each of the sending districts. The district has two high schools, Highland Regional and Triton Regional both serving grades nine through twelve with one superintendent, one assistant superintendent, and one school business administrator.

The district has been in existence since 1957 when Triton Regional was built, followed by Highland Regional which was built in 1967. Each high school has one principal, three vice - principals, and seven supervisors each heading two departments.

The Black Horse Pike District is comprised of approximately 10% white collar, 85% blue collar, and 5% below blue collar region. The ethnic diversity of this region is comprised mostly of Italian and Irish Americans, with a smaller population of African

American, Asian American and Indian American citizens. The housing in the Black Horse Pike District is 82% single homes, 10% apartment dwellings, and 8% townhouse buildings.

The history of the Black Horse Pike Regional voting for school budgets is very grim. The school budget has not passed for the last twenty - five years with the exception of the last two budgets. The 1998 - 1999 budget was approved by nineteen votes and the 1999 - 2000 budget was approved by thirty seven votes.

Significance of the study:

Existing school buildings have a lack of air conditioning in the classrooms. During the early fall and late spring months, the temperature of the classrooms can reach the high ninety's. These temperatures create a very difficult learning environment. When a classroom reaches a temperature of ninety or above, the environment becomes more humid, air flow decreases, and the standard of health is impacted. These factors along with human nature and tolerance create a very difficult learning environment in which the student can achieve (Connors, 1983). Air conditioning the classrooms will provide a healthier and more enhanced learning environment for both the student body and faculty. A thermally controlled classroom will maintain air flow, humidity levels, and an over all standard of health. These factors along with general comfort will contribute to the students' learning and enhance the productivity throughout the school year (Connors, 1983).

Organization of study:

The intern will use the researched case study and interviews as foundation to present to the Board of Education and School Business Administrator in order to demonstrate the importance of such a project. After the data is presented on the

educational, health, attendance, and discipline benefits of a climate control environment, the intern will present the electrical and cost analysis of doing the project at once versus doing the project in stages.

The intern will use a neighboring school district (Sterling Regional High School) as the model school because of the demographical, economical and student population similarities. After the plan is submitted, the intern hopes to receive the approval of the committee to proceed with this project. If approval is not achieved, the intern will conduct a mock project developing all the costs and procedures as if the intern was actually doing the project for the district.

The school that is to be studied for the project is Triton Regional High School. Triton was built in 1957 and is a two story building which houses between fourteen - hundred and seventeen - hundred students. It is a blue - collar community with an average income of sixty to eighty thousand dollars and has a thirty percent population of senior citizens.

Chapter 2

Review of Literature

Context of Study:

A school building's condition and classroom environment affects student achievement and behavior, Certain facility design elements can improve the learning climate (Podolosky, 1938). There are many reasons for a climate controlled classroom: The improvement of learning and teaching efficiency, effective use of the educational plant for a greater part of the year, and more efficient use of space through compact building design. Five climate control techniques that are important in providing optimum teaching - learning environments: Control of individual classroom temperature within prescribed limits, the dilution of odors to an acceptable minimum, the cleansing of the air from dust, pollen, etc., an acceptable and uniform air pattern, and the control of relative humidity within practical comfort standards. These conditions make the teaching and learning environment very difficult.

One of the responsibilities of the teacher is to utilize every minute of their lesson with instruction and time on task. When a classroom reaches a temperature of ninety or above, teacher and student begin to lose their interest and energy for the lesson. Studies have shown that students' learning and productivity is enhanced when a better learning environment is provided (Peccolo, 1962; Howard and Burkett, 1987).

Modern school buildings are more able to meet the needs of a good learning environment today because they incorporate the latest innovative ideas and technology along with a controlled climate. Older facilities are obsolete and cannot meet the current educational needs without major renovation.

These renovations are slow to occur if at all, because of the high cost of school construction and the decrease in aid from the state. School facility planners are concerned about this recent trend and are working hard to research the relationship of a school building's age/physical environment and student achievement. Research establishes that students are affected positively or adversely due to visual, acoustical and thermal characteristics purposely or inadvertently built into the classroom environment (Earthman, 1995).

Teachers and administrators need to be aware of the surroundings due to the seven or more hours they and their students spend in a facility each day. It seems reasonable to assume that enhancement of the physical characteristics of the learning space will improve the teacher's ability to teach and the student's ability to learn as well as affecting the student's health, attendance, and discipline (Sewell, 1995).

The physical characteristics of the surrounding environment is only one facet of the learning space, the classroom environment has a greater impact on student learning and improvements made to that environment will enhance student achievement. A "good" learning environment consists of four main factors: visual, acoustical, aesthetic and thermal (Chan 1996).

The visual environment refers to appropriate lighting system in the classroom to facilitate students in focusing their tasks. One of the most critical physical characteristics of the classroom is the lighting. Glare, inadequate illumination, too much color contrast and improper maintenance of fixtures lead to lower - than - average student performance such as misinterpretation of the written word, whether on a handout or at the chalkboard. Trace amounts of ultraviolet radiation in classroom lighting significantly reduced the development of dental cavities and contributed to improved health which enhanced a sense of well - being and in turn improved student attendance (Hathaway & Fiedler, Wohlfarth, 1986).

Acoustical environment means a well designed environment free from external noise disturbance. There are two kinds of sound, impact and air - borne. Unwanted noise can reduce human energy and efficiency as well as affect the mental and emotional health of the teacher and student (Cohen, Sheldon and Lezak,1977). Carpet in the classroom controls noise caused by footsteps along with providing acoustical control and adequate distribution of sound. The floor cover prevented multiple reflections of sound caused, in man instances, by a hard floor surface and a hard ceiling surface. Other acoustical materials placed in strategic areas throughout the classroom diffuse sound created by those who are conversing (Rodman and Kunz, 1966).

The aesthetic environment focuses on an appropriate use of pastel color which affect student learning activities, human anatomy, student's health and efficiency. Color combinations for floors, walls, and ceilings affect the lighting in a physical structure (Wohlfarth, 1986). John's Hopkins Institute for Cooperative Research conducted a two year study (1962-1964) in two Baltimore schools to evaluate behavior and performance traits of 2,500 students. One school was painted conventionally, the second school was painted according to directions of a paint manufacturer. The results showed that color had an effect upon student population. The school painted by the manufacturer in a series of pastels with a concentration on the lighter shades of blue, showed a decrease in fights and discipline problems, while demonstrating an increase in attendance and academic achievement (Environment for Learning, 1966).

The thermal environment includes adequate air conditioning, heating, air ventilation, and regulation of moderate humidity levels to ensure physical comfort. Teachers will argue that the thermal environment is the most important of all, especially in a school plant where there is no air - conditioning. The temperature in a classroom can be insufferable during certain times of the year. Added to the

environmental temperature, is the temperature of 25 to 30 students and teacher in a classroom. High temperatures and increased humidity levels produce physiological and psychological stress which accelerated fatigue. Tired people work at a slower pace, exert greater effort and make more mistakes. The comfort index strongly influences the physiological state of the student and teacher. If the temperature is 72 degrees Fahrenheit, a relative humidity of 60% is acceptable. As air temperature rises, the humidity should decrease (Castaldi, 1977).

The New York Academy of Science conducted a five month study (April - September, 1964) to determine the physiological and psychological effects of the thermal environment on performance of workers placed in duplicate wings of a government building. One space was air conditioned and the other was not. The results showed an average student work increase of 9.5 percent in the air conditioned building, an error reduction of .9 percent and an absenteeism of 2.5 percent (Environment for Learning, 1966).

References and Review

A learning environment has direct and indirect impact on student achievement. The direct impact is associated with coloring, lighting, acoustics and thermal control. A good learning environment frees students from physical distress which allows them to concentrate on school work and induces students in logical thinking. Students in good learning environments have demonstrated higher achievement. A poor learning environment is usually dull in coloring, has inadequate lighting, and is noisy with fluctuating temperatures. Students in poor learning environments are under many physical constraints and only very few with tremendous discipline and determination can overcome the difficulties presented by a poor learning environment.

(Chan, 1996) claims in his study of eighth grade students placed in different learning environments that the indirect impact is the student's sensitivity to their learning environment. Students respond to good and poor learning environments by expressing positive and negative attitudes respectively (Ryan, 1991). With a positive attitude towards their learning environment, students learn with high motivation and are able to demonstrate better performance. Students dissatisfied with poor learning environments will have less interest and enthusiasm in learning.

One study done on the impact of a learning environment in relationship with student achievement was a study conducted by Dr. Charles Pecco in 1962. Pecco conducted a study of two sets of fourth grades from the state of Iowa in conjunction with the Iowa Center for Research in School Administration along with Lennox Industries Inc. and the Saydel Consolidated School District. These students were selected from the same school district and had the same academic ability based on their scores from the Iowa Basic Skills Test. The four groups were two low achieving and two high achieving groups of fourth graders. These groups were placed in a constructed two classroom school that was identical to the classrooms in their own schools. The only difference reported was that the environment of each classroom. The two groups were not told which group would be in the good learning environment classroom and which group would be in the conventional learning environment. The groups were given the exact same tasks at the exact same time in the exact same order. The experiment lasted three months from March 1st until June 1st the results were significantly in favor of the groups that were in the good learning environment.

The high achieving group in the good learning environment scored five to ten percent higher on most of the tasks, and as the experiment went further along the percentages began to increase. The low achieving group in the good learning environment only showed a three to seven percent increase, but again as the experiment continued the percentages increased.

(Bowers and Burkett, 1987) Howard J. Bowers and Charles W. Burkett conducted a study on the relationship of student achievement and characteristics in two selected school facility environmental settings. They found that students are affected positively or adversely by the visual, acoustical, and thermal characteristics of the classroom environment. During the 1986 - 87 school year, 280 fourth and sixth grade students were housed in two separate school facilities, one being the oldest and the other being the newest in a rural Tennessee county school district. These students were tested to determine if the physical environment of a school was related to student achievement, health, attendance, and behavior. The results of the data demonstrated a significant difference existed between students at the two elementary schools in regard to the relationship between the physical environment and student achievement. Scores in reading, listening, language, and arithmetic showed a significant difference with the students in the modern building performing much better than the students in the older school. The former students proved to have a better record in the areas of health, attendance, and discipline when compared to the latter students.

Other studies described below have shown that pupils in improved thermal environments have made significantly fewer errors and required less time to complete their tasks than did pupils in the regular classroom. In the 1975 -76 school year, Dr. Chan conducted a study where 191 standard schools containing eighth graders from the state of Georgia were given the Iowa Test of Basic Skills.

The study classified the schools into one of the following environmental categories: (1) Modern Learning, (2) Obsolete learning Environment and (3) Half Moderate Learning. The main differences among these three categories of learning environments are in coloring, lighting, acoustical control and air ventilation. Category (1) Environment and Category (2) Environment represent the two extremes of good and poor learning environments where as Category (3) stands for a medium learning between Categories (1) and (2). Student achievement data were also collected by school and were analyzed statistically.

Results indicated that students achieved highest in Moderate Learning Environment and lowest in Obsolete Learning Environment. Student achievement in Half - Modern Learning Environment was right in between Modern Learning and Obsolete Learning Environment.

The study showed that pupil achievement was consistently higher in an air conditioned school as opposed to that of a non air conditioned school. The air conditioned environment enables the students to increase their productivity and enhance their learning, along with providing a healthier working environment for the entire school district.

Other research investigating the effect of a climate controlled environment in relationship with student achievement, health, attendance, and discipline (Maurice Wilson, 1963; Stuart and Curtis, 1964; N.H. Whitesides and The Houston Lighting Company, 1967; The New York Educational Facilities Laboratories, 1971; Killough, 1971; Jefferys, 1971; Sudbury Study, 1972; Ertel, 1973; Plumley, 1978; Maiden and Foremen, 1998; The National Education Association, 1998; The Environmental Protection Agency, 1998).

Examining these case studies (Peccolo, Chan, Educational Laboratories Facilities Report), the intern conducted preliminary interviews with two teachers who have taught in a non - climate controlled and a climate controlled classroom. Conducted to give the Board of Education Committee and School Business Administrator a local view of these studies as well as the interviews demonstrated the positive affect a climate controlled classroom has on students and faculty.

Some research investigating the effect of a climate controlled environment in relationship with student achievement, health, attendance, and discipline that showed no significant evidence of scientific proof to support the belief that the physical environment of a school affects the achievement and behavior of students and teachers (Stockton and Mayberry, 1976; Brown, 1978; Judith Arter, 1991). Carol Weinstein (1979) gathered data concerning spatial behavior and the effect of student density on student attitudes, yet, found no consistent evidence regarding the impact of the environment on student achievement.

An analogous study, Carol McGuffey (1978) conducted a study involving the relationship of crowding, the age of the school building, and the visual, acoustical, and thermal environment to student behavior and learning activities. The effect of the environment on individuals was possible through the research of certain variables, but there was no consistent pattern of evidence to substantiate concrete theory that a physical environment genuinely effects student performance.

Some of these aforementioned studies are describe as follows in some detail: Thomas (1962) said after sampling 206 secondary schools, the relationship of student achievement and over thirty variables including school building age found significant relationships between student achievement and physical environment.

Some other studies using the relationship of school buildings and student achievement are: Burkhead, Fox and Holland (1967) investigated the relationship of school building age and student achievement in 138 secondary schools and found results that indicated significant relationship between a school building's age and student reading achievement.

Another study, Michelson (1970) states through an investigation that 32 student achievement related variables in 597 white and 458 black students that he found significant relationship between the age of a school building and verbal scores of these sixth grade students.

In accordance with the previous studies, Guthrie, Kleindorfer, Levin and Stout (1972) said school buildings are essential educational resources impacting on student achievement. Their study of over 50 students demonstrated a significant relationship between school building age and reading, mathematics and verbal achievement.

Similarly, Plumley (1978) focused his study on the elementary school buildings in Georgia. Plumley's study found five per cent of the variance in student achievement attributable to the school building's age and the physical environment it presented.

Along with student achievement, the issue of health and air quality is addressed when a good learning environment is provided. The NEA Today (1999) says a cooperative partnership between the National Education Association and the United States Environmental Protection Agency to help educators understand the importance for cleaner air inside school buildings will not only improve student achievement but will create a more healthy environment. They state the importance of clean air for children to breath, and how air conditioning and air ventilation would help to clean and purify the indoor air of a school building. NEA only touched on air conditioning and the benefits from it.

The benefits the NEA spoke of was primarily health oriented, but did mention some evidence of air conditioning not only being healthy but also contributing to the improvement of student performance.

The Memphis Business Journal (1998) says that focuses on school construction projects planned by the Memphis City School System are being done because of the belief of the direct impact a physical environment has on student achievement. They detail the total cost of projects; Expansion of air conditioning and adding more classrooms to comply with the state's Educational Improvement Act. The Memphis Business Journal stated how air conditioning is needed and how it will improve the school districts performance academically and from a health stand point.

A thermally controlled classroom has a positive impact on student's learning. If students are to achieve academic success shouldn't they be provided with an environment that helps facilitate success. In today's society it is rare for an adult to work in an office that is not air conditioned. Shouldn't the same environment be provided for children in their "work place", the classroom.

As a classroom teacher for over 10 years, I have seen extensive amounts of money spent on programs and curriculum. These monies for the most part have been well spent and have helped enhance student achievement. However, no matter how dynamic the teacher or how pioneering the curriculum is, it is only part of a good learning environment. A good learning environment is only complete when there is a balance between good curriculum, good teaching practice, and a building that provides physical comfort and health.

Chapter 3

The Design of the Study

General Description:

A school building's learning environment can affect student achievement and behavior positively. Strategic facility design elements can also enhance climate and student learning. Reasons cited for advocating a climate controlled classroom are: (1) the improvement of learning and teaching efficiency, (2) effective use of the educational plant for a greater part of the year, and (3) more efficient use of space through compact building design. Further - Five climate control techniques are cited as providing optimum teaching - learning environments: (1) control of individual classroom temperature within prescribed limits, (2) dilute odors to an acceptable minimum, (3) cleanse the air of dust, pollen, etc. (4) provide an acceptable and uniform air pattern, and (5) hold relative humidity within practical comfort standards.

There is a tendency to spend a great deal of time planning for curriculum enhancement for the benefit of the student, which is well and good. However, the physical environment is assumed by most educators to be of great importance (Castaldi,1977). The assumption is that students are affected positively or adversely due to visual, acoustical and thermal characteristics purposely or inadvertently built into the classroom environment. The learning environments have an impact on learning activities.

With technologies of modern times, improving the learning environment by controlling major environmental factors should not be difficult. There is a need to improve students' learning environment to meet the physical needs of learning activities. Disregarding the improvement of the learning environment totally ignores the physical difficulties of learning.

Purpose:

The purpose of this study is to develop a plan for air conditioning Triton Regional High School to the Black Horse Pike Regional Board of Education. The researcher developed a plan which includes research and data that supports the relationship between a good learning environment and student achievement. The plan includes the economical and electrical feasibility of air conditioning the existing school.

Development and Design:

The intern interviewed the Black Horse Pike Regional Board of Education, the Facility Committee at Sterling Regional High School, the electrical contractors, school electricians, school business administrators, superintendents, and faculty members from Sterling Regional High School. The intern researched data supporting the theory that a good learning environment enhances student performance.

Interaction with the Black Horse Pike Board of Education, Superintendent, and School Business administrator will enable the interviewer to develop a better understanding of the various board member's and administrator's views on how to improve a good learning environment along with the physical characteristics of the school building.

Discussions with the Facility Committee along with other members from Sterling Regional High School, will provide the interviewer with the necessary information to help validate the importance a climate control has on improving a good learning environment and the physical characteristics of a school building.

The information the researcher collected from the Sterling Regional School District provides pertinent geographical and demographical data that establishes the influence a good learning environment makes to enhance student's performance. The data also explains the benefit a climate controlled environment has on the improvement of the health and mental attitude of the faculty and student body during the months of high temperatures. These interviews are with people that teach in a neighboring district before and after it became a climate controlled environment and will provide practical information along with the supporting researched data on climate controlled environments.

Communication with the electrical contractors and school electricians from Triton Regional High School will provide the interviewer with an outline detailing the economical and schematic feasibility of this project. These interactions will provide information needed to answer any concerns the Black Horse Pike Board of Education members may have relating to the practicality of the project.

Data Collection:

After coding the interviews with both the Black Horse Pike and Sterling Regional Districts, the researcher triangulated the data and formulated thoughts and procedures on presenting the data from the Sterling District to the Black Horse Pike District.

The researcher, after interviewing the faculty members from Sterling, toured the building with the different faculty members. The researcher witnessed the building being used at an 85 to 90 percent capacity during the summer months. The researcher observed a full summer school curriculum being applied to students from all over South Jersey, along with distance learning and advance placement classes being held for students who desired continued learning during these summer months.

In another wing of the high school, staff development and training for certified and noncertified personnel was taking place. The workshops ranged from the latest techniques in teaching certain subjects to brushing up or advancing knowledge in computer programs the district uses such as word processing, spread sheet, grade books, and video technology. The faculty members and administrators who were taking me on the tour explained that these workshops are offered every one to two weeks for their entire staff and some workshops go on for the majority of the summer. The administrators explained the staff does not receive payment for all these workshops, but because of the climate control and availability, about half to three quarters of the staff take advantage of the workshops. To confirm this statement, I spoke with a few members of the faculty who were participating in these workshops. Of the ten members I spoke with, seven were not being paid and three were. The seven voluntary members were learning a grade book program and because of the climate control these teachers were willing to give their time freely. The three paid teachers were learning the power point program and commented they would have taken the workshop without pay because of the climate control.

After viewing these different programs and coming back at different times in the summer, I researched how many Black Horse Pike students might have chosen the Sterling summer school program over the Black Horse Pike summer school program because of climate control. Unfortunately, I only found two students out of 326 that

were using Sterling instead of Black Horse Pike. The one student selected Sterling because it provided the course she needed to make up while Black Horse Pike did not. The other student chose Sterling because of the climate control and his parents were willing to pay the tuition to go to Sterling's program. I spoke with fifty different students in the Black Horse Pike summer school program. I asked them why they did not chose a climate control environment over a non - climate control environment? Of the fifty students, twenty did not have a means of transportation and their parents would not transport them because of their anger for having to go to summer school. Twenty - five had the transportation, but did not have the money for tuition. Five, if they had known about the possibility of Sterling in time would have paid for it and driven themselves to the Sterling program. All the students including the last five stated if the money and transportation was available, they would all go to the climate controlled summer program.

I presented this information to the Black Horse Pike Superintendent and Director of Curriculum, and Black Horse Pike Board members. I explained how the climate control atmosphere was not only helping student achievement during the school months, but also how the Sterling District was getting a twelve month use of their building by providing workshops and summer programs for their students in regular and advance curriculum courses. The Director of curriculum and the Committee for the school facility assured me if there was money in the budget, they would consider the plan.

Discussions and with the school electricians help provide information on how the school should be wired, considering the safest and most economically practical procedure. The aspects of the discussion analyzed the best way to thermally control the school's environment, taking into account whether the air conditioners should be purchased in bulk, or if the project is going to be done in stages, purchasing the units

as needed. Other aspects of the discussion considered the electrical wiring, the labor cost and determining the most practical and convenient manner in which to prepare the building for this project.

After analyzing the data and coding the interviews, I formulated the different options available to the district and discussed this information with the different administrators and Board of Education. In the discussion with the Board and the Administrators, I addressed the researched data on the effects a climate controlled environment has on student achievement, the success a neighboring district (Sterling Regional) has enjoyed with their students as well as the use of the building throughout the year, and the infrastructure plan of wiring and installing the air conditioning units. The administrators and Board members listened respectfully, but it was obvious the only way this plan would be seriously considered would be if a grant or bond money became available.

Summary:

The Superintendent, School Business Administrator, and Energy Committee of the Board of Education were given a presentation of all the researcher's data. The information on academics and economics support the theory that a climate controlled environment enhances students' learning.

The data pointed out the improvement in the school's attendance as well as the mental and physical attitude in both staff and student body. The presentation illustrated the history and studies that have been developed and validate this type of project . The interviews and information obtained from a neighboring school district support the researcher's belief that a climate controlled environment enhances student learning. The intern interviewed teachers from the Sterling Regional High School District that have taught before and after a climate controlled environment was established.

The teachers chosen for the interview were from the math and english departments, taught academic and low level students, and taught in the district before and after the climate controlled environment was established. The criteria developed was to concentrate on the different type of subjects (math, english) and the thought process they demand, different levels of student ability, and taught in the district before and after the climate controlled environment was established. The teachers were asked three questions:

1. Has air conditioning made a significant improvement in your students' performances and your performance as an educator?

2. What is the greatest change teaching in an air conditioned environment versus a non - air conditioned environment?

3. Do you feel all schools should be air conditioned?

The research provided the Superintendent, School Business Administrator, and energy committee of the Board of Education the option of using a step design plan or a one time implementation. Each plan laid out the economical, electrical, and practical aspect of providing the district with a climate controlled atmosphere. The research demonstrated implementing the project can be accomplished without financial burden, and show an increase in productivity in all facets of the academic arena, as well as a twelve month use of the facility.

Chapter 4

Introduction

Most existing school buildings lack the necessary qualities in their classrooms to provide a good learning environment (Bowers, 1987). During the early fall and late spring months, the temperature and humidity of the classrooms create a very difficult learning environment (Burkett, 1987). Providing a good learning environment, specifically air conditioning in the classrooms, enhance student learning and provides a healthier environment for both the student body and faculty (Earthman, 1986).

The intern researched studies in the area of thermal environment and the relationships it has with student achievement. These studies were chosen for a specific reason. In the past, presentations for thermally controlled classrooms were presented to the Black Horse Pike Regional School District Board of Education solely on the basis of student / teacher comfort. The past presentations did not include any data on academic achievement, health, or air quality issues. I felt if I was going to make any headway with the Board, I must present data relating thermal control to academic achievement and health issues instead of recycling an older presentation that the Board has already heard and dismissed. These studies include experiments conducted by Dr. Charles Pecco (1962), Dr. Tak Cheung Chan (1996), and Dr. Maurice Wilson (1963), along with articles and research reports by Dr. Howard J. Bowers (1987), Dr. Glen Earthman (1986), and Dr. Charles W. Burkett (1987) all obtained data on the positive affect a good learning environment has on student achievement.

Pecco (1962) conducted a 3 month study from March 1st to June 1st on two sets of fourth grades from the state of Iowa. This study was sponsored by the Iowa Center for Research in School Administration along with Lennox Industries Inc. and the Saydel Consolidated School District. The study was held in a two classroom school building built by the Lennox company specifically for this experiment. The classrooms were modeled exactly to the specifications of the Saydel School District classrooms. The two sets of fourth grades were selected from their Iowa Basic Skills Test scores. The two groups were of the same academic ability, two were high achieving groups and two were low achieving groups. The students were given the exact same type of work at the exact same time of the day. The skills and tasks came from the Saydel curriculum, and were taught in the same manner as in the actual Saydel classroom.

One classroom was kept at an ideal temperature range of 72 to 78 degrees. The other classroom was the actual temperature of the Saydel classroom for that day. The results of the experiment showed the high achieving group in the good learning environment scored five to ten percent higher on most of the tasks, and as the experiment went further along the percentages increased. The low achieving group in the good learning environment showed a three to seven percent increase, but again as the experiment continued the percentages increased.

Similarly, Chan (1996) studied the affects of a good learning environment and the impact it has on student achievement. This study dealt with the environment variables of lighting, sound, colors, and physical comforts such as air conditioning, air ventilation, and heating. Dr. Chan conducted a studied on 191 standard schools containing eighth graders from the state of Georgia who were given the Iowa Test of Basic Skills. The data for his study was obtained from the results of the eighth grade Georgia pupils in the Iowa Test of Basic Skills in 1975 - 76 and from demographic information obtained from a questionnaire completed by the principals of Georgia

standard schools containing the eighth grade. The questionnaire asked about the pupils's immediate environment: whether the eighth grade instructional rooms were air conditioned, whether they were carpeted, whether they were installed with fluorescent lighting, whether they were painted with pastel colors, and the final question asked about the percentage of paid pupil participation in the school lunch program in eighth grade. The results of Dr. Chan's study was the eight graders that were in the air conditioned classrooms achieved significantly higher than the students that were not in air conditioned classrooms. However, Dr. Chan's study did not find significant changes with the other factors of a good learning environment.

A Report written in March 1971 for the Educational Facilities Labs, Inc. in New York advocates air conditioning to improve educational productivity. The report, which included Dr. Pecco's experiment cites educational experiments that substantiate the benefits of air conditioning in promoting learning. One experiment in the article was conducted at Kansas State University by researchers R.D. Pepler and R.E. Warner of Dunlap and Associates. This was a controlled experiment of 72 college students that were subjected to controlled temperatures ranging in six degree increments from 62 degrees Fahrenheit to 92 degrees Fahrenheit while humidity was kept at a relative 45% throughout all tests. The students showed their most significant performances at 80 degrees Fahrenheit with the following learning indexes improved: time to complete assignment; reduction of error rate; and effort required to learn which was subjectively judged.

Another more ambitious experiment conducted by Pepler and Warner (1971) was designed to eliminate extraneous factors, correlated air conditioning with improved academic performance at elementary, junior high, and high school levels. Staged at two one month intervals, in late spring and early autumn, this experiment demonstrated the benefits of air conditioning in the moderate Portland, Oregon,

climate. Academic achievement was measured in sixth grade spelling, seventh grade social studies, eighth and ninth grade Spanish, and in high school Latin, general mathematics, and geometry. Extraneous conditions were standardized wherever practicable: spelling tests were given at the same time in the air conditioned and the non - air conditioned school, and Spanish was taught by the same teacher in both junior high schools. During the experiment, the researchers found that the students in the good learning environment achieved at a greater percentage, approximately 6 to 9 percent than the students that were not in a good learning environment. The experiment also discovered that smaller temperature variations approximately 2 to 3 degrees affected academic performance more in the air conditioned schools than larger temperature variations 8 to 10 degrees in the non - air conditioned schools.

This report for Educational Facilities Lab inc. writes about several other studies that all buttress the same findings about a good learning environment and student achievement. A common theme throughout the data analysis and all the experiments are thermal control is not the sole solution for student achievement. Every researcher and writer emphasized thermal control as an important step in obtaining higher student performance, but many other steps go into the process.

In correlation with the researched data, I interviewed faculty members and administration from a neighboring high school district (Sterling Regional) which had implemented a climate control plan. The first group of people from Sterling I interviewed was the English teachers. This group specifically taught freshman/junior fundamental classes and junior/senior honors English classes. When the data from these interviews were coded and analyzed, the information demonstrated the following: The most significant changes in the classes was the overall academic performance and ability to get through the entire or the majority of the curriculum. During the years of teaching in an air conditioned environment, the freshman/junior

fundamental classes achieved at a 4 to 6% higher rate as an average, and the junior/senior honor classes achieved just a little higher at 5 to 7% as an average. In the years of non - air conditioning, the fundamentals would usually get through 80 to 85% of the curriculum as opposed to 95% completion of the curriculum in the air conditioning. The honors class in both air and non - air conditioned got through the entire curriculum but with lower achievement levels. The data from the second part of question one showed since the air conditioned environment was established, the group felt more energetic throughout the year and had a better attitude and outlook during the months of teaching in the latter part of the school year. The english teachers and I discussed in length how they felt mentally and physically drained during the months of May and June. The english group acknowledged part of their feeling was caused by the typical drain of a school year. The other factor however was the physical condition of the classroom and the extra effort needed to keep the classes on task because the kids are unmotivated due to the physical environment of the classrooms. The english group freely admitted they would use sick and personal time on Fridays and Mondays to help get through the later months. I tried to verify absentee rate with the business office, but the SBA would only give me information on the entire faculty rather than specific groups. However, the data did show an absentee decrease of 2.8% during the months of April, May, and June since the air conditioning was installed.

The other aspect of our conversation dealt with the mood of the classes since the air conditioning was installed. The teachers expressed how good it felt to be in their classrooms and see the heat coming up from the parking lots. The teachers addressed how the students hated to switch classrooms because the hallways were so uncomfortable, and students coming from gym or lunch expressed excitement about being back in class with air conditioning. The group noticed a decided

difference in their classes work ethic and attitude toward schoolwork. The classes still complained about work, but it was the typical banter of students and not the rhetoric of the heat. The groups feeling was supported by the amount of the curriculum all the classes got through. The lower achieving groups got through more of the curriculum while the higher achieving groups accomplished the same amount of work but at higher levels of accomplishment (Sterling Regional High School, 1999).

The data answered the second question with primarily the same response as the first question. The greatest change teaching in an air conditioned environment is the student performance, both the teacher and student stamina, and the demeanor of the classes. The interviews stated that prior to air conditioning being installed in the classrooms students were less energetic and more irritable during the late spring months. A teacher from the english group questioned "If prisons can be air conditioned, shouldn't our children receive at least the same treatment".

After interviewing the english teachers, I interviewed the superintendent, school business administrator and maintenance supervisor to obtain the history behind the thermal control plan for Sterling Regional High School.

The Sterling Regional High School District began a plan to air condition the entire school in 1987 using window units in each classroom starting with rooms that were in the sun most of the school day. The plan is 98% completed with only a few rooms, the cafeteria and gymnasium being two of the rooms not having air conditioning. These rooms are located away from the sun and are not scheduled for as much use during the early fall and late spring months.

The cafeteria and gymnasium were slated last on the original plan because of their size and the fact they are non - instructional areas. The air conditioning plan was done in stages each school year with a completion goal of 95% for the year 1995 when the original plan was developed. The total cost of air conditioning the entire

school including the 2% of rooms that are not completed was approximately \$220,800, which included electrical upgrade and outside contractor work. This cost does not include the monthly utility and yearly maintenance of the units. The averaged utility cost rose approximately 15% annually with an average maintenance cost of \$5,500 a year (Giambre,1999) .

The original plan was developed and approved in May of 1986 by the Sterling Regional High School Board of Education and then Superintendent of Schools Dr. G.A. Dinich. The School Business Administrator who developed the original plan was Mr. J. Amato. Both individuals have since retired. The plan was completed under the administration of Mr.G. Kasprack, Superintendent of Schools, and Mr. J. Giambre, School Business Administrator. The original plan had two ideas. The first idea was to air condition the classrooms with window units, while the second option was to centralize the air conditioning with a new vent system. The new vent system was to expensive at the time so the Board of Education decided to use window units. The school's in - house electrician did a power analysis of the school and had to upgrade 95% of the school's power supply. This upgrade was not caused solely by the air conditioning project, the school also knew that in the future there would be a need for more power because of technology and the growing use of computers. The power upgrade and new electrical wiring cost approximately \$98,000. Once the school was electrically capable of handling the air conditioning, the district attempted to install air conditioning in a wing of the school at a time. A wing consists of twelve classrooms. This was accomplished most of the time but due to budget defeats and other unforeseen variables the plan was altered and some wings were only 95% completed until the following year or not at all. The classrooms that are not air conditioned are expected to be completed by August of 2000, with the cafeteria and gymnasium projected in the year 2001. The intern was unable to obtain a copy of the electrical

plans for Sterling before the air conditioning was installed because they were not available.

When the administrative interviews were complete, I interviewed the math teachers who teach sophomore geometry classes (an academic group) and fundamentals math (a lower achieving group). These responses were coded and analyzed with the following themes: The most significant changes the data demonstrated was the academic performance and ability to get through the entire curriculum with the students still maintaining similar grade distribution . During the years of teaching in an air conditioned environment, the fundamental classes did not show significant improvement academically, but these class averages were similar in May and June as in September and October. The math teachers felt this was academic improvement because in the non - air conditioned years the fundamental classes production dropped significantly in the months of May and June.

The data on the geometry classes showed improvement during the air conditioned years of 6.2 to 8.4% as an average. The data showed the group has always driven through the curriculum to completion, but in the years of non - air conditioning the productivity in the latter months dropped approximately 5.7%. The data showed with air conditioning, the classes still get through the entire curriculum but with higher accomplishments and levels of performance as demonstrated in their grades at an increase of 2.9%.

The math teachers answered the second part of question one with much the same response as the english teachers. Since teaching in an air conditioned environment, the math teachers also have more energy throughout the year and maintain a better attitude and outlook during the months of May and June. However, the math data also touched on the subject of allergies. Since the air conditioning years, 92% of the math group allergies have not caused any significant problems for

them during the school day. In years before the air conditioning, approximately 3.7% of the math teachers were sent home or did not come in at all because of these afflictions (Sterling Regional, 1999). After the math teachers brought up the subject of allergies, I went back to the english teachers in hopes of finding a similar result. Unfortunately, the english teachers that were interviewed did not suffer from allergies.

Question two, which dealt with the most significant teaching change in a thermally controlled environment, was the same response as in question one and as the english group responded. The greatest change teaching in an air conditioned environment is the student's endurance, and the teacher's and student's attitude throughout the year.

The response to the last question of the interview demonstrated an adamant yes from the math teachers. The math group added, they did not know how they survived teaching summer school all those years without an air condition environment.

Summary:

The data used from the interviews at Sterling do not address every possible variable or situation and certainly should not be used solely for evidence to begin a thermally controlled environment. These interviews were conducted for use as supporting material for the researched experiments. The groups at Sterling are current day teachers who I felt brought a touch of reality and "closeness to home" so to speak to the presentation for the Board of Education. Some of these teachers and administrators from Sterling live in the Black Horse Pike District and some even know Board Members personally. I felt this personal connection along with the researched studies help tie together the hardcore scientific data with supporting local evidence of why a thermally controlled environment and the physical characteristics of a school building is important to a child's education.

Chapter 5

Introduction

Conclusion:

A school building's learning environment can affect student achievement positively or negatively (Bowers, 1987). During the early fall and late spring months, the temperature of the classrooms can reach the high ninety's. These temperatures along with high percentages of humidity make the teaching and learning environment very difficult (Burkett, 1987). When a classroom reaches a high temperature with uncomfortable humidity, the teacher and student lose their interest and energy for the lesson (Earthman, 1986).

The intern has concluded through active research and interviews that students are affected positively or adversely by the visual, acoustical, and thermal characteristics of the classroom environment. Differences exist in student achievement regarding the relationship of physical characteristics in a classroom (Chan, 1980). Improvements in reading, listening, language, mathematics, spelling, rate of error, and rate of completion time are interrelated when a classroom has a good learning environment (Maiden, 1998).

Students in schools where special attention has been given to the physical environment experience a greater degree of success in the academic realm of the curriculum as well as attendance, discipline and health (Maiden, 1998). Educational consultants, architects and administrators should be apprised of the importance attached to the compatibility of physical environment, learning and other characteristics regarding students living in the contemporary school facility.

Implications of the study:

The intern through active research and interview developed an air conditioning plan for the Black Horse Pike Regional School District, specifically Triton Regional High School. The Black Horse Pike Regional School District has an enrollment of approximately thirty - seven hundred students and a current school budget of over thirty - eight million dollars. The district is made up of three sending districts: Bellmawr, Gloucester Township, and Runnemede. The sending districts comprise the following percentages of enrollment: Gloucester Township 80%, Bellmawr 10%, Runnemede 10%.

The Black Horse Pike School Board is made up of nine members, equally proportioned for each of the sending districts. The district has two high schools, Highland Regional and Triton Regional both serving grades nine through twelve with one superintendent, one assistant superintendent, and one school business administrator. The district has been in existence since 1957 when Triton Regional was built, followed by Highland Regional which was built in 1967. Each high school has one principal, three vice - principals, and seven supervisors each heading two departments.

The Black Horse Pike District is comprised of approximately 10% white collar, 85% blue collar, and 5% below blue collar region. The ethnic diversity of this region is comprised mostly of Italian and Irish Americans, with a smaller population of African American, Asian American and Indian American citizens. The housing in the Black Horse Pike District is 82% single homes, 10% apartment dwellings, and 8% townhouse buildings.

The history of the Black Horse Pike Regional voting for school budgets is grim. The school budget has not passed for the last twenty - five years with the exception of the last two budgets. The 1998 - 1999 budget was approved by nineteen votes and the 1999 - 2000 budget was approved by thirty seven votes. Triton Regional High School is a two story building with approximately 72 classrooms, two gymnasiums, one auditorium, and one cafeteria that is currently not air conditioned. Triton houses 145 faculty members and between 1,400 and 1,700 students.

The intern with the help of Triton's in house electrician and an electrical contractor, Cooney & Sons, developed a cost analysis and electrical power plan for installing window units in all the classrooms that did not already have air conditioning in them. The cost of each window unit, if bought in bulk, whether the Board of Education was going to air condition Triton at once or in phases would be \$27,000 (\$375/unit) for the classrooms. The gym and cafeteria would be air conditioned using industrial units that would range in price from \$3,500 to \$7,500 for each unit. The cost of purchasing the window units at different times could not be determined because the market price could not be predicted. The intern suggests purchasing the window units in bulk the next winter months because of the deflated prices in the winter and putting them in storage because of the savings and the district having the necessary storage facilities. The approximate cost of upgrading Triton's power supply to handle the additional electrical draw would be \$145,000 (Cooney, 1999). This cost includes labor and materials. These prices are an approximation, Cooney & Sons contractor could not give a detailed bid unless the project went out for official bid. This is only a proposal and not an official board approved action, therefore bids cannot be sent out or received.

The intern's plan suggests that the district wire the school in phases and purchase the air conditioners at one time. The Black Horse Pike Regional School District recently had a bond referendum passed which includes wiring upgrades for technology. These wiring upgrades will allow some portions of the school to handle any additional electrical needs including the anticipated draw for the incoming technology. The portions of the school that can not handle the additional draw will be wired after the school is reevaluated electrically for classrooms that still need air conditioning units. Waiting for the upgrades from the bond referendum to be completed, an anticipated 35% of the school will already have the necessary power supply for the technology and air conditioners. This will save the district approximately 15% of the cost of wiring the entire school at once (Cooney, 1999).

The intern's plan calls for the second story of the building to be addressed initially. The second story is the warmest part of the building during the early fall and late spring and is already capable of handling the needed power for air conditioning. After the second story is completed, the wings will be done according to sunlight exposure and amount of use for instructional time. The cafeteria and gymnasium will be the last sections done because of their size and their limited instructional use. The intern's time line for this project is three years barring any major financial problems occurring.

Leadership Developed:

The intern using active research and interviews developed leadership skills in questioning techniques, fact finding, categorizing information, and retention of relevant data. The intern developed and learned about the appropriate procedures for selecting and using the professional services of architects, engineers, electrical contractors, construction managers and other professionals outside the educational

field. The intern experienced “school politics” and how the inter workings of the chain of command is used when developing an educational or structural proposal. The intern developed leadership skills in understanding the roles and responsibilities of outside professionals and their relationship with school districts, school administrators, and school boards. As this project unfolded, the intern experienced how a business administrator must follow certain rules and responsibilities when dealing with outside professionals. The first experience came about the bid process. The state mandates that a project over \$12, 000 must be submitted for bid. Once the project is submitted, the bids come in a sealed fashion and read aloud at a public meeting with most of if not all the bidders present. After the bids are read, the company or companies with the low bid must be awarded the contract unless there is substantial documentation listing reasons this company should not be awarded the contract. Also, if the particular company did a past project for the district and there is substantial documentation stating a bad history between the district and the company the district can award the bid to the next lowest bidder. The intern and the district must now deal with communities members that bid on this project but did not get awarded the contract because of this low bid law. This creates much tension though the community especially during Board of Education meetings and budget voting results. Another part of the leadership skills is dealing with the local unions and the fact that the company that is awarded the contract might be using nonunion labor. When this happens, it is the business administrator that must face all the questions and accusations from these local union members.

The intern also discovered during this project that if the district did not hire a construction management firm or a clerk of the works which is a person that is knowledgeable about the type of work the project deals with, then the business administrator must be handle and be accountable for the product the company that

was awarded the bid produces. When this occurs, and the business administrator also becomes the overseer of the project, the business administrator must utilize leadership skills in handling construction workers, municipal and state officials, and the Department of Education to be sure all the rules and regulations are being adhered to (Giambre 1999, Heston 1999).

Organizational Change:

The Superintendent, School Business Administrator, and energy committee of the Board of Education reviewed the intern's proposal. The district is now aware that climate control is not just an issue of comfort but has a direct impact on student achievement. The organizational change cannot be determined until the plan is implemented. This study made a significant change in the awareness of the relationship between environmental characteristics and student achievement. Plans to air condition the district have been presented before, but economics and physical comfort were the only issues addressed, as opposed to student achievement combined with health issues.

This plan introduced the points of the relationship between a good physical environment and student achievement as well as the health issue. The plan presented case studies, experiments, and data from a neighboring district to validate the relationships of student achievement and health with a good learning environment.

The study of classroom environment should be continued and unified in future curriculum plans and district goals. At the present time there is information and data that show the positive relationship between student achievement and a good learning environment. The data however is not coordinated to make the needed impact at the federal, state, and local levels. Organizations such as the U.S. Environmental Protection Agency, The National Education Association of Health Information Network,

The Council for Educational Facility Planning, The American Association of School Administrators, and The Association of School Business Officials need to organize and inform the federal and different state education departments of the importance of a good learning environment and student achievement. Once this is accomplished, these same organizations must convince the proper authorities that funding is necessary to alleviate the local tax payer and allow our school's to give the students one more advantage in their educational career.

The implications of this study is to make the Black Horse Pike Regional School District and other school districts aware that climate control and physical characteristics of a school building are just as important as a good text book or computer to a child's education. This study is a demonstration of researched findings, neighboring implementation, and professional design stating that a climate controlled environment and attention to the physical characteristics of a school building will contribute to a child's education and not break a school district's free balance of school budget in the process. This project is to be used as a guideline for any school business administrator or anyone concerned about their child's education for the justification of creating a climate controlled environment as well as developing a facility plan to not only take care of outside portion of their school but the infrastructure as well. This study provides information on research findings that support climate control and student achievement as well as an outline or at least ideas to implement such a plan in a school district.

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Biographical Data

Name	Dennis M. Vespe
High School	Sterling Regional High School Somerdale, NJ
Undergraduate	Bachelor of Arts Mathematics/Secondary Education Glassboro State College Glassboro, NJ
Graduate	Master of Arts Mathematics/Secondary Education Rowan University Glassboro, NJ
	Master of Arts School Administration Rowan University Glassboro, NJ
Present Occupation	Mathematics Teacher Triton Regional High School Runnemede, NJ