Can an Architect Design a Space that will Unconsciously Create a Mood that Would Motivate People to be More Productive?

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Abstract

Can an architect design a space that will unconsciously create a mood that would motivate people to be more productive is the question for which the author of this thesis has conducted research in many disciplines. The documentation for the answer to this question was derived by using the results from a behavioral science, which was a three-part survey, and the results from three physical sciences which included experiments that involved environmental influences pertaining to illumination, HVAC, and acoustics. This research includes reference to architecture for aesthetics and wayfinding; anthropology for the Neanderthal and Java man; acoustics for sound; archeology for earliest shelter at Catyl Huyuk; urban planning for the development of towns; mechanical engineering for HVAC environmental systems; electrical engineering for illumination; acoustics for controlling sound and noise pollution; psychology for perception of understanding of the environmental factors that transmit stimuli to brain; and medicine for the understanding of how environmental influences can cause hormones such as cortisol to be stimulated which can have an effect on one's immune system, making one more vulnerable to infection during a prolonged stress.

Psychological environmental factors are all around people, not only in the controlled environments in man-made spaces but in natural surroundings. As a result, it is essential that one understands, perceives, and is aware that stimuli are being transmitted to one's brain about how one perceives environmental influences. The "how" of perceiving data has an influence on one's behavior and mood.

Acknowledgements

I dedicate this thesis to the memory and leadership of my father,

Berney Weiner,

who took the risk to invest in me so that I became the person I am,

and to my grandsons,

Addison, Andrew, and Astin,

who motivate me to continue in the achievements of my goals.

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Chapter 1 Introduction

Research Goals and Objectives

It is important to understand all variables of a problem. This research emphasizes the interrelationships of environmental factors. “The best way to view a present problem is to give it all you’ve got, to study it and its nature, to perceive within it the intrinsic interrelationships, to discover (rather than to invent) the answer to the problem within the problem itself” (Maslow, 1971, p. 63). Supporting this, Zeisel (2006) quoted George Poyla, “A great discovery solves a great problem, but there is a grain of discovery in the solution of any problem” (p. 91).
This does not necessarily indicate that there is a problem between the actual and ideal conditions when one compares learning or work environments; however, it does indicate that a determination shall be made on the effects of environmental psychology which shall have a direct influence and effect on the school or business environment.

The objectives were to gather survey data from students, faculty, and professionals and to conduct interviews with psychiatrists and architects. In addition, experiments were performed to gather environmental engineering data which would be conclusive in fact. Upon completion, all the input data was evaluated, analyzed, and presented in graphics, charts, and text indicating statistical results from the survey and mathematical results from the engineered experiments. The goal based on the objective was to prove with conclusive data whether an architect can design a space that will unconsciously create a mood that would motivate people to be more productive. “An environment-behavior research project begins with the definition of a problem. You assess what you know about it and what you want to know, and you envision what you

might do with the results" (Zeisel, 2006, p. 91). An example can be found in the classroom experiments. As in the previous quotation, one first has to define the problem. If in the illumination experiment, one might find there are not enough foot-candles, one can refer again to the previous quotation, "You assess what you know…and you envision what you might do with the results." Obviously, if the foot-candle data are low, one has to supplement or increase the existing foot-candles. In the HVAC experiment, if the temperature is assessed as too low in winter conditions, one also knows what to do, and in a similar assessment for the acoustics experiment, many times, according to Maslow and Zeisel, the answer is in the question.

Michael Polanyi said, "Personal knowledge in science… commits us, passionately and far beyond our comprehension, to a vision of reality. Of this reality we cannot divest ourselves by setting up objective criteria of verifiability-or falsifiability, or testability, or what you will" (as cited in Zeisel, 2006, p. 119).

The results from the data would be used to prove conclusively if an architect could design a space that would unconsciously create a mood that would motivate people to be more productive. In academia, the assessment would be the effectiveness of teaching and learning. In the business situation, the assessment would be the effectiveness of productivity.

Research Question

Can an architect design a space that will unconsciously create a mood that would motivate people to be more productive?

Background of the Situation

Environmental psychology started in the early 1950's; however, there are documented writings that it started in the late 1960's and early 1970's.

Whether we are aware of it or not, we react to our environment. Environmental psychology as a formal discipline came into being in the 1950's when researchers were primarily seeking to improve mental hospitals. Previous to this, architects were rather self-involved; they built the structure to fit their own personal requirements and completely ignored the human element that would inhabit it. Researchers found that traditionally-designed mental hospitals actually aggravated problem behavior in mental patients. With little adjustment, a better environment could be created that would sooths the patients and make their issues easier to handle ("Environmental psychology," 2009).

As a result, architects consulted with psychologists to learn more about human behavior. Research was done on what was then called "architectural psychology." During the following years, the research between humans and the environment was expanded to include teams of professionals such as city planners, economists, interior designers, mechanical engineers, and designers of ergonomic furniture. Although the preceding quotation notes that environmental psychology came into being in the early 1950's, it is necessary to support and continue this research paper with the following quotation which refers to the 1950's and 1960's, not only in the early 1950's. It is also noteworthy that Hershberger (2002) wrote, "A number of social and behavioral scientists began to direct attention to the built environment in the 1960's" (p. 292).

However, according to Lawrence (2002), in the 1950's and 1960's, pioneering studies in environmental psychology were meant to study the relationship between attitudes and behavior of patients and staff and the physical conditions of hospital wards for psychiatric care. At the outset, it is necessary to underline that health was not the subject of the study. Rather, the behavior of the patients in relation to the physical setting and other people with whom they had contact was observed systematically. The authors of these contributions noted that in the

discipline of psychology there had been little concern about the relation between human behavior and the physical setting in which that behavior occurred (p. 401).

According to Proshansky, Ittelson, and Rivlin, the objective of environmental psychology was to identify and explain the relation in order to general findings that could be applicable to other settings, including schools, child care centers, offices, and housing (as cited in Lawrence, 2002, p. 401).

It is realized that the research in environmental psychology from the preceding quotation is now implemented not only in mental hospitals but also in academia and in the office workforce. It is also noteworthy to mention that in addition the two quotation references of environment psychology, one starting in the early 1950's and the second in the 1950's and 1960's, there is still another quotation contradicting the two previous quotations. Edelstein (2002) wrote,

> The field of environmental psychology emerged during the environmental era of the late 1960's and the early 1970's, contemporary to the U.S. National Environmental Policy Act's call for the study of newly recognized environmental impacts using a systematic, interdisciplinary approach will insure the integrated use of the natural and social sciences and the environmental design arts. (p. 559)

One realizes that there was a need to combine the talents of several sciences and professions to foster and improve the relationship between man and his needs. Considering the different documented dates of inception for environmental psychology, that being from the early 1950's to the early 1970's, it should be recognized that the University of Surrey in England was the first school to offer a degree in environmental psychology**.** "The Department of Psychology

was the first in the world to establish an MSc in Environmental Psychology in 1973" (University of Surrey, Department of Psychology, 2003, Welcome).

There is a need and an opportunity for engineering and medical professionals to research design and build healthy spaces.

> Public health needs to rediscover the importance of place. From nature contact to buildings, from public places to cities, there are research needs and unmet opportunities to design and build healthy places. As health professionals, urban planners and architects, transportation engineers and real estate developers, environmental psychologists and geographers learn the vocabularies and perspectives of each other's fields and pursue active collaborations, these research questions will be asked and answered with solid evidence, and healthier, more sustainable human environments will be envisioned, planned, and built. (Frumkin, 2003, p. 1454)

In the preceding quotation from Frumkin, one would realize that more research is needed "to design and build healthier places." This is not unreasonable. "Architects can create places not just spaces!" (Aspinall, 2001, p. 34). When environmental psychology is taught at colleges and universities "more sustainable environments will be envisioned, planned and built" (Aspinall, 2001, p. 34).

Environmental psychology is the discipline focused on the interplay between people and their environment, and as such, it explores the parameters and variables that might alter one's mood, behavior, productivity, effectiveness, and attitude. It should also be considered whether or not an architect can create a space that would reduce stress, provide for better learning environments, and make the workplace more efficient and effective with less effort. Although this might be a topic that most do not know about, at least by the name "environmental

psychology," it is real, and more and more educated professionals are developing use of this behavioral-based discipline.

> The prospects for behavioral-based architectural programming are mixed. On one hand, some sophisticated clients like the General Services Administration (GSA), United States Postal Service (USPS), and a variety of universities, hospitals, and other major institutions have seen the value of behavioral-based architectural program and are hiring consultants or developing in-house staff capable of producing them. A number of social/behavioral scientists and architects (who have done advanced study in the social sciences) are using behavioral research methods as an active component of their programming practices. (Hershberger, 2002, p. 303)

In the past few weeks, several architects and psychiatrists were asked to comment on "environmental psychology," and none of these professionals could comment on that subject by its title; however, when it was explained, all the professionals had very constructive and professional statements based on their learning and experiences. Is it because of interest and the lack of professional and academic exposure to this interdisciplinary field that there is a desire and motivation to bring environmental psychology into academia? It is the intent that the outcome of this research shall be taught to students who shall implement their exposure and research in the business world. Whatever the reason, it appears that "environmental psychology" is recognized, even if not by this terminology, and there is a need to expand this discipline into academia and the workforce.

Relevant Theory

The theory is that environmental psychology does have an effect on mood, behavior, and attitude. Research shall prove or disapprove this theory with surveys, interviews, experiments, plan drawings, photographs, and research.

Scope and Limitations

The scope of the research project on environmental psychology shall include but not be limited to the following:

1. Researching articles from books, scholarly reviews, published articles, etc.
2. Conducting interviews with architects.
3. Conducting interviews with psychiatrists.
4. Conducting interviews with professors that use conventional and "smart classrooms."
5. Providing and evaluating survey questions to students.
6. Providing and evaluating survey questions to professors.
7. Conducting experiments considering variable HVAC environmental factors.
8. Conducting experiments considering acoustical environmental factors.
9. Conducting experiments considering lighting environmental factors.
10. Providing drawings of classrooms used for experiments.
11. Documenting experiments with photographs to compliment drawings and data.
12. Documenting above numbers 1 to 11.

Conclusion

After the three surveys, three experiments, and five professional interviews, the data were compiled, analyzed and translated into graphs for definitive comparative evaluation of the results. The final comments from each of the five professional interviews were also reviewed.

Based on the three independent surveys with different questions for professionals, educators, and students; the experiments in acoustics, lighting, and HVAC comparing a conventional classroom to a “smart classroom”; and five interviews with an urban planner, a professor of architecture, a doctor of Audiology and Speech-Language Pathology, a psychiatrist, and an architect, research suggests that an architect can design a space that will unconsciously create a mood that would motivate people to be more productive.

Chapter 2: Literature Review

> Nothing estranges man more from the ground plan of his instincts than his learning capacity, which turns out to be a genuine drive towards progressive transformations of human modes of behavior. It, more than anything else, is responsible for the altered conditions of our existence and the need for new adaptations which civilization brings. It is also the source of numerous psychic disturbances and difficulties occasioned by man's progressive alienation from his instinctual foundation, i.e., by his *uprootedness* and identification with the consciousness at the expense of the unconscious. The result is that modern man can know himself only in so far as he can become conscious of himself-- a capacity largely dependent on environmental conditions… Separation from his instinctual nature inevitable plunges civilized man into conflict between conscious and unconscious… (Jung, 2006, pp. 78-79)

If one were to analyze from the preceding paragraph "It, more than anything else, is responsible for the altered conditions of our existence and the need for new adaptations which civilization brings," one could support that quotation by comparing the evolution of the Neanderthal and Java man to environmental factors. Catal Huyuk in Turkey, the best preserved Neolithic site to date, is an excellent example of man's desire to utilize the environment. It is well documented that with the evolution of mankind, man moved from open spaces to caves and

then adapted to caves with southern exposure because the stone liberated heat at night. This was a psychological environmental factor that altered his behavior, but he did not know why.

> From the psychological point of view, primitive man's belief that the arbitrary power of chance answers to the intentions of spirits and of sorcerers is perfectly natural, because it is an unavoidable inference from the facts as he see them.… He believes that the world is lighted by the sun, and not the human eye. (Jung, 1933, p. 146)

This can be taken one step further to say that the Java man lived in a solar dwelling. He did not understand the psychology of the environment as we know it today, but he did know if he adapted to environmental conditions, unconsciously his mood and behavior became more rewarding. Analogous to this environmental factor, one can acknowledge that one's behavior and mood is influenced by the environmental factors that consciously or unconsciously affect one's mood, behavior, productivity, and effectiveness.

In the preceding example, one might take heating for granted; however, if one were to consider air conditioning, the influence of environmental psychology would be more evident. Architects with mechanical engineers create spaces that have an effect on our moods and behavior by controlling the conditioned spaces. Heating, ventilation, and air conditioning, commonly referred to as HVAC, are almost always demanded in first world countries as evidenced by the percentage of homes and vehicles with air conditioning.

From the previous quotation, "…and identification with his conscious knowledge of himself, by his concern with consciousness the expense of the unconscious" (Jung, 2006, p. 79), one can ask the question, "Can an architect design a space that will unconsciously create a mood that would make people more productive?" The challenge is to question whether or whether not

introducing positive stimuli into the unconscious mind to support the conscious mind can unconsciously control the behavior of people by psychologically altering the environment.

Environmental conditions are dependent upon many factors. "The result is that modern man can know himself only in so far as he can become conscious of himself—a capacity largely dependent on environmental conditions" (Jung, 2006, p. 79). Although one is dependent on environmental conditions, environment psychology is evidenced in one's understanding of lighting, ergonomics, acoustics, HVAC, electronic media, color, and aesthetics. The change in environments and the perception of the same affect cognitive reactions.

> Environments and changes to environments affect what people do. How people see and interpret their surroundings mediates environmental effects. Effects also are tempered by experiences people have had with past surroundings and their intentions for future ones. Hence, the more you know about how people see environments and what they know about environments, the more you will understand their behavioral, emotional, and cognitive reactions to them. (Zeisel, 2006, pp. 290-291)

Some of these environmental influences we can see or touch such as seeing the aesthetics of a space or touching an upholstered ergonomic chair. Some of these environmental influences we cannot see or touch, yet they have a direct influence on our behavior and mood. "Somehow there is a close identification between the image that man has of himself and the space that he inhabits" (Hall, 1966, p. 179). However, it is essential that one does not neglect the influence of our senses. Each of the five senses has specialized cells with receptors for certain stimuli which have links to the brain through the nervous system, and it is the brain that analyzes the environmental factors, consciously or unconsciously, to alter one's mood and behavior which

translates into one's productivity and effectiveness. "Man is constantly changing and being changed by his environment" ("Environmental psychology," 1971, p. 59).

Space and environment is everywhere and all around us all the time. That is a given, but how one molds these spaces is how one creates places. "Architects create places not just spaces!" (Aspinall, 2001, p. 34). Although it is the architects, space planners, and interior designers who play a very important role in creating these spaces, it must remembered and practiced that the input from psychologists, psychiatrists, urban planners, and related professionals is always considered and part of the plan to reach the goal of creating the optimum places that complement the achievements and goals of the developing team. Teams in this instance are not only those professionals noted but the professionals working in unison with the community.

> To encourage and reinforce community participation in the environmental planning and management projects, it is necessary to understand participation as a collective action process whereby the community performs a role of crucial importance in the joint formulation and execution of decisions that may have an enormous impact on the environment... This also implies that community participation takes place in conjunction with the particular characteristics of the context, whose identification is necessary to allow the professionals working with the community to act in concert with it. (Wiesenfeld & Sanchez, 2002, p. 641)

As the architect can create the place, the urban planner can define the space with the surrounding buildings and landscape. These parks, spaces, and buildings create neighborhoods. It is essential that these professionals realize the significance of a suburban neighborhoods as well as megastructures in an urban environment. The comparison and development of urban and

suburban settings are contributing environmental factors that affect our behavior. One only has to consider a man walking along Madison Avenue in New York on a Sunday morning. The stores are closed, and he is walking on concrete between concrete and glass canyons, only to be enhanced by the pollution of speeding vehicles. If he is lucky at 12:00 PM, he might feel the sun on his face. In contrast, consider the same man walking on a sidewalk in his suburban subdivision. It is unlikely that the streets are going to regimented perpendicular and parallel to each other. Most likely, there would be some gentle curves in the road. An architect, when designing this subdivision, would consider and respect the topography and amenities of the entire site. That respect of the natural environment translates not into only gently curved roadways but also into the gently sloped sidewalks and roads with retention of the ground vegetation and trees and preservation of any rivers, streams, or ponds that would make this a tranquil environment.

Comparing both environments, the man essentially walks alone and greets no one in the urban environment. In the suburban environment, he has a choice. He can either get into his car or drive to the store or he can take a walk and perhaps greet someone. The disadvantage of getting into his car defeats the purpose of the New Urbanism which promotes neighborhoods. Given the two choices, one realizes that the use of the environment can be a psychological balance with nature to control our mood and behavior. The pedestrian path and trees are there, but does one walk or drive? This is an example of the unconscious making the decision of which route to take. When there is no choice, the unconscious will perceive. The environment is reflected in oneself. It is a delicate balance, and there is not always one best answer.

> In the suburbs, time normally spent in the physical realm is now spent in the automobile, which is a private space as well as a potentially sociopathic device. The average American, when placed behind the wheel of a car, ceases to be a citizen and becomes

> instead a *motorist*. As a motorist, you cannot get to know your neighborhood because the prevailing relationship is competitive. (Duany, Plater-Zyberk, & Speck, 2000, pp.60-61)

If the man walks with nature, perhaps saying "hello" to a neighbor, all in a natural non-polluted environment, he is in scale with nature. Trees, ponds, rivers, vegetation, and planned walkways are human in proportion and scale with gentle curved forms unlike hard concrete surfaces at right angles. It is important in any subdivision where it is part of a total mixed land use plan that community participation is involved. The developers know how to make a profit, and the architects know how to design the complex; however, it is the people in the community who know what is affordable and what is needed, especially when the project is zoned for mixed land use. "The core goal of a community participation project may be unclear at the outset of the project in question, but as time goes on it comes into sharper focus through the collectivity's interaction with the support of external agents" (Weisenfeld & Sanchez, 2002, p. 640). Input from the community may convince the developer to set a plot of land aside for a playground as an environmental factor to promote happy and healthy children that would reflect in their behavior. Another consideration in a subdivision may be for the developer to leave three lots for a future association to build a pool and clubhouse. This is not reinventing the wheel; it has been done. Although one does not think of a developer allocating several lots in a subdivision for the future use by an association as an environmental factor such as illumination, a playground and a clubhouse with a pool in a community, this brings people together. This creates a neighborhood which puts people in touch with people. The interaction of people creates a healthy environment, mood, and behavior, all of which are a part of a behavioral science. In essence, the suburban environment creates a neighborhood which is inviting that when the man walks along a path and says "hello" to a neighbor, he creates a friendship. "Simply being aware of others can reduce

anxiety, and can be the springboard for development of friendships or neighbourhoods" (Aspinall, 2001, p. 42).

This is supported in the following article from *The Boston Globe*, "How the city hurts your brain…And what you can do about it" by Jonah Lehrer (2009).

> Now scientists have begun to examine how the city affects the brain, and the results are chastening. Just being in an urban environment, they have found, impairs our basic mental processes. After spending a few minutes on a crowded city street, the brain is less able to hold things in memory, and suffers from reduced self-control. While it's long been recognized that city life is exhausting—that's why Picasso left Paris—this new research suggests that cities actually dull our thinking, sometimes dramatically so. "The mind is a limited machine," says Marc Berman, a psychologist at the University of Michigan and lead author of a new study that measured the cognitive deficits caused by a short urban walk." One of the main forces at work is the lack of nature, which is surprisingly beneficial for the brain. Studies have demonstrated, for instance, that hospital patients recover more quickly when they can see trees from their windows and that women living in public housing are better able to focus when their apartment overlooks a grassy courtyard. Even these fleeting glimpses of nature improve brain performance, it seems, because they provide a mental break from the urban roil. (p.1)

City life can be exhausting, yet one likes the city and also wants the suburban life. There are advantages to each style of life, and one must recognize the environment factors of each. In many instances, one likes both and achieves that goal by living and working in the city and maintaining the vacation house to escape the city.

> Just as the world around us affects our behavior, our thoughts, emotions, and actions affect out surroundings. When asked to predict the most important environmental influence on behavior in the twenty-first century, researchers almost invariably give the same answer: urbanization, or making places citylike without making cities. (Gallagher, 2007, p.19)

The correlation of the preceding sentence pertaining to hospital patients is of significance since the evolution of environmental psychology started in 1950 as a result of the collaboration of architects and psychiatrists recognizing the need for better design for mental hospitals.

How one reacts to the environment, whether the interior or exterior, is a matter of perception to the environment and is essential to our positive behavior and mood. According to Zeisel (2006), "Making sense of environment is a process of *perception*" (p. 291). However, it should also be recognized one's behavior is not always perceived by one's environment. People in our proximity can have an effect on our attitudes and behavior. "The major influence on our attitudes and behavior is not the media but rather our contact with other people" (McKenzie-Mohr & Smith, 1999, p. 95). Perception to noise, pollution, and bright flashing signs is disruptive to our thought process and not productive in rendering positive behavior. "Successful solutions are based on the powerful principle that resolution occurs by fostering the positive, not by attacking the negative" (Hawkins, 2002, p.169). Controlled perception of tranquil environments such as surface vegetation, trees, rivers, and the like bring humans into a serene environment and reduces stress. Calthorpe (1994) wrote, "The New Urbanism is concerned with both the pieces and the whole. It applies the principles of urban design to the region in two ways. First, urbanism—defined by diversity, pedestrian scale, public space and structure of bounded neighborhoods …." (p. xi).

There are many stimuli in a city that must be addressed that are constantly changing which affect our perceptions.

> A city is so overstuffed with stimuli that we need to constantly redirect our attention so that we aren't distracted by irrelevant things, like a flashing neon sign or a cell phone conversation of a nearby passenger on the bus. This sort of controlled perception--we are telling the mind what to pay attention to--takes energy and effort. The mind is like a powerful supercomputer, but the act of paying attention consumes much of the processing power. (Lehrer, 2009, p.1)

When the positive psychological environmental factors are in place, the controlled perception of the stimuli to the brain directs one to a controlled positive behavior or mood, for example, at this time one should consider a well illuminated air conditioned classroom as opposed to a classroom with high humidity and low level lighting. Then one should consider if an architect can design a space that will unconsciously create a mood that would motivate people to be more productive. In a classroom, the controlled perception would be to eliminate or minimize negative environmental factors which would allow the student to focus more on the lecture than the distractions, thus making the learning experience more productive. "Although it is true that everyone orients himself in the accordance with the data supplied by the outside world, we see every day that the data in themselves are only relatively decisive" (Jung, 1976, p. 182). Stimulation to the nerves immediately transmits data to one's mind which absorbs the environment by use of the senses; however, as fast this is transmitted, one must still consider the "instinct" and the "unconscious" and how they work together. Considering HVAC, one wants clean and healthy buildings which are free of mold and fungi, which smell good, and which do

not have high humidity. HVAC systems now control the temperature and other environmental influences within a space.

> Buildings should be dry and healthful. They should smell good and feel dry. They should not support the growth of microorganisms that can emit offensive odors and cause allergic reactions in sensitized persons. The indoor humidity should be sufficiently low that the skin can dry to the indoor air in a reasonable time and clothes do not stick to the skin. (Rose, 2005, p. 248)

It becomes evident that one must now control the environmental spaces within a building, not only for the comfort of the people occupying the space but also for the related health issues.

> We speak of "instinctive actions," meaning by a mode of behavior of which neither the motive not the aim is fully conscious and which is prompted only by obscure inner necessity…..Thus instinctive action is characterized by an *unconsciousness* of the psychological motive behind it, in contrast to the strictly conscious processes which are distinguished by the conscious continuity of their motives. (Jung, 1976, p.48)

If one's instinctive unconscious action is to be comfortable because a created space is air conditioned with a view, then consciously one is comfortable. The unconsciousness of the psychological motive is to make one comfortable through the results, and this was achieved through the unconsciousness. Again, environmental psychology was the factor. "Accordingly, the instinctive activity would have to be included among the specifically unconscious processes, which are accessible to consciousness only through their results" (Jung, 1976, p. 49).

The impact of the environment, natural and man-made, is always around us. It is always changing with technology, medicine, the arts, and the related professions. The goal is the same for all allied professions, and that is to integrate man and his environment to be the best it can for

a sustainable earth and for humanity. These goals are to integrate environmental factors such HVAC, illumination, color, art, and ergonomics into the unconscious mind so that one's perception is positive which in turn shall motivate one to be more effective in academia, in the community, and in the workforce.

> Public health needs to rediscover the importance of place. From nature contact to buildings, from public places to cities, there are research needs and unmet opportunities to design and build healthy places. As health professionals, urban planners and architects, transportation engineers and real estate developers, environmental psychologists and geographers learn the vocabularies and perspectives of each other's fields and pursue active collaborations, these research questions will be used and answered with solid evidence, and healthier, more sustainable human environments will be envisioned, planned and built. (Frumkin, 2003, p. 1451)

When one references the previous quotation in part "…more sustainable human environments will be envisioned, planned and built" and evaluates the results of psychologically introducing environmental factors unconsciously in the consciousness of one's mind, the question for this paper still remains, "Can an architect design a space that will unconsciously motivate people to be more productive?"

Assumptions in Environmental Psychology, Common and Different

The intent of environmental psychology is for the medical professions and related architectural professions to combine their talents so that people may enjoy their lives to the fullest. Although the field of environmental psychology started by improving mental hospitals with respect to patient care and comfort within the structure pertaining to aesthetics, it has also afforded architects the application of their learning experiences into the workforce.

When implementing the learning experiences of environmental psychology, one must realize that conditions and people are different. One cannot say that a particular ergonomic improvement is definitely the best for everyone. Workers are constantly evaluating the environment that surrounds them. One perceives and evaluates differently from another person for many reasons; for example, an elderly gentleman might find a very well air conditioned space too cold whereas a teenager might think it is just right. As for the illumination, both the teenager and the elderly gentleman could both very well appreciate good illumination, thus one realizes some assumptions can be common or different. In the workforce, intercom music certainly has an influence on one's motivation and effectiveness; however, one worker might love the music while the other loathes it. The intent by the organization was the same for both workers, and that was to make the workers more relaxed and comfortable in their work. As noted, people are different, and they may react differently or similarly the same to identical stimuli.

When a mother goes to a supermarket, the music is non-offensive and conducive to the situation; thus, making the mother comfortable in her shopping experience. Her son might not be as comfortable there as his mother, but the mother most likely would not appreciate the loud music in a music shop. The commercial objectives for each organization are to make the customers more comfortable, stay longer, and spend more. The environmental factor is the same, intercom music. The people are different, the music styles are different, the sexes are different, and the ages are different, yet it is agreed that that music makes a difference.

Applying research from the teachings of environmental psychology is difficult. An architect can satisfy most of the people, but it would difficult to satisfy all the people all the time. If one were to consider more variables such as age and sex to the music criteria, it would be even

more obvious that the variables are common or different, and that not all conditions of perception are the same.

Environmental Perception

Perception of the environment, whether natural or manmade, can differ from one person to another. This is readily observed when one likes a certain fragrance and another does not or when one likes vanilla flavor and another likes chocolate.

> Your awareness and evaluation of striking architecture, sublime landscapes, or distasteful dumps are probably founded on the sensations created by an array of photons of light stimulating individual receptor cells in your eyes…perception, a term that is applied to the more complicated processing, integration, and interpretation of complex, often meaningful stimuli like those we encounter in everyday life. (Bell, Greene, Fisher, & Baum, 2001, p. 57)

Perception of the exact observation can be completely opposite from one person to another, and interesting enough, they could be 100 percent justified in their perceptions; for example, consider the words "architecture," "landscape," and "dumps" in the preceding quotation. One who likes Classical Greek architecture with a gable pediment, entablature, triglyphs, stylobate, and Corinthian columns might not appreciate a very contemporary building with a façade primarily constructed of tempered glass. Each perceives the architecture completely differently. The next example is landscapes. One can appreciate beautiful mountain views of green vegetation while another can appreciate a desert scene with cacti. Still considering the mountain view with vegetation, one might notice harvesting of some lumber. In this instance, one might perceive this as yielding a crop, providing jobs, and maintaining an ecological life cycle of trees by strategically harvesting trees to emit sunlight to permit growth of other trees. Another might

perceive the harvesting of trees as the raping of the mountain of its character. Lastly, one can consider the dump. In this example, one can perceive it as place where all kinds of debris are stockpiled, most of it eventually decomposing or oxidizing, although there are the materials which will never decompose or oxidize. On the other hand, if it is a sanitary landfill, one can perceive this acreage as a place that was strategically engineered by controlled compaction and venting so that in years to come it could be a desirable subdivision. One can consider three observations with three perceptions which are completely opposite and all with merit.

Supplementing "perception," one should also consider "preconception." In preconception, a researcher or planner might have a preconceived image in his/her mind of how people would act in certain environment. In this instance, he/she would design as space accordingly as to how he/she has a preconception. His/her influence can also be noticed in the aesthetics or character of the space; however, what must be realized is the preconception of the designer might not be the perception that an individual might appreciate. When designers and planners create spaces based on their preconceptions, they may very well be surprised by the results of the perceptions of the users of this space.

> …perceptions can be helpful. For example, in a study of how people work and feel in open-plan offices, one researcher might begin with a preconception that everyone will be miserable because there is no privacy. Another investigation expects everyone to be smiling and happy because the lack of walls brings people together. These preconceptions,
>
> or advance guesses, no matter where they come from, can be used as reference points in future observations. (Zeisel, 2006, p. 37)

Although the designer might not create the ideal space because the perception of the user might be different, the experience that the designer acquires can be very useful on his/her next project. Considering the example of defined smaller spaces in comparison to larger open spaces, a person in a senior citizen complex might be more receptive to the open dining room plan where one could mingle and be exposed to others. In contrast, smaller rooms would not provide this opportunity to mingle. An experienced designer would realize that the perception of all residents is not always the same. In this instance, he/she can design with most of the dining room as an open space floor plan with several smaller dining rooms along the perimeter. In this instance, providing a choice would be the better decision of the designer to allow the perceptions of different residents to be perceived as they liked with accommodations designed to receive their perceptions.

There are many indicators that designers look for in evaluating the success of a created space "because both researchers thought about worker's happiness, both will look for indicators of attitudes: smiles or frowns, backslapping, chatting, angry looks, fights" (Zeisel, 2006, p. 37). These observations are very helpful in future design considerations. The observations can be used based on a theory which employs empirical data, enabling the designer to make scaled architectural models of the space.

"Investigators initially formulate exploratory hypotheses based on theory and previous empirical data, and then they use preliminary, unfocused investigation to decide what specific data they will use to confront these hypotheses" (Zeisel 2006, p. 37). As more data are obtained and evaluated, the more investigators would be able to define and thus organize, simplify, and explain the conceptual framework.

> Complex and sophisticated possible solutions to a problem—that is, hypothesis—can be thought of as conceptual models analogous to the physical models that designers use… Physical models represent abstract attributes of a concept: massing of buildings, openness of space, or clustering of elements…Models represent the intended resolution of problems in mathematical, symbolic, physical, or some other form… Developing and testing working hypotheses and working models allow researchers to make major adjustments in approach before such changes would mean destroying the whole project and starting from scratch. (Zeisel, 2006, p. 38)

One realize from the above quotations that the environmental spaces created by designers and architects do have an effect of the perception of the occupant of the space. The perception of the space can and will vary depending on the individuals' preferences. It is also recognized and acknowledged that heating and cooling attributes are perceived by the occupants of a space as a positive attractor. Considering the evaluations, observations, hypotheses, and scaled architectural models of the proposed space to be created, one can appreciate the efforts and talents that environmental psychology requires for it to be successful when variable attributes are involved. As noted, air conditioning and heating are accepted, regardless of the geometry. These environmental environments are required to maintain homeostasis. It is the aesthetics that requires the extensive research since it involves different perceptions of different people.

Environmental Psychophysiology

Environmental psychology and environmental psychophysiology overlap in many ways; however, in comparing one to another, one can observe several distinctions. Whereas psychophysiology pertains primarily to the relationship between mental and physical processes within the body, environmental psychology suggests the perception to the surrounding

environment and not involuntary actions of the body. Parsons and Tassinary (2002) described this in a chart where there is a psychological domain consisting of the words "orienting," "startle," and "defense" and a physiological domain where there are responses pertaining to skin conductance response (SCR) and heart rate response (HRR) (p. 175). The significance of this chart and the relationship to environmental psychology is that in environmental psychology, one perceives positive or negative attractors. In a work environment, these positive attractors may make a worker more productive. These psychological changes are associated with changes in physiological elements like heart rate and skin conductance responses, a measure of sweat gland activity (Parsons & Tassinary, 2002, p.175).

It appears that when one compares comparing environmental psychology to environmental psychophysiology, research and experiments from the behavioral and medical sciences suggest that the more definitive conclusions are derived from environmental psychophysiology; for example, in the heated space, one might consider a certain temperature comfortable while another may not consider that same temperature comfortable. How one perceives a space is an opinion; however, if the same heated space had a high dew point, most likely one would perspire, and if the dew point were very high in a warm room, one would definitely perspire. When one perspires, that is a fact and not opinion, and when one compares experiments from the behavioral sciences, the facts are more conclusive than the opinions. What are difficult to compare are the variables from one test or experiment to another. People are different and react differently. A thin person may feel the opposite; thus, it is difficult to replicate exact conditions to compare results.

Although environmental psychology and environmental psychophysiology may overlap in some instances, some observations are distinct to each other, not only by the observation of

each but by the terminology that describes similar conditions. When one is in a space and one is not comfortable about some external influence that affects one in that space, one would refer to that influence as an attractor or detractor, depending on how the person perceives the influence when relating to environmental psychology. An example of this is how one would perceive lighting, acoustics, air conditioning, or heating. When considering environmental psychophysiology, one would try to measure pain with experiments to determine the best pharmacological treatment for the pain. In essence, when one compares environmental psychology to environmental psychophysiology, the distinction is whether the contributing influence is external to the body or from within the body.

Illumination as an Environmental Psychological Influence

Illumination is more than an incandescent or fluorescent bulb type projecting light into a space. Two factors, economics and the environment, are essential in good design. Economics can be divided into two parts: first, the cost of the fixture and second, the efficiency pertaining to operating costs. The environmental component of lighting involves sustainable architecture of which an architect has many considerations to explore in order maintain low energy consumption, orientation of the building for maximum natural light, the area of glass on the exterior walls, and sloped ceilings where the highest point is closest to the glass wall.

The north-south orientation of a building to obtain maximum natural lighting is first considered in the site planning of the building. Many professionals such as lighting engineers, architects, landscape architects, and urban planners comprise a team. Given a building with a long and short axis, many argue the best orientation to capture the most natural light is to locate the building preferably on the east-west axis. This provides sunlight from dusk to dawn of the southern exposure. Heating and cooling loads are considered; however, heating and cooling are

part of the mechanical system. This is addressed in "HVAC as an Environmental Influence." Another consideration is that the building should be located with the long axis in the north-south direction. This orientation would provide sunlight to the east side in the morning and daylight to the west side in the morning. During the afternoon, the west side would have the sunlight, and the east side would have daylight. These are two different approaches, and each has merit; however, in an urban setting, the site is already determined, and there is no choice of the orientation placement of the building.

Since the orientation of the building can limit the sustainability of the building pertaining to illumination, an architect can design a building to maximize the sustainability by incorporating an atrium into the design and adding more surface exposure on the exterior walls. Considering this, the ceiling would be sloped with the highest part of the ceiling closest to the exterior glass wall. These two design factors would provide additional lighting into the building and make it more sustainable. It should be noted that although natural lighting would be utilized closest to the exterior glass wall, the space farthest away from the exterior glass wall would be supplemented with artificial illumination and controlled with sensors. At this time, it should be noted that interior lighting is designed for nighttime conditions, so whatever natural light is used during daytime is an influence on the sustainability of the building with a decrease in energy consumption.

Illumination and the intensity of illumination is an environmental factor that has a direct and obvious relationship to one's mood.

> Research studies in lighting demonstrate that direct or objective measures of the ambient properties of the work environment may indicate or predict performance and satisfaction with the physical environment. They also indicate a clear connection between the

> physical environment and the psychosocial issues relevant to work performance. (McCoy, 2002, p. 451)

Excessive illumination in a jewelry shop to emphasize the display or low levels of illumination in an intimate restaurant are two contrasting examples of illumination that one perceives differently and is reflected in one's mood and behavior.

> Loudness, light intensity, and air flow are *environmental conditions* that directly affect possibilities for behavior relationships by limiting and augmenting people's ability to hear, see, and smell other people and activities. For example, light turned low in a restaurant effectively separates people at different tables as if there were a physical screen between them. (Geisel, 2006, p. 215)

Consider a hotel lobby; the entrance is inviting and well illuminated. The registration desk is well illuminated, usually with high illumination over the counter. The remainder of the large lobby is well designed with sitting areas defined by area rugs, conversational seating, lamps, and vegetation. When a guest enters the lobby, he/she feels welcome. The illumination in the central part of a lobby can be of low intensity, but he/she is focused and directed to the registration counter with high illumination. When he/she checks in or is waiting to check in, the hotel management wants him/her to be comfortable and relaxed, and this is done with a well planned seating and lighting arrangement. He/she is not asked to sit in an area with suspended fluorescent lighting and high intensity metal halide or sodium vapor lighting. Management created an environment to set mood and behavior. Management wants him/her to be relaxed and come back. It's just good business to do it right.

In the H-E-B case study of the corporate headquarter in San Antonio, Texas, there was a team effort to promote the construction of their new headquarter complex. "The company knows

how to participate in complex projects. The company's organizational structure includes accounting, advertising, publicity, printing, human resources, purchasing, marketing, planning, design, and real estate, all under one roof and leadership structure in addition to its hundreds of stores" (Zeisel, 2006, p. 83). In addition to the company being so diversified, the structure was such that the company had the talent for input and team effort in the design and construction of the new complex. "The client fully participated, making certain the program findings and analysis were incorporated into the master plan for the complex, its architecture, and space planning. The client's sophistication, philosophy, and complexity contributed to the positive tenor of this effort" (Zeisel, 2006, p. 82). As a result of this talent and structure, environmental conditions and needs were considered, not only from the architect to the client but from the client to the architect.

> A three-part team of client, programmer, and architect emerged in the project. The three maintained a dynamic tension during the entire process, through construction and move-in, leading to efficient, effective, and quality decisions… Like its design, the H-E-B program was developed as an iterative spiral of research, reports, and decisions…As a result of regulatory and financial objectives, the design had had to start sooner than anticipated. This presented more obstacles that had to be addressed, one of which was the environmental factor of letting light into the building…The architects also decided to bring light and views into the large non-office buildings by selectively cutting portions out and creating atria within the buildings. (Zeisel, 2006, pp. 83-85)

As one would have realized by now, bringing natural light into a building and extending the views are environmental factors that affect one's mood and behavior. "The San Antonio, Texas,

headquarters of the H-E- B Food and Drug Company houses an extremely successful U.S. company…" (Zeisel, 2006, p. 82) of many talents which were used in a team effort to design a complex on an eleven-acre site in San Antonio.

Ergonomics as an Environmental Psychological Influence

Ergonomics is a scientific study and evaluation of how people function at work. It not only involves how to make people more comfortable in their work but also how to make the equipment and tools more user- friendly. The intent of designing and using ergonomic furniture and equipment is to reduce stress and minimize or eliminate injuries as a result of overusing muscles. Overusing muscles is not intentional; it can be the result of bad posture or a result of an inadequate or improperly designed seat for a certain function or for excessive repeated tasks. Ergonomics further explores designing tasks that require less muscle strain, locating controls on equipment within easy reach, improving design of tools to fit the body, in addition to making illumination in the workplace more pleasant.

Stress is unhealthy for many reasons. First of all, it decreases productivity and effectiveness. Secondly, it affects one's health by impairing one's immune system which increases susceptibility to infection. This is described in more detail in the section "HVAC and Health as an Environmental Influence."

In the workplace, it is the intent of the employer to keep his employees healthy, motivated, pain free, and productive. Improper or ill designed tools and equipment can cause needless injury and downtime, thus making the workforce less productive. When workers are injured, the employee loses, and the employer loses. The employee loses not only because of pain he/she has incurred but also because of his/her lack of esteem in not providing an income. He/she is less productively structured in his/her daily activities. The employer loses because of

payment of worker's compensation benefits which may include retraining at trade schools or colleges.

> Ergonomics is an important design consideration, especially in the workplace. When workers are uncomfortable or in pain, their productivity and morale decline; worse, an acute discomfort can lead to a chronic or permanent affliction that negatively affects a worker's quality of life. Employers pay millions annually in workers' compensation benefits (including rehabilitative training) for employees who have sustained injuries as a result of poor ergonomics. (Kopec, 2006, p.237)

One might think ergonomics pertains to a backache because of improper posture as a result of uncomfortable seating, excessive standing, or lack of full movement of the employee's wrist or fingers as a result of prolonged use of a computer; however, ergonomics goes beyond these symptoms. It includes scientific support from epidemiologic research as well from musculoskeletal disorders. There is always a better way of providing certain functions. In simple terms, ergonomics matches people and machines so that injuries are prevented and work is productive.

Natural Environmental Psychological Influences

Natural environmental psychological influences are all around in nature. The beauty of nature is everywhere, and what is of significance is protected by the United States government. According to Brooks (1988), the 1960's was a time of social unrest in the United States. At that time, the sentiment of Congress was that government agencies were not monitoring or protecting the natural resources in this country. Reference was made to a 1954 landmark decision in Berman v. Parker where the issue did not pertain to money and the environment but to environmental quality. As a result, Congress supported this concern of protecting the natural

environment and adopted legislation acknowledging that the environment has an intrinsic value to society (pp. 30-31). “It is no coincidence that the increased awareness and concern about environmental problems in the U.S. public opinion beginning in the 1960’s was followed by a burst of new legislation in the 1970’s” (Gardner & Stern, 2002, p. 74).

Support for protecting the natural environment is still a controversial topic. Although there are laws governing conservation land, wetlands, moving bodies of water such as rivers, streams, and oceans, there has always been some developer who challenges the respect and preservation of our natural amenities. Occasionally one hears in the media that a developer proposes a project that would detract from the serenity of a water view or would obstruct a scenic view. Two contrasting examples would be the wind farm proposed for Nantucket Sound and the building of the Hyatt Hotel along the Riverwalk in San Antonio, Texas.

Years ago, building contractors disposed of construction materials and other debris in what was appropriately called a “dump.” Not only were contractors with large truck loads dumping in these selected locations but the typical common person could also do the same. There was no control as to what was allowed to be deposited at these sites. Environmentalist and government agencies recognized that if this were allowed to continue, land would be contaminated and would become a hazard in the future. As a result, it is now unlawful to dispose of hazardous waste in an arbitrary manner. The typical common person does not think of these restrictions to protect the environment for future generations, but he/she does enjoy the mountain and water views. For those few who do not appreciate water and ocean views, there are still government agencies protecting them from the pollutants and contaminants which work their way into the water supply if debris is not disposed of and regulated by government statutes. In

consideration of these influences and statutes, waste disposal is regulated to protect the environment and deposits in sanitary landfills.

Considering the extent to which sanitary landfills are packed, vented for gas to escape, and landscaped when they reach their maximum capacity, one can appreciate the contrast between the Hyatt Hotel on the Riverwalk in San Antonio and the wind farm in Nantucket Sound. Hyatt already had one high-rise hotel on the Riverwalk and decided to build another; however, the architects and Hyatt were very sensitive to the environment because it was realized that if the building were to be constructed as originally designed, a shadow would be cast in front of the Alamo, and for the most part, the Alamo would be in shade. Future generations would not be able to walk along the landscaping in front of the Alamo with the sun shining beautifully. Sensitive to this, the team determined that the building could be built only sixteen stories high and not cast a shadow on the Alamo. In contrast, recent developers want to build a wind farm near pristine Nantucket Sound. If successful, future generations will always have an obstructed view of the horizon, sail boats, and the natural beauty.

Light and Time as an Environmental Psychological Influence

One can readily relate to HVAC, illumination, acoustics, and ergonomic furniture as an environmental psychological influence; however, light is also an environmental influence. In this country and around the world, there are time zones. Not only are there different time zones in the United States but there is also Daylight Saving Time. People comment that it is lighter in Florida longer than it is in Massachusetts during the winter months, and that is true. Considering these facts, one does not have to prove that natural light affects our behavior. All of us live through the changes every year, dismay that it is getting dark earlier in December, and look forward to the longer days of summer.

> The basic principle that links our places and states is simple; a good or bad environment promotes good or bad memories, which inspire a good or bad mood, which inclines us toward good or bad behavior. We needn't even be consciously aware of a pleasant or unpleasant environmental stimulus for it to shape out states. The mere presence of sunlight increases our willingness to help strangers and tip waiters… (Gallagher, 2007, p. 132)

Acoustics as an Environmental Psychological Influence

Not all acoustic experiments can be performed in a controlled environment. "The complex sounds of the real world are heard in environments that make it difficult to deal with them experimentally" (Kaufman, 1979, p. 262). It would be difficult to perform experiments in New York City and duplicate the experiments elsewhere in similar conditions and compare the results; however, it is acknowledged that sound is an environmental factor on the highway, and that has been addressed many times. Going south to Eastern Nazarene College from Boston along Route 93, one would notice sound barriers, and going north along Route 128 traveling toward Eastern Nazarene College, one would also notice sound barriers. Relatively new, these sound barriers serve two functions: first, they separate visually the highway vehicles from the neighborhoods that are adjacent to the highways, and second, they are an acoustic barrier minimizing noise pollution to the adjacent neighborhoods. The placement is not coincidental or arbitrary as evidenced not only the height of these barriers, many exceeding twenty-five feet, but also by the vegetation placed in front of many of these barriers. Vegetation is a very important factor to the composite result of the effectiveness of these barriers since vegetation is "soft" and absorbs sound. The vegetation is not of deciduous trees but of the coniferous species. The

decision was to use coniferous trees to absorb the sound which are green all year long since deciduous trees shed their leaves in the winter, thus making the absorptive acoustic result less effective.

These acoustic barriers with vegetation in front can be very effective, especially when they minimize noise coming into a classroom. Architects are aware of sound transmission and design with acoustics in mind. Windows and glass curtain walls have a sound transmission coefficient (STC) which is utilized and factored into the design of a building. Gifford (2002) noted that crowding affects social action, and noise harms learning (p. 323). In the classroom, one now realizes that noise harms learning. Noise is also unhealthy in construction sites and manufacturing factories. OSHA regulation 29 CFR- 1910.95 section C, pertaining to noise exposure, is the regulation for protection to employees. This regulation defines allowable decibel exposure ratings for different conditions. These conditions are environmental factors. In the example of the classroom near a highway, there are acoustical barriers with vegetation; however, in a 90 dB environment for more than 8 hours per day (unless workers experience a Standard Threshold Shift), hearing protection is required. The need for hearing protection to be provided to employees is determined by the dB rating, duration of noise, movement between different noise levels, and noise generated from a single or multiple sources. The U.S. Environmental Protection Agency's Office of Noise Abatement (1978) found that noise was not just a nuisance but also a health hazard (as cited in Bronzaft, 2002, p. 502). Health, pertaining to noise, is a biological science and an environmental influence, which was addressed by the aforementioned agency.

Sound, for this paper, is directed to the environmental influence of acoustics in a controlled environment where experiments can be reliably conducted to determine the

effectiveness of the materials, locations, and geometry of the materials. This is evidenced in buildings to a great extent and is hardly perceived by the public. One does not have to go far to appreciate the movie theatre where the walls are made of panels with small holes throughout to trap the sound. Schools that are built on a budget will usually have rigid fibrous panels adhered to masonry or concrete walls and ceilings to absorb sound. The acoustical value of the placement of these materials is to capture the sound and thereby limit reverberation back into the room. These environmental factors are designed and built with the talents of architects and acousticians. For the most part, the public is not aware of the engineering in acoustics, yet the public is unconsciously benefiting from the effectiveness. The differences between the acoustics and aesthetics as perceived by the public are that the public can see the aesthetics; however, the public cannot see what it hears. The perception of excellent sound engineered by acousticians and architects is an example of an environmental influence which is appreciated but not seen.

Color as an Environmental Influence

Color, like other environmental factors, has an influence on one's behavior and emotions. "There is also a physical science to color. Often these emotions that are tied to color are not purely defined though sociological refinement, but rather are visceral reactions created in the brain that slow down or speed up the nervous system" (Marks, MINE, Origin, & Sutton, 2009, p. 7). The reactions of our perception that transmit reactions to the brain through color as an environmental influence are analogous to one's other senses as well as to those environment influences which also affect one's mood, behavior, and effectiveness.

One does not have go far to decide what color one likes for a certain application. This is personal; however, much has been written, studied, and perceived about the power of color. In a personal interview, one should consider a red tie if one would like to perceived as strong and

powerful. Blue would suggest trust, and the earth tones, such as tan, umber, and light brown, would suggest a more friendly emotion. Color is also used to motivate people. Although a selected color on the walls of a space would be a positive environmental influence to the behavior and mood of a person, the same color could have the opposite effect elsewhere; for example, a bright red and white wall would not be very desirable as a bedroom; however, in marketing, these are powerful colors. One does not have to look far to observe these colors in the retail sector. Consider the brands of Staples, Colgate, or Coca Cola. In architecture, architects tend to design for nonspecific uses in subtle tones that do not offend anyone. Hotel lobbies and rooms are usually neutral in color; however, restaurants and specialty shops within the hotel, can be of special combinations of color compatible to the service or product provided.

Although one can appreciate neutral colors in public spaces, it is important to acknowledge that the significance of a color's meaning to different cultures; for example, the Navajos in the United States perceive color differently.

> Americans treat colors informally as a whole—that is, situationally. We may use a spot of yellow or of red, or yellow and red to accent a gray wall. We would be unlikely to put the yellow and the red next to each other. The colors in themselves have little or no value…To the Navajo the situation is quite different; colors are ranked just as we rank gold and silver—only more intensely. (Hall, 1959, p. 104)

It is also recognized that different colors symbolize different meanings. When one notices a flag on an overextended item on a truck or trailer, it denotes caution and danger. In the classroom, teachers now make corrections in green ink which has been determined to be less offensive than red ink. The mood of the student is affected by the color of the ink. This same experience is affected by spaces, only to a different extent.

In essence, it is recognized by professionals that color does influence people. The environmental influence in a space would to be to create a mood compatible with the goal of the provider. As previously mentioned, in a hotel, the hotel management would want the lobby to be welcoming and not offend anyone. The color schemes would vary depending on the motif and character of the hotel. It is not coincidental; it is well thought out. The same thinking goes into a restaurant or a mental hospital. This concept of environmental psychology has been analyzed in the early 1950's. "Certain hues have been defined by their usage over the years, and have become widely known to evoke certain feelings or emotions" (Marks et al., 2009, p. 7). Thus, the question remains, "Can an architect create a space that can control the unconscious to make a person more effective?"

Interior Design as an Environmental Influence

In large architectural projects, it is the architect who designs the complex pertaining to the site development, character of the building(s), elevations, and floor plan. Basically, it is the floor plan without any walls that pertains to the core of the building. The core of the building is that part of building which is typical for every floor with the exception of the first floor. It includes the means of egress, mechanical and plumbing duct space, toilet rooms, electric and telephone rooms, janitor's closet, storage rooms, elevators, and other considerations.
When this portion of the design is complete, a space planner takes over to allocate spaces according to the terms of the leases with future tenants. When the demising partitions are determined, the space is defined for the tenant. At this time, the interior designer becomes part of the team. The interior designer may be part of the architectural firm's staff or an independent consultant. Many times, large organizations have their own planning department work closely with the architects and space planners and use their own staff personnel for interior design.

One might think of an interior designer as a talented person who can coordinate furnishings, texture, color, and art. According to Gifford (2002), "Interior design can also support environment goals" (p. 330).

Wayfinding as an Environmental Influence

One would more likely think of air conditioning, illumination, or ergonomic furniture as a psychological environmental influence than wayfinding, yet wayfinding is definitely a factor. "Being lost is frustrating. There's nothing more frustrating than wandering around a building for 15 minutes, not knowing where you are going or not finding someone to ask**"** (Carpman & Grant, 2002, p. 428).

One would say this is true, especially after coming out of a shopping center and wondering where one parked the car. Perhaps more markers and color coding of the markers would help, but for the most part, one should learn to pay attention to the location of the parked car. Most poles for illumination are marked for easy identification. Wayfinding, does influence behavior and causes the frustration which affects one's mood, which is the forgetfulness or disorientation of the individual.

More than almost any other environment behavior issue, wayfinding has found regular coverage in the American popular press, lending it familiarity as a widespread problem and demonstrating its multidimensionality.

> People lose their way indoors and outdoors, in large and small spaces, in complex and simple environments including hospitals and medical centers; colleges and universities; hotels; elementary, middle, and high schools; transit stations; shopping centers; ports complexes; expressways; office buildings; apartment complexes, and the like… Most

> people become lost or disoriented at one time or another. (Carpman & Grant, 2002, p. 430)

For the most part, people do get disoriented in buildings and forget where they parked; however, from an architect's point of view, one should consider the following: first of all, the environmental influencing elements are often there and obvious such as large numbers or letters on the light poles which people do seem to pay attention to. Secondly, when an architect designs a building, sports stadium, or office building, there are many factors which are innate to an architect. When designing a complex, he/she must consider the pedestrian and vehicular circulation of the building so that they do not overlap, and he/she has to provide service to the building in such a manner that it is separated or not obvious to the public. In contrast to the service entrance to the building, he/she has to do the opposite for the entrance to the building to orientate the public. There are many ways that he/she successfully introduces environmental factors to direct people toward the building. One of the more common aesthetic features is to make the entrance a focal point. This is done by more illumination at the entrance; making the roof higher at the entrance location; or directing the public unconsciously toward the entrance with a pattern of paving, bollards, and vegetation. This is not revolutionary in the architectural profession. People seem to find their way easily to the entrance. The entrance stands out by size, roof projection, or something that distinguishes it from the remainder of the building or complex. Wayfinding, perception and cognition, cognitive mapping, imaging, and designing are among the many ways people relate to their environment. Emerging neuroscience research shows that these environment-related activities are reflected both in our brains—their neuronal structure and electro-chemical processes—and in the way our minds manage environmental input and knowledge. (Zeisel, 2006, p. 142)

The problem is that people do not always make note of where they parked; thus, if one still considers cognitive mapping or the ways people relate to their environment, one must still remember that people are human, and sometimes people forget or are not perceptive. Going into the building is not the problem because the entrances are defined in many ways and in a large scope enabling them to be seen from a distance. Getting from the entrance to the car is the problem because one did not make note of the position of the parked car due to forgetfulness or disorientation.

HVAC and Health as an Environmental Influence

When one thinks of HVAC as a factor of comfort to influence behavior, one is usually thinking of the heating and cooling as an environmental factor. "Effective temperature, an index composed of air temperature, humidity, and air movement measures, is an indicator of thermal comfort. While heat and cold can affect both environmental satisfaction and performance, the effects are complex" (McCoy, 2002, p. 450). One's emotion is attributed to one's perception, whether it is baseball player being cheered on by the spectators to hit a ball or a student perceiving the air around him. "The 'real cause' of an emotion is the perception of the individual" (Lindgren & Fisk, 1976, p. 66). In a classroom or workplace, it is important that, in addition to heating and cooling, one benefits by other criteria so that one is in a healthy environment which contributes to one's perception of the environment and is thus reflected in one's behavior. A student's emotional reaction to an instructor is positive and enhanced when the environment factors are in place. "All the Great Teachers throughout the history of our species have merely taught one thing, over and over, in whatever language, at whatever time. All have said, simply: Give up the weak attractors for strong attractors" (Hawkins, 2002, p. 141). Weak

attractors in a classroom are the lack of good environmental conditions. To "give up the weak attractors for strong attractors" is difficult when one is in a hot classroom, and the stimuli in the classroom tell one to be uncomfortable.

In a classroom or workplace, it is not a coincidence that there are strong attractors such as air conditioning. It was well thought out and engineered.

> Building codes perform a critical function for the community of people who build or inhabit buildings….we are critical of present building code requirements in the area of moisture control in the context of overall satisfaction with the methods and content of building codes… (Rose, 2005, pp. 21-22)

Considering that there are weak and strong attractors, the building codes and the implementation of the same insure the inhabitants of the building that minimum criteria have been established for the safety, health and well-being for those who enjoy the use of the spaces. If it pertains to air quality, it is the work of a mechanical engineer; if it pertains to illumination, it is the work of an electrical engineer; and if it pertains to noise control or noise pollution, it is the work of an acoustician.

The air changes in a room are factors that cannot be seen; however, when a mechanical system is designed properly, the air changes are in place as defined by building code criteria. A student in an air conditioned classroom would be comfortable because the positive attractors are in place. If the classroom were not air conditioned in the summer, then the lack of air conditioning would be a weak attractor, and the student would not be comfortable. The perception of the positive enables a student to focus on the subject matter. In contrast, the negative attributes or negative perceptions would distract the student from focusing on the positive. In a well balanced and well designed classroom, the situational experience would be

more favorable to a positive emotional reaction "… it is the way the individual perceives or interprets the situation, consciously or unconsciously, rather than the situation itself that determines his emotional reaction" (Lindgren & Fisk, 1976, p. 66). Although the temperature of the air and air exchanges cannot be seen as environmental factors that affect one's mood and behavior, there are other factors that cannot be seen, yet they are there and well engineered to provide the best environmental conditions available. Some other factors are ventilation for odor control, air washing where the odors are absorbed by a liquid mist and elimination and control of pollutants from vehicles. "Automobile fumes, industrial pollutants, dust, and grime all exist to some extent in otherwise 'fresh' outdoor air. These pollutants must be minimized, as they contain sulfur oxide, carbon oxide, hydrocarbons, nitrogen oxides, and exhausts form nearby buildings" (Rowe, 1994, p. 407).

As one would now realize, the temperature of the air, the fresh air exchanges as required by building codes, and the absence of odors and pollutants have all been factored into the environmental engineered space for which the unconscious mind has been made to work less, enabling one to focus and be perceptive of the positive.

> We know much about which features make a nature scene beautiful, how personal space changes with age, which sorts of people are more are more likely to hold proenvironmental attitude, what the key environmental dimensions of personality are, how crowding affects social interaction, how noise harms learning, and how temperature is related to violence. (Gifford, 2002, p. 323)

Considering "how temperature is related to violence," one realizes that maintaining homeostasis is an important factor in our behavior. "Theories of instinct or homeostasis emphasize the causes of motivation—whether biological or environmental…" (Watson, 1992,

p. 298). It should be recognized that in the United States and in other countries, architects and engineers rely on mechanical means of controlling air quality as an environment factor; however, alternate methods such as fresh air are still preferred when applicable and are considered in the design process. "In countries with a strong social democratic culture such as Sweden, Germany, and the Netherlands, companies started to build 'health' office buildings with natural ventilation and operable windows" (Dewulf & van Meel, 2004, p. 248). The building codes in the United States do not dictate what materials are to be utilized. They are based on performance standards; thus, one realizes that there is no one solution that fits all. Natural ventilation, in addition to mechanical backup systems, in office buildings is an environmental factor that is strongly being implemented. In reference to the Kitsap County Administration Building in Port Orchard, Washington, fresh air was implemented into the design of the building as environmental factor. "Terracing the building into the hillside allows for multiple, smaller floor plates with an open office seating plan. Operable windows provide access to the fresh air" (Misel, 2009, p. 9). This low- rise office building is located in a suburban environment; thus, the design which reflected the environmental factor of pollutants from vehicles, however minimal, was considered. "Indoor air quality sensors in conference rooms determine the necessary quantity of outside air delivered by the HVAC system based on the number of occupants" (Misel, 2009, p. 12). As one now realizes, the CFM, temperature of the air, dew point, and natural or mechanical controlled environment factors all influence the inhabitants of a building.

In addition, there are many airborne particles in the air that cannot be seen or smelled; thus, one realizes that integrating solutions for environmental factors are not always absolute or the same for every condition. It is a delicate balance of many factors, all of which have to be considered for each instance and designed accordingly for each condition. Criteria that contribute

to alternative approaches are location, history of air quality, prevailing winds, type of building use, and the applicable building codes for the jurisdiction of construction.

> Building design is a second arena in which health research offers great promise. Recent attention to "sick buildings" has focused attention on indoor air quality as a determinant of health. Indeed, choosing building materials, furnishings, and cleaning agents that minimize indoor emissions; designing and operating effective ventilation systems; and maintaining air circulation and humidity at optimal levels are all recognized as important design strategies to protect health… (Frumkin, 2003, p. 1451)

The perception of the individual must be considered. "The 'real cause' of an emotion is the perception of the individual" (Lindgren & Fisk, 1976, p. 66). When one is not distracted by negative influences in the environment and the air circulation, ventilation system, and humidity are at optimum levels in conjunction with an ergonomically designed space, then the positive emotions, moods, and behavior are influenced by the controlled environment. If the perception is positive and the energy is not a diversion of one's perception, then one can be more motivated. Considering a classroom where participation and motivation is a factor and there is little or no negative stress from unfavorable environmental conditions or the lack or ergonomic furnishings, then there is a less stress.

> Of possibly wider architectural implication is the growing body of research concerned with the effects of the general environmental context in providing stimulation. The broad effect being such that aspects of behaviour such as the ability to attend, or general performance in response to stimuli, seem to be related to optimal levels of general environmental stimulation. (Canter, 1981, p. 42)

The stimuli for optimal levels of performance are the psychological environmental factors. Health issues are also always of concern when evaluating environmental influences. "Aware that the immune and nervous systems are particularly responsive to environmental stimuli, scientists who study the links between psychological and physical health and the environment aren't surprised that the hypersensitive introvert also suffered from allergies and hay fever" (Gallagher, 2007, p. 18). Outside the classroom, this could very well relate to the workforce in professional seminars or in training programs. Supporting Gallagher's previous statement about suffering from allergies and hay fever, Winter and Koger (2004) wrote that the autonomic nervous system functions in conjunction with one's endocrine system through the pituitary-adrenal axis. This is a part of one's stress response that is set off by long-term chronic stressors. In turn, several hormones such as cortisol are stimulated which can have an effect of the suppression of one's immune system. As one suppresses one's immune system, one becomes more vulnerable to infection during a prolonged stress (p. 125).

The common denominator is the psychological environmental factors that influence one's being. "Unlike the negative stress that often accompanies academic work or work endeavors, positive stress, called eustress, is reflective of people's desire to find stimulation of life" (*Psychology & mental health,* 2010, p. 1861). Positive environmental factors that are influential to mood perception, motivation, and eustress can have a positive behavioral pattern in the classroom as well as in the workforce. "The amount of value placed on an attitude or activity indicates the intensity level of energy" (Stein, 1998, p. 75). Thus, a space created where the perception is favorable dictates positive behavior, moods, and eustress which can be a very effective environment for learning, teaching, and working. It is essential that environmental psychology be integrated into the academic and workforce environments, not only to enable one

not to perceive negative influences but also to enable one to focus positively and maintain good health.

Geometry as an Environmental Influence

When one reacts to an environmental factor in a room, the brain receives the stimuli through nervous system and computes area, volume, shape, color, texture, in addition to other environmental conditions such as illumination, acoustics, and temperature. "Possible distance between people is a major determinant of potential behavior relationships. The *size* of a setting offers opportunities for people to put distance between themselves or limits their options" (Zeisel, 2006, p. 215). The volume of the space is a factor in one's comfort; for example, one goes to temple or church in the middle of the week where services are held in the chapel. On a Saturday or Sunday, the services are held in the sanctuary. Considering this, one would readily observe that sitting with forty-five congregants in a fifty- seat chapel would be more comfortable in comparison to sitting with forty-five other congregants in a sanctuary with a capacity of five hundred congregants. In this example, the acoustics, illumination, HVAC, and ergonomic furnishings are of equal quality and standard. It becomes obvious the size and geometry has an effect on the mood and behavior of the congregant.

> Spatial organization of the physical work environment is its most researched feature. The organization of space determines the level of enclosure, adjacencies, proxemics, and territoriality. It can provide needed privacy and control, variety and adaptability, flexibility, and legibility. Spatial organization can facilitate or inhibit communication and collaboration. Spatial organization may contribute to the efficiency and effectiveness of the organization. (McCoy, 2002, p. 443)

A long narrow office would influence the behavior of a worker differently when compared to an excessively large office plan where the worker would be in a corner or perhaps in the middle of the office with only a desk and chair. Although these are two extremes, it becomes obvious that there is an optimum office floor plan. A plan is an area comprised of two dimensions, width and depth. When one adds the third dimension, one creates a volume which is space. This space is the geometry that influences one's behavior. "Every man's new standard of space measurement……affects him everywhere he goes, and he can go anywhere. But, most of all, the new sense of space affects him where and how he may live" (Wright, 1963, p. 239). The space is the office, and there is a hierarchy of office space and prestige that goes with it. The hierarchy of the best office offers prestige, power, and authority which can influence one's mood.

> The office is where individuals or groups of individuals congregate for handling information and making plans and decisions…. Traditionally, offices reflected the hierarchy or structure of the organization with the largest and most prominent or desirable office location and resources given to the highest-ranking member of the organization. In many traditional offices, job titles and office size and furnishings were indications of status. (McCoy, 2002, p. 443)

Although the geometry has an influence, the actual geometry of the space is not always the determining factor in creating a mood. A well defined intimate space can be created and extended to unlimited horizons by extending nature within the space. This can be done in many ways. The most obvious is with windows which can be expanded in design to glass walls with sliding glass doors. In a suburban setting with a mountain or ocean view, one is connecting with nature as far as one can see. In an urban environment, on any floor, one would have plants

throughout an apartment. Whether in an urban or suburban environment, one can visually expand one's perception of space to enhance one's mood.

> Architecture is organic only because intrinsic. In the reflex it seeks to s*erve* man rather than to become a force trying to rule over him. Another reason why we say organic architecture cultivates "the space within" as a reality instead of the roof and walls: it is building from inside out, instead from the outside in. (Wright, 1963, pp. 96-97)

Frank Lloyd Wright's phrase, "… it is building from inside out, instead from the outside in," is particularly significant. One should consider that it started in the early 1950's when the need to design better accommodations for patients in mental hospitals was recognized by architects and psychiatrists. Prior to that time, psychiatrists were medical professionals who addressed themselves to the mind, and architects were the construction professionals who addressed themselves to the structure. Wright was "on target" when he practiced bringing the outside inside. Geometry was not limited in its power to create a mood.

Spatial relationships and geometry pertain to all types of buildings. The Bloomfield Township Public Library in Bloomfield Hills, Michigan "features colorful décor, comfortable lounge seating, open space, natural light.…" (Sullivan & Horwitz-Bennett, 2010, p. 35) which are environmental factors within the created space.

Space and comfort are environmental factors that are now demanded in buildings in the same way that one now expects spaces to be air conditioned. Elliot Felix, associate director of the consulting firm DEGW in New York, said, "Now libraries must enable people to access hundreds of different types of media and technologies, help people navigate the information landscape, and provide a variety of physical and virtual spaces for them to work in…" (as cited in Sullivan & Horwitz-Bennett, 2010, p. 34). Pertaining to the comfort and environment,

Denelle Wrightson, AIA, director of library architecture for PSA-Dewberry in Dallas, said, "People will come and stay much longer if is a comfortable and pleasing environment" (as cited in Sullivan & Horwitz-Bennett, 2010, p. 36). One can now appreciate the significance of space, ergonomic furniture, and other environmental factors that influence people.

Materials as an Environmental Influence

The two most obvious environmental factors that one would first relate to are the created spaces and the materials. The materials define the space; thus, it is essential that much consideration be given to the materials. As the materials influence the aesthetics of the space, the space influences the mood and behavior of the users of the space. Certain materials are assembled in a space for acoustical reasons, and other materials are assembled in a space for payback and ease of maintenance. When one considers a flooring material for a resort where the lobby is adjacent to the exterior and pool, carpet might not be the best choice for many reasons; however, floor tile has merit. Although architects would use a hard material for flooring because of its durability and easy maintenance, the talent of the architect lies in the ability to make a less desirable material desirable by choosing the unit size of the material reflecting scale in proportion to a human and by selecting materials for color, texture, and compatibility with other materials; for example, a 13 inch by 13 inch nonslip quarry tile could be appropriate in comparison to carpet. The advantage of tile, either marble or quarry tile, would be that it can be cleaned easily and would retain less moisture than a low pile carpet. Moisture in a carpet is a health issue in addition to increasing the dew point of the air in the space. Also, excessive moisture would require increased power consumption for the mechanical equipment to maintain a desirable controlled environment. Increasing power consumption in this instance is contrary to sustainable architecture. In order to make this space comfortable, the architect would have to

decide on the color or grain of the tiled flooring material and the complementing or contrasting grout, followed by consideration of compatibility with the other materials in the space. Since the flooring material is hard in this example, an interior designer would be consulted to make one unconsciously comfortable within this space. In this instance, the area could be softened with upholstered furniture and vegetation of small plants and trees. In addition, accessories in scale, wall covering with texture, and indirect lighting with wall washers could transform what could have been a cold space into an intimate space. The proportion of materials and the scale of unit dimensions of the material in proportion to a human are factors that can create a mood and emotion. The perception of the environment creates a corresponding mood and behavior.

> Inspiration is not always limited to what we can see and touch but can often be inferred from emotions and feelings, which are abstract concepts. The psychology of how users perceive a space or the community in which they live can have obvious ramifications. (Hall & Porterfield, 1995, p. 69)

Water as an Environmental Influence

Water is everywhere. When it is near, one goes to the water. When it is distant, one brings it into one's home. Water is a biological ingredient, and man has a natural attraction and desire to return to the oceans.

In an urban environment where water is available, people travel; for example, consider Boston's waterfront development in the past forty years from the mid 1970's with Faneuil Hall Marketplace where one would notice the development of the waterfront area near what is now the Rose Kennedy Greenway. Up to the present day with the addition of the Fan Pier project and the development of these waterfront areas, upwards of eighteen billion dollars was spent to remove an elevated highway and replace it with a tunnel. By doing this, the city of Boston

opened its pedestrian circulation and visual perception toward the ocean. Prior to the dismantling of the elevated expressway, there was a separation of city land and ocean. There was a psychological barrier and a negative environmental factor of immense proportion. It is well accepted that the demolition of the elevated highway and construction of the tunnel was a success. Now, almost every street in Boston's financial district is perpendicular to the ocean and leads to the ocean with unobstructed views and planned walkways.

In New York, there are Pier 17 and the South Street Seaport. Unlike Boston, the elevated highway separating the city from the East River still exists; however, the area is viable and has become a tourist attraction. Considering the scale of skyscrapers bordering the South Street Seaport, urban planners recognized that the environments contradict one another. On one side there was Pier 17 built on the East River, and toward the city, there were buildings that are not in scale with humans. Planners realized that the development would benefit from a transitional and environmental scale factor, and "tall ships" are moored along the waterfront for a gradual transition in scale for tourists and New Yorkers to enjoy this environment.

In Baltimore, Maryland, there is another good example of waterfront development. If it is built on the water or has with a water view, people will come. In Baltimore, one would readily notice many buildings of mixed use. Lighthouse Point is an 80-unit apartment building with 30,000 square feet of retail space and 35,000 square feet of office space. The National Aquarium in Baltimore is a 70,000-square foot museum, a good example of mixed land use development. Another example is the Ritz Carlton which has 225 hotel rooms, 97 condominium units, and a 600-car parking garage. The waterfront works not only because of people's desire to be near the water but also because it is a planned development comprised of entertainment, housing, and

commercial and retail enterprises, complimented by available parking. People are interfacing here in a manner which is similar to suburban neighborhood which creates a mood and behavior.

As one would realize and accept, water is a very powerful environmental factor. It is so much in demand that real estate brokers classify real estate near water as "salt water waterfront, freshwater waterfront, saltwater water view, and freshwater water view." The value of proximity to water is well documented. "Real estate developers have attempted to capitalize on the attractiveness and human preference for water amenities in residential subdivision designs" (Nelson, Hansz, & Cypher, 2005, p. 167).

If one cannot be near the water, one can bring it into one's with home with a small bubbling fountain within the house or with a larger fountain in a flower garden. When space is limited within an apartment, one might display a small ceramic dish with a pump that circulates water on small stones. It is not only the visual effect of the water flowing but the sound of the water flowing which presents a relaxing and tranquil environmental factor to affect one's mood.

Comparing Classrooms

Ergonomic Furniture

The conventional classroom consists of one-piece seating made of molded plastic seats and metal frame supports with small plastic laminate desktops measuring 14 inches by 19 inches. The work surface height is 28 ½ inches.

The "smart classroom" has upholstered ergonomic seating with large table-style working areas measuring 24 inches by 36 inches for each student. The work surface height is 31 inches.

Flooring

The conventional classroom flooring material is vinyl composition tile. The "smart classroom" flooring is low pile commercial carpet.

Ceilings

The conventional classroom and "smart classroom" ceilings consist of 2 foot by 2 foot white suspended acoustic tile with a revealed edge. The elevation of the ceiling tile is 9'-9" in the conventional classroom and 9'-2" in the "smart classroom."

Wall Finish

The finish materials for the conventional classroom are as follows: north wall--- concrete; east wall---concrete block, chalkboard, glass sidelight, glass transom, wood door; south wall--- concrete block; west wall--- concrete, concrete block, wood door, glass sidelight.

The finish materials for the "smart classroom" are as follows: north wall--- concrete block, wood door; east wall--- concrete block, wood door, glass transom, sidelight; south wall--- concrete block; west wall--- concrete block, whiteboard, fabric screen, door, glass transom.

Chapter 3: Method

Statement of Purpose

The statement of the purpose is the research question, "Can an architect design a space that will unconsciously create a mood that would motivate people to be more productive?" The results of the three surveys from the participating students, educators, and professionals consisting primarily of doctors and architects are described with charts and graphs in Chapter 4--- "Results and Analysis/ Findings" The conclusive engineering documentation from the illumination, HVAC, and acoustic experiments are described in Appendices D, F, G, H, I, J, K, and L. These experiments were compared by analyzing the criteria, data, and results as to whether or whether not an architect can create a mood that would motivate people to be more productive.

Hypothesis

The hypothesis's purpose is to answer conclusively the question, "Can an architect design a space that will unconsciously create a mood that would motivate people to be more productive?"

Data Collection Procedure

Data were collected by sending out surveys and conducting experiments comparing two classrooms of similar size and shape. There were three separate surveys, each with ten questions and specifically designed to target a specific audience .The first audience was a survey for educators and it was sent out to twenty-two educators. The second audience was a survey for students and it was sent out to twenty-four students. The third audience was for professionals and it was sent out to forty-nine professionals since the field of environmental psychology was the integration of talents of architects and psychiatrists, thus, the majority of the surveys for professionals were sent to architects, doctors, and nurses.

The first source used psychology as a biological science to provide a survey. Statistics of the survey data were analyzed and plotted. The second source used engineering as a physical science from data which were obtained from two classrooms. One classroom, room 401, was a conventional classroom, and the second classroom, room 124, was a "smart classroom." Data were obtained from each classroom to provide engineering functions, and the differences were mathematically compared. In order to provide reliable results, all the walls, floors, and ceilings were measured and the sizes recorded. Items on each wall were recorded as to the size and material. This included cork boards, chalkboards, concrete block, cast-in-place concrete, wood, and glass. In addition, the characteristics of the ceiling tile, floor tile, and carpet were carefully measured and recorded for a comparative analysis of results. Notation was also made for influencing data such as the type and number of light fixtures in each room, the number of speakers in each room, and the method of heating and cooling as applicable.

The engineering data were located on a plan for each condition in each room and plotted on a graph where the results were accurately compared using fact and not opinion. These classroom experiments included HVAC, illumination, and acoustics. The illumination

experiments were conducted in a nighttime condition when maximum illumination was required. The acoustic experiments were conducted with the same students in each classroom since building materials as well as students absorb sound. The HVAC experiments were conducted to determine the relative humidity, temperature, and dew point in each room. The illumination experiment was conducted under nighttime conditions on October 5, 2010; the acoustic experiment was conducted on November 1, 2010 with the same students in each classroom; and the HVAC experiments were conducted on June 9, 2011.

An architect, a psychiatrist, a college president, an urban planner, and a medical doctor were interviewed. At the end of each interview, each professional was asked to reply with his/her opinions and comments via e-mail to the thesis question, "Can an Architect Design a Space that will Unconsciously Create a Mood that Would Motivate People to be More Productive These responses are documented in appendix Q.

Analytical Tools and Tests

The analytical tools from psychology, the biological science, were used to provide a survey of questions to students, faculty, and professionals. The circumstances that caused something to happen were the environmental factors that were present or not present in each classroom. The results were computed as statistics and displayed graphically. The analytical tools from engineering and the physical sciences were used in the experiments. The experiments were in HVAC, illumination, and acoustics. All the experiments were conducted in normal classroom conditions with the exception of illumination since illumination in buildings is designed for nighttime conditions. The HVAC experiments were conducted on a hot day, and the acoustical experiments were also being conducted under normal classroom conditions with an equal number of students in each classroom.

Survey Questions

The reader is directed to Appendix **N** for the cover letter and to Appendix O for the survey questions.

Conclusion

"Environmental psychology" can be defined as the relationship between humans and his environment. If one were to define "environmental," one would realize that it pertains to the physical sciences such as the engineering of heating, cooling, lighting, acoustics, etc.

> If you understand how people's brains and minds develop and function in different situations, and how they have evolved over time to respond to physical environments, then environments designed to support these capabilities as well as tasks, activities, and user needs, will contribute to people's quality of life, creativity, and survival. (Zeisel, 2006, p. 143)

The results of the physical science experiments from the HVAC data for temperature and dew point, illumination data for lighting foot-candles and lumens, and acoustical data for sabins of sound absorption were analyzed and documented. The results from the analyzed physical and social sciences data were charted and graphed, complimented by three independent surveys and interviews with an architect, a psychiatrist, a college president, a professor, an urban planner, and a doctor of Speech Pathology and Audiology. It was concluded that the three physical experiments were scientific and the results could not be disputed. The three surveys from a social science complimented the physical science surveys, and all the professional interviews supported the physical and social science findings.

> The main purpose of a theory in science is to go beyond the data. It is a means of identifying the crucial aspects of any phenomena and representing the general relationships between those aspects and the condition under which those relationships will hold. Theories go beyond any particular instance or set of data to indicate generalities that allow us to extrapolate beyond specific examples. That is the power of science and the reason why it has had such world-changing influence. It allows us to take the results from the past in one context and use them confidently to predict what will happen under similar, but not identical, conditions in the future. (Canter, 2008, p. 664)

The theory in asking the question, "Can an architect design a space that will unconsciously create a mood that would motivate people to be more productive?," was to determine if this were possible. The theory and the hypothesis were determined by two sciences. Psychology, a social science, and engineering, a physical science, from which the results were compiled. Psychology, a social science, was the basis for three surveys whereby the received data were evaluated in statistical form and charted. Engineering, the physical science, which includes engineering from the disciplines of illumination, heating, ventilation, air conditioning, and acoustics, was the basis for obtaining accurate mathematical and conclusive results. As stated above by Canter, "It is a means of identifying the crucial aspects of any phenomena and representing the general relationships between those aspects and the condition under which those relationships will hold." The crucial aspects of the acoustics, illumination, and HVAC phenomena engineering data and their results were represented by charts and plans located in appendices H, I, J, K, and L. The computed results of the experiments were congruent to the science of engineering. "That is the power of science and the reason why it has had such world-changing influence" (Canter, 2008, p. 664). This suggests that one can take the results from the

past in one context, that being the social science of psychology, and taking the results from the experiments which are from a physical science like engineering to predict the conclusion. "It allows us to take the results from the past in one context and use them confidently to predict what will happen under similar, but not identical, conditions in the future" (Canter, 2008, p. 664) forms the basis for the survey and the experiments. The three survey questionnaire results from the students, faculty, and professionals provided the statistics which were plotted. The measurable variables were documented in the experiments. The variables for acoustics were the construction and finish materials, area of materials, and students in the room. The variables for illumination were the ceiling heights, work surfaces, quantity of lighting fixtures, distribution of light, and types of lighting. The variables for HVAC were the air conditioning, indoor and outdoor temperatures, and dew points. The existing engineering data and results were scientific documents that could not be disputed. The results of these engineering experiments were not opinions or predictions but undisputable engineering conclusions that are conclusive. The results of the survey were based on creditable entry data and statistics.

As a result of the reliable entry data and results of the survey and the engineering data for the experiments, and interviews, one can now ask the question, "Can an architect design a space that will unconsciously create a mood that would motivate people to be more productive?," and confidently say, "Based on the reliable statistical results of the three customized surveys, the consensus of opinion of professional interviews, and the plotted engineering data of three engineered experiments, research suggests that "an architect can design a space that will unconsciously create a mood to motivate a person to be more productive."

The value of this research is well documented and shall be beneficial to academia and structured organizations. Academia shall benefit from this research by incorporating it into the

curriculum to be taught, and business shall benefit by graduates bringing it from the classroom into the executive offices.

Chapter 4: Results and Analysis

Findings

Hypothesis- An architect can design a space that will unconsciously create a mood that would motivate people to be more productive.

Null Hypothesis- An architect can design a space that will not create a mood that would motivate people to be more productive.

Implication for the Research Question

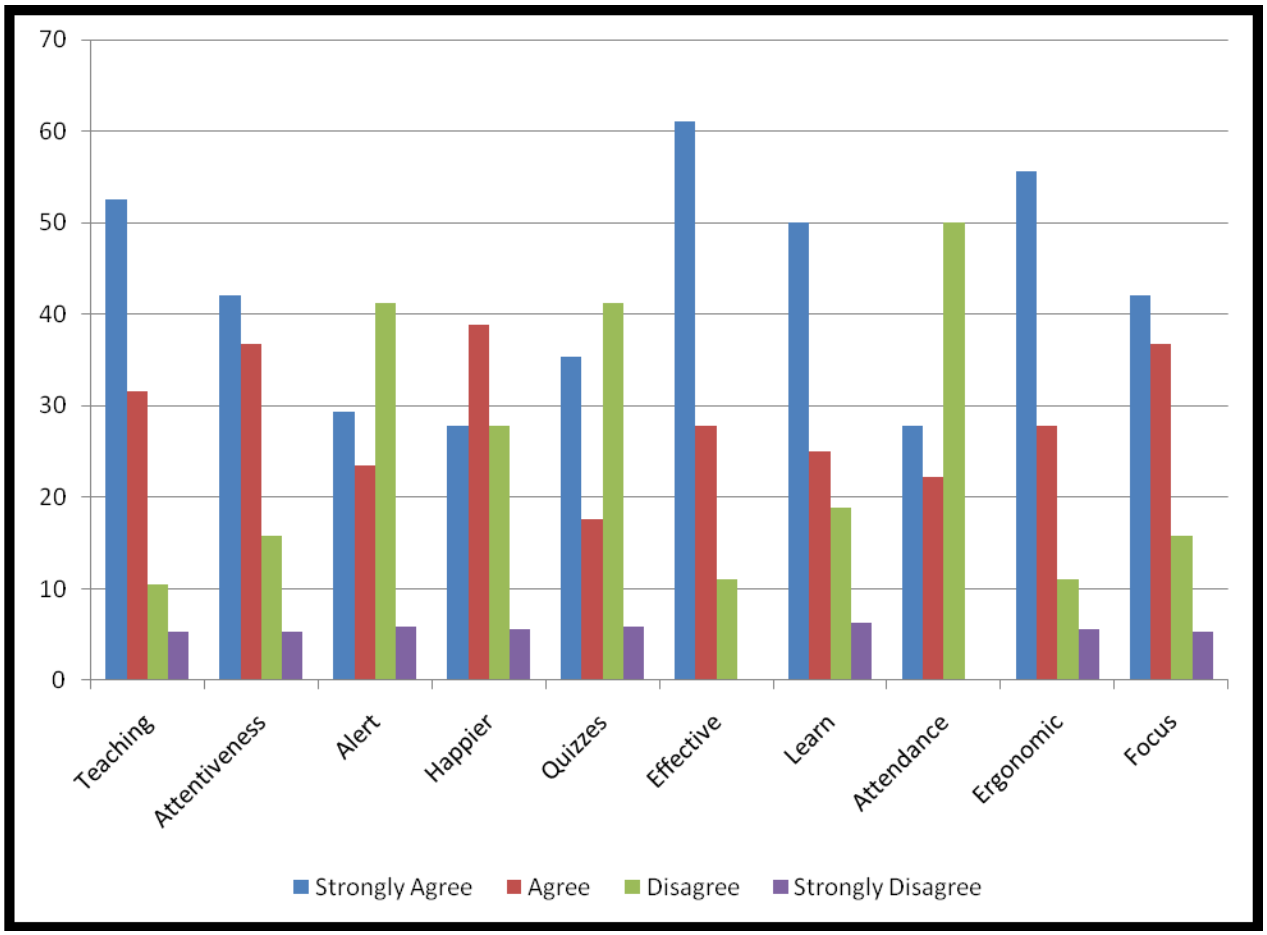
A questionnaire comprised of ten different questions was distributed to each of the three groups: educators, professionals; and students. Each question consisted of a statement which evaluated preferences followed by a Likert scale of four choices. Forty-nine questionnaires were sent to professionals including ten architects, six doctors, one psychiatrist, three college presidents, eight nurses, and one psychologist with the balance of the professional questionnaires sent to accountants, building officials, and executives. Architectural and medical professions were emphasized since environmental psychology started with the collaboration of doctors and architects. Thirty-six of the forty-nine professional questionnaires were returned. Twenty-two questionnaires were sent to educators of which twenty-one were returned, two of which were not completed with notes attached indicating they had never taught in a smart classroom. Twenty-four questionnaires were sent students of

which twenty-four were returned. The respondents' returns of the surveys were tabulated and statistically analyzed using SPSS and Microsoft Excel software.

After the surveys and experiments were completed, the data were compiled, analyzed and graphed for an accurate evaluation of the results. The results of the three surveys and three experiments conclusively document that an architect can design a space that will unconsciously create a mood that would motivate people to be more productive. The concluding comments from all those interviewed supported the same

Chart and Graph for Educators from Survey

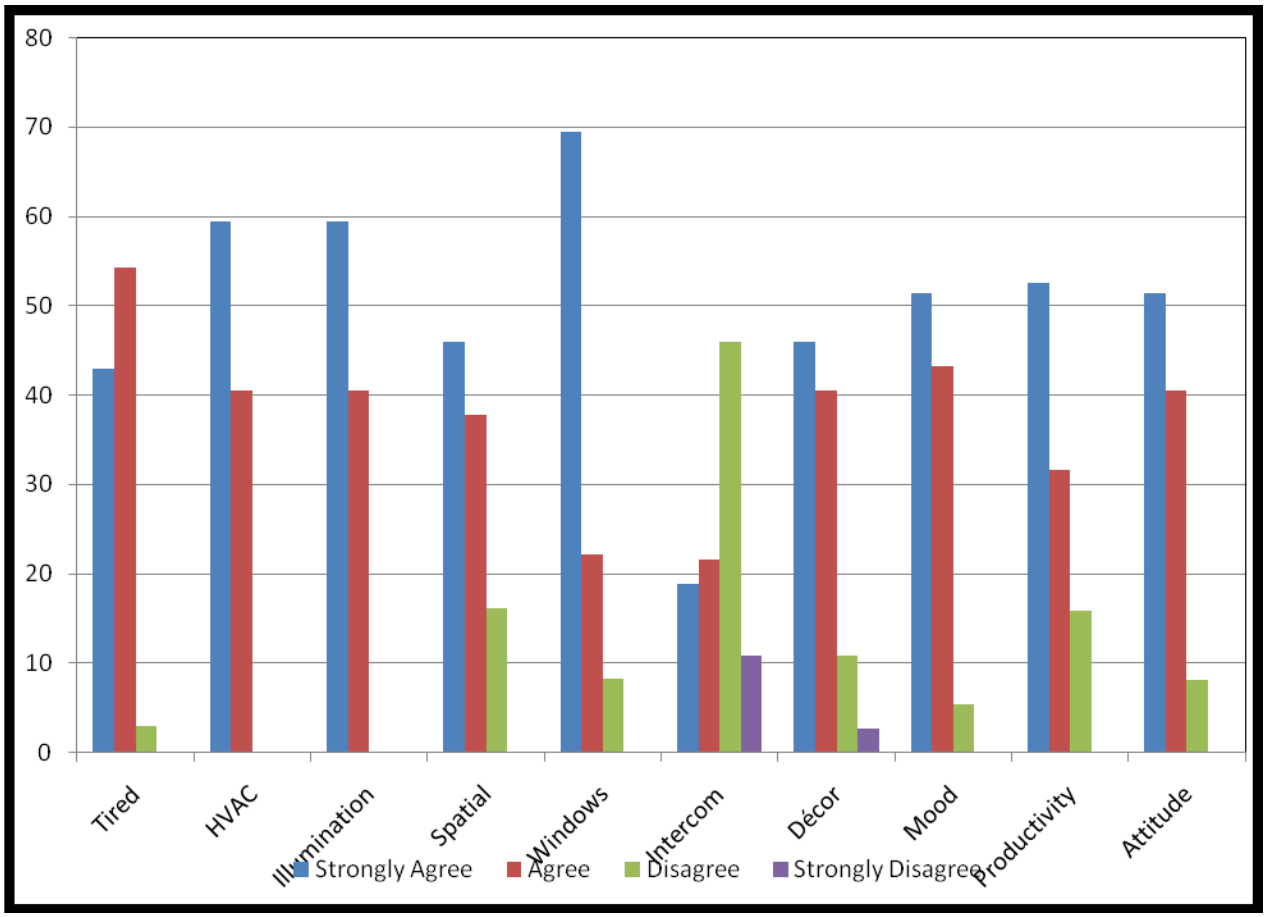
Educators	Teaching	Attentiveness	Alert	Happier	Quizzes	Effective	Learn	Attendance	Ergonomic	Focus
Strongly Agree	52.6	42.1	29.4	27.8	35.3	61.1	50	27.8	55.6	42.1
Agree	31.6	36.8	23.5	38.9	17.6	27.8	25	22.2	27.8	36.8
Disagree	10.5	15.8	41.2	27.8	41.2	11.1	18.8	50	11.1	15.8
Strongly Disagree	5.3	5.3	5.9	5.6	5.9		6.3		5.6	5.3



Research strongly suggests that an architect can design a space that will unconsciously create a mood that would motivate people to be more productive based on the survey results from a survey sent to educators.

Chart and Graph for Professionals from Survey

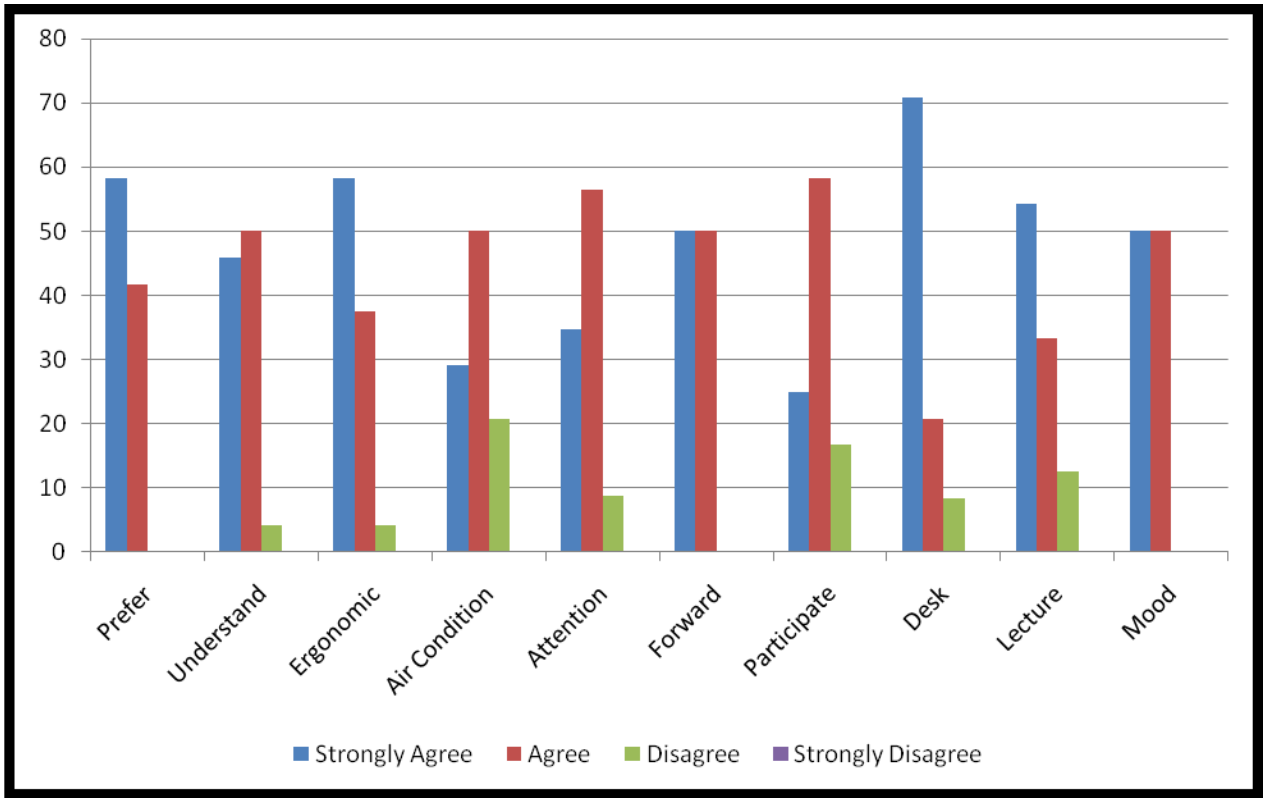
Professionals	Tired	HVAC	Illumination	Spatial	Windows	Intercom	Décor	Mood	Productivity	Attitude
Strongly Agree	42.9	59.5	59.5	45.9	69.4	18.9	45.9	51.4	52.6	51.4
Agree	54.3	40.5	40.5	37.8	22.2	21.6	40.5	43.2	31.6	40.5
Disagree	2.9			16.2	8.3	45.9	10.8	5.4	15.8	8.1
Strongly Disagree						10.8	2.7			



Research strongly suggests that an architect can design a space that will unconsciously create a mood that would motivate people to be more productive based on the survey results from a survey sent to educators.

Chart and Graph for Students from Survey

Students	Prefer	Understand	Ergonomic	Air Condition	Attention	Forward	Participate	Desk	Lecture	Mood
Strongly Agree	58.3	45.8	58.3	29.2	34.8	50	25	70.8	54.2	50
Agree	41.7	50	37.5	50	56.5	50	58.3	20.8	33.3	50
Disagree		4.2	4.2	20.8	8.7		16.7	8.3	12.5	
Strongly Disagree										



Research strongly suggests that an architect can design a space that will unconsciously create a mood that would motivate people to be more productive based on the survey results from a survey sent to students.

Chapter 5: Conclusion

Recommendations

Academia, the military, and business organizations should incorporate environmental psychology and environmental influences into future planning when providing a workspace. A workspace is considered to be a classroom, office, manufacturing facility, construction site, or any type of vehicle.

Implementation

It is recommended that the professions of architecture and medicine continue to pool their talents to promulgate more collaboration, research and design, and product development for the enhancement of the development of future spaces. This can be done with the innovation of advanced illumination, climate-controlled environments, aesthetics in design, and advanced research in ergonomics.

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Appendix A

Survey Cover Letter

December 2, 2010

Dear Participant:

This study is being conducted in order to complete the requirement for a Master of Science in Management degree (MSM) at Eastern Nazarene College. This research shall examine to what degree an architect can design a space that will unconsciously create a mood that would motivate people to be more productive.

The survey should only take a few moments to complete, and your time and effort are greatly appreciated. The validity of the results depends on obtaining a high response rate, and your participation is crucial to the success of this study. I kindly request that you return the survey by December 20, 2011, using the self-addressed envelope provided or in person. The return of the survey indicates consent of your participation in this study.

Please be assured that all responses will be held in the strictest confidence and that no identifying information shall be used. All surveys will be carefully stored until the data are processed and the thesis is presented to the Eastern Nazarene College faculty.

If you have any questions regarding this study, please contact me via e-mail at AIAarchitect@comcast.net.

Thank you for your time and effort which are sincerely appreciated.

_____

Irving M. Weiner NCARB, AIA, CSI

Appendix B

Glossary of Terms

Ambient lighting…….The average illumination within a space.

CFM…….. Cubic feet per minute pertaining to air in a duct.

Decibel…… An acoustic measure of loudness, abbreviated dB. It varies from 0 dB to 140 dB which is the threshold of pain. An average rating for normal conversation is 60dB.

Foot-candle …….. The average illumination resulting when one lumen of light falls on one square foot of surface.

HRR……Heart Rate Response.

HVAC …….. Heating, Ventilation, and Air Conditioning.

Lumen …….. The amount of light falling on a one foot square when every part of the square is exactly one foot away from a standard candle.

OSHA…… Occupational Safety and Health Administration.

Sabin …… The measure of sound absorption of a particular surface that is equal to one square foot of absorptive surface.

SCR…….. Skin Conductance Response.

STC…… Sound Transmission Coefficient

Sling psychrometer… Two glass thermometers used to measure the wet and dry bulb temperatures. As the water in the wick in the wet bulb thermometer cools the web bulb thermometer, the readings in both are recorded.

Psychrometric chart… A chart used by mechanical engineers to determine the dew point when the wet and dry bulb temperatures are known.

VCT…….. Vinyl Composition Tile, usually referring to floor tile.

Appendix C

Classroom 401 Photographs

CONVENTIONAL CLASSROOM 401 EAST WALL

CONVENTIONAL CLASSROOM 401 NORTH WALL

CONVENTIONAL CLASSROOM 401 SOUTH WALL

CONVENTIONAL CLASSROOM 401 WEST WALL

CONVENTIONAL CLASSROOM 401 CEILING

CONVENTIONAL CLASSROOM 401 FLOOR AND SEATING

Appendix D

Classroom 401 Existing Conditions

Room 401	**Existing Data Characteristics**
Width :	26’-0”
Depth:	27’-6”
Ceiling:	Suspended acoustic tile, 2’-0” x 2’-0 x 3/4” at elevation 9’-9”
Speakers:	None
Diffusers:	Not air conditioned
Flooring:	Vinyl composition tile 12” x 12”
Illumination:	Fluorescent lighting, 2’-0” x 4’-0” recessed 4 tubes, 7 fixtures in total
Seating:	Plastic seating with metal frames, work surface 14” x 19”, 34 in total
North wall:	Cast- in- place concrete, 4’-0” x 6’-0” corkboard, 4’-0” x 12’-0”chalkboard
South wall:	Exposed concrete block
East wall:	Exposed concrete block, 2’-0” x 5’-6” wire glass transom, 3’-0” x 7’-0” wood door, 2’-6” x 7’-0” wire glass sidelight
West wall:	Concrete block to 7’-2” full width, concrete beam 2’-7” full width, 3’-0” x 7’-0” wood door, 2’-6” x 7’-0” wire glass sidelight, 2’-0” x 5’-6” wire glass transom
Console:	Portable, overhead projection capability, no camera capability

Appendix E

Classroom 124 Photographs

SMART CLASSROOM 124 MEDIA CONTROL PANEL AND DROP DOWN SCREEN

SMART CLASSROOM 124 MEDIA CONTROL PANEL and WHITE BOARD

SMART CLASSROOM 124 SOUTH WALL

SMART CLASSROOM 124 WEST WALL

SMART CLASSROOM 124 EAST WALL

SMART CLASSROOM 124 NORTH WALL

SMART CLASSROOM 124 CEILING WITH SPEAKERS AND AC DIFFUSERS

SMART CLASSROOM 124 ERGONOMIC FURNITURE

Appendix F

Classroom 124 Existing Conditions

Room 124 Existing Data Characteristics

Width:	28’-0”
Depth:	30’-0”
Ceiling:	Suspended acoustic tile, 2’-0” x 2’-0” x ¾” at elevation 9’-2”
Speakers:	Six speakers in evenly spaced in ceiling
Diffusers:	Air conditioning and heating diffusers, 4 in total
Flooring:	Low pile commercial carpet
Illumination:	Fluorescent lighting 2’-0” x 2’-0” recessed 2 tubes, 12 fixtures in total Recessed R type hi-hat on rheostat control, 9 fixtures total
Seating:	Ergonomic upholstered adjustable seating, work surface 24” x 36” at 31”, 28 total
North wall:	Concrete block painted 2- 3’-0” x 7’-0” wood doors
South wall:	Concrete block painted
East wall:	Concrete block painted
West wall:	Concrete block painted, 3’-0” x 7’-0” wood door, 3’-0” x 2’-0” wood transom, 4’-0” x 21’-10” whiteboard with a 6’-0” high x 9’-9” wide drop- down screen in front
Console:	Built-in media console with capability for lighting control, overhead projector, camera projection, built-in computer

Appendix G

Descriptions of Acoustic, Illumination, and HVAC Experiments

Acoustics Experiment

This experiment in environmental psychology to determine the effects and results of acoustics was performed at the Canton Campus of Massasoit Community College on November 1, 2010 using Room 401 as a conventional classroom and Room 124 as a "smart classroom." Classrooms 401 and 124 were selected because they are of similar shape and size. In addition, the adjacent spaces surrounding these classrooms were similar in function. The data derived from these two spaces delineated markedly different acoustic environments.

The acoustic data measured sound levels within each classroom and the immediate adjacent spaces. The decibel data were procured with an "A" weighted sound meter which mimicked the auditory performance of the human ear. The data were obtained with both high and low levels of activity in both the classrooms and adjoining spaces. The echo-producing surfaces and the absorptive surfaces in each classroom were measured and compared. Total sabins of absorption were compared for each space. The experiment was conducted with students in the classrooms since the sound absorption of clothing was a factor in obtaining reliable data. The sound- producing activities in each classroom and the adjacent spaces were comparable. Barrier effects of varying construction materials enclosing the classrooms were contributing factors in the calculations. These resulting sound levels were due to the results of the types of surfaces and structures of the classroom enclosures. The acoustic data were analyzed, compared, and graphically recorded in Appendix I.

Illumination Experiment

The experiment in environmental psychology to determine the effects and results of illumination was performed at the Canton Campus of Massasoit Community College on October 5, 2010 using Room 401 as a conventional classroom and Room 124 as a "smart classroom." The criteria for selecting these two classrooms were predicated on the premise that both classrooms would be of the same shape, size, and existing ambient lighting conditions. The types of bulbs and wattage were recorded for each classroom. Foot-candles and lumens readings were recorded for each room at similar locations in each classroom. The engineering data were analyzed, compared, and graphically recorded in Appendix H and Appendix K.

Heating, Ventilation, and Air Conditioning Experiment

The experiment in environmental psychology to determine the effects and results of heating, ventilating and air conditioning" was performed at the Canton Campus of Massasoit Community College on June 9, 2010 using Room 401 as a conventional classroom and Room 124 as a "smart classroom." The experiment was conducted on a hot day for the data to reveal more decisive extremes since only the smart classroom is air conditioned. The criteria for selecting these two classrooms were predicated on the premise that both classrooms would be of the same shape and size and that the conditions of the adjacent four spaces compared to each of the two experimental rooms would also be the same in order to obtain reliable engineering values.

The analysis for the HVAC consisted of observation and documentation of three experiments to obtain engineering data.

The first experiment was conducted to record the dry bulb temperature with a thermometer. The second experiment was conducted to record the wet bulb temperature by using

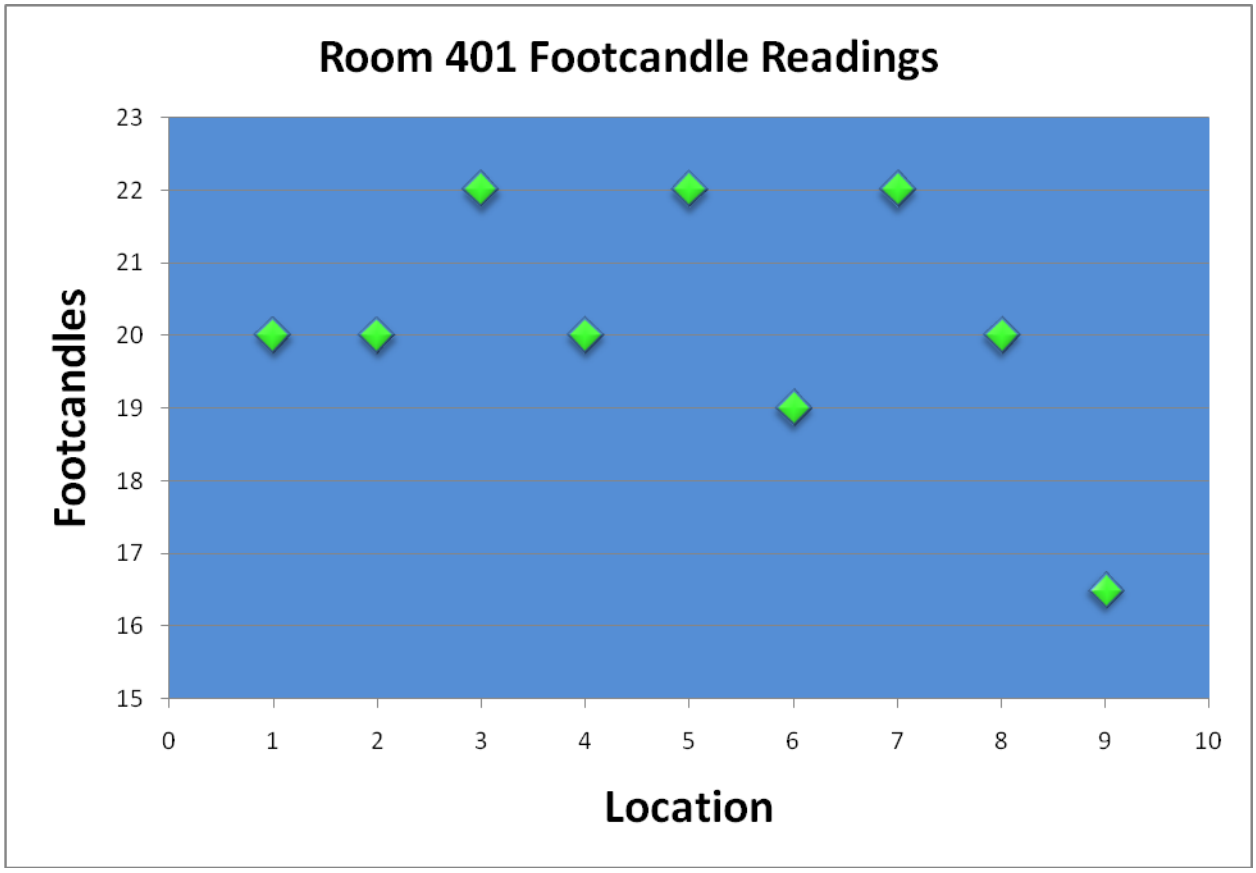
a sling psychrometer. When this was recorded, the relative humidity was determined with the use of a psychrometric chart.

Wet and dry bulb temperatures, BTU/#, and relative and actual humidity data were compared on the HVAC chart in Appendix J.

Appendix H

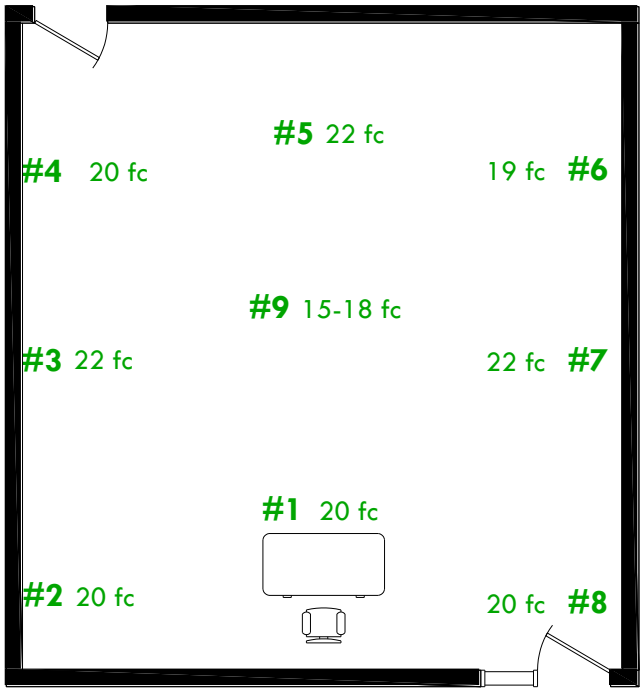
Illumination

Illumination Chart -Classroom 401



Classroom 401 has only fluorescent lighting. The foot-candle intensity is fairly uniform at 20 foot-candles on the student work surfaces. The area at the teacher's station on the corridor wall is considerably darker than the uniform level of foot-candle brightness in the rest of the room. This condition permits satisfactory image projections on screens at the teacher's station only, as the remainders of the wall surfaces have a high level of reflectance.

Illumination Data Plan Classroom 401



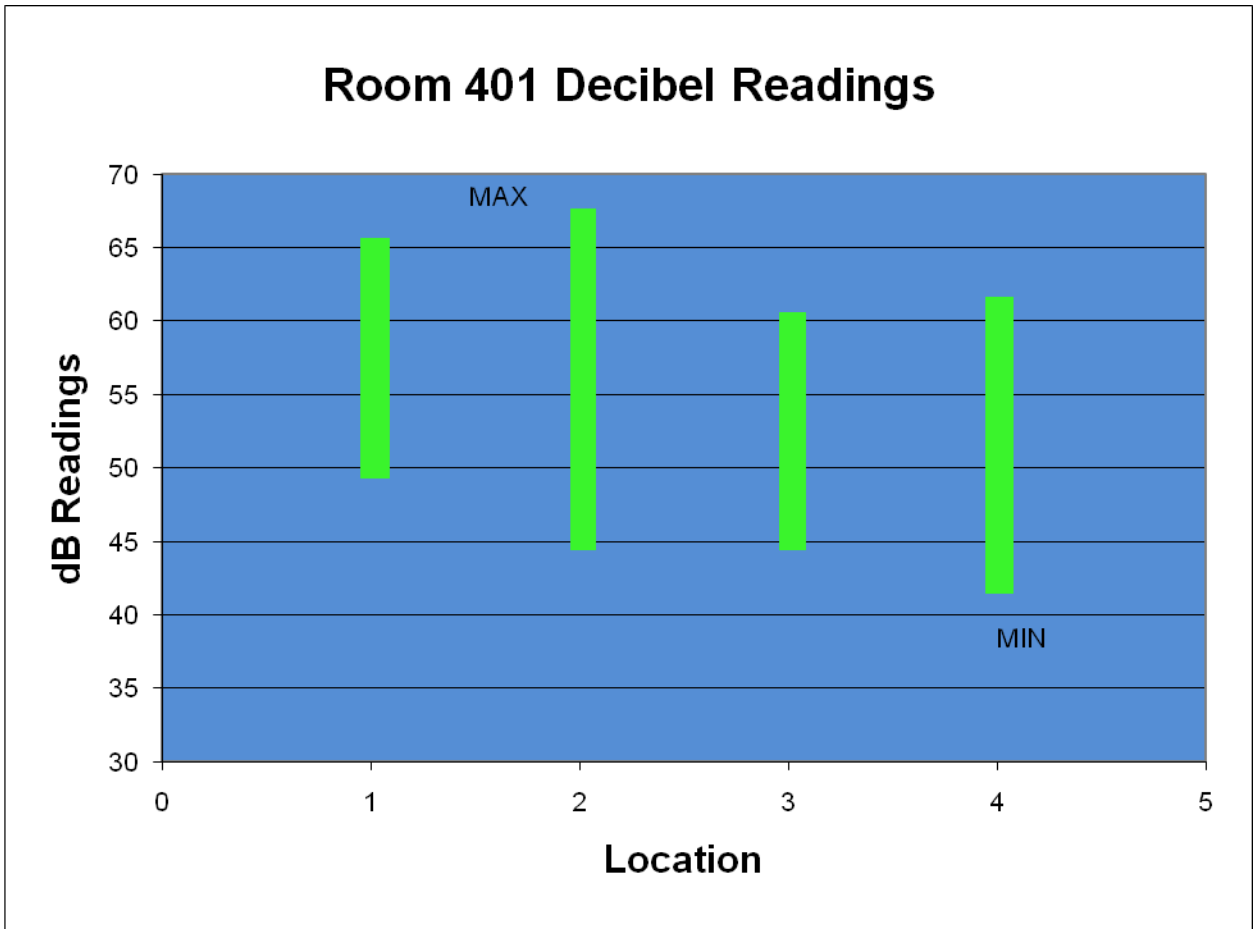
PLAN OF ROOM 401 WITH DATA LOCATIONS

NORTH ⇨

Appendix I

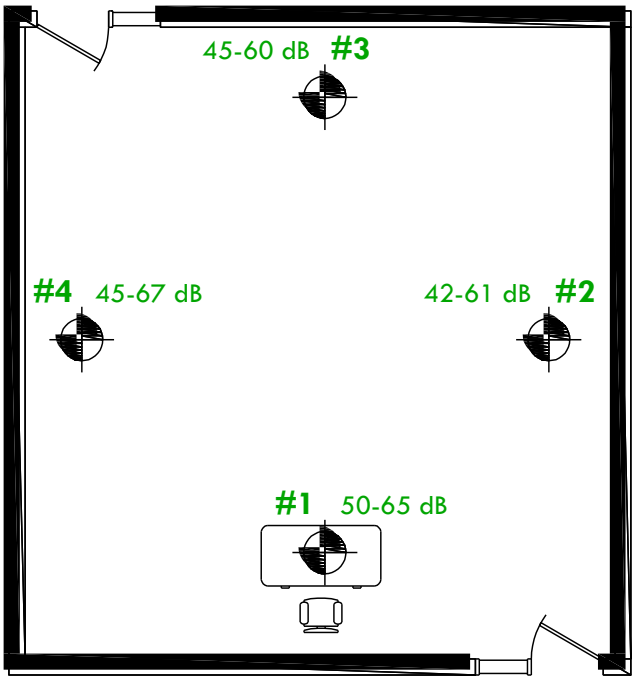
Acoustics

Acoustics Chart Classroom 401



Sound level readings were taken with an "A" weighted meter which resembles the human ear responses to sound pressure. The readings in Classroom 401 varied between 15 and 22 decibels with reverberation strengthening the loudest levels of speech from the teacher's station. The teacher's station had a variable dB of 15 which was exceed in all areas of the room except the rear. Large differences in sound level can be distracting and tiring in the effort to hear all of what's said.

Acoustics Data Plan Classroom 401



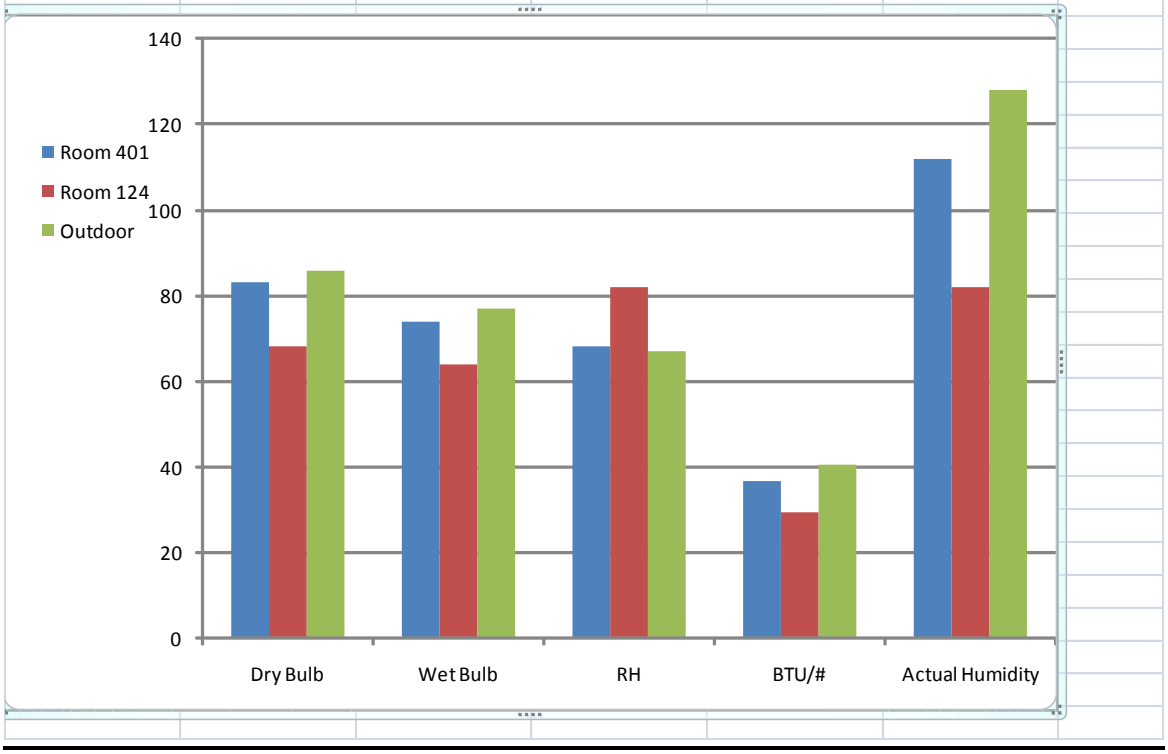
PLAN OF ROOM 401 WITH DATA LOCATIONS

NORTH

Appendix J

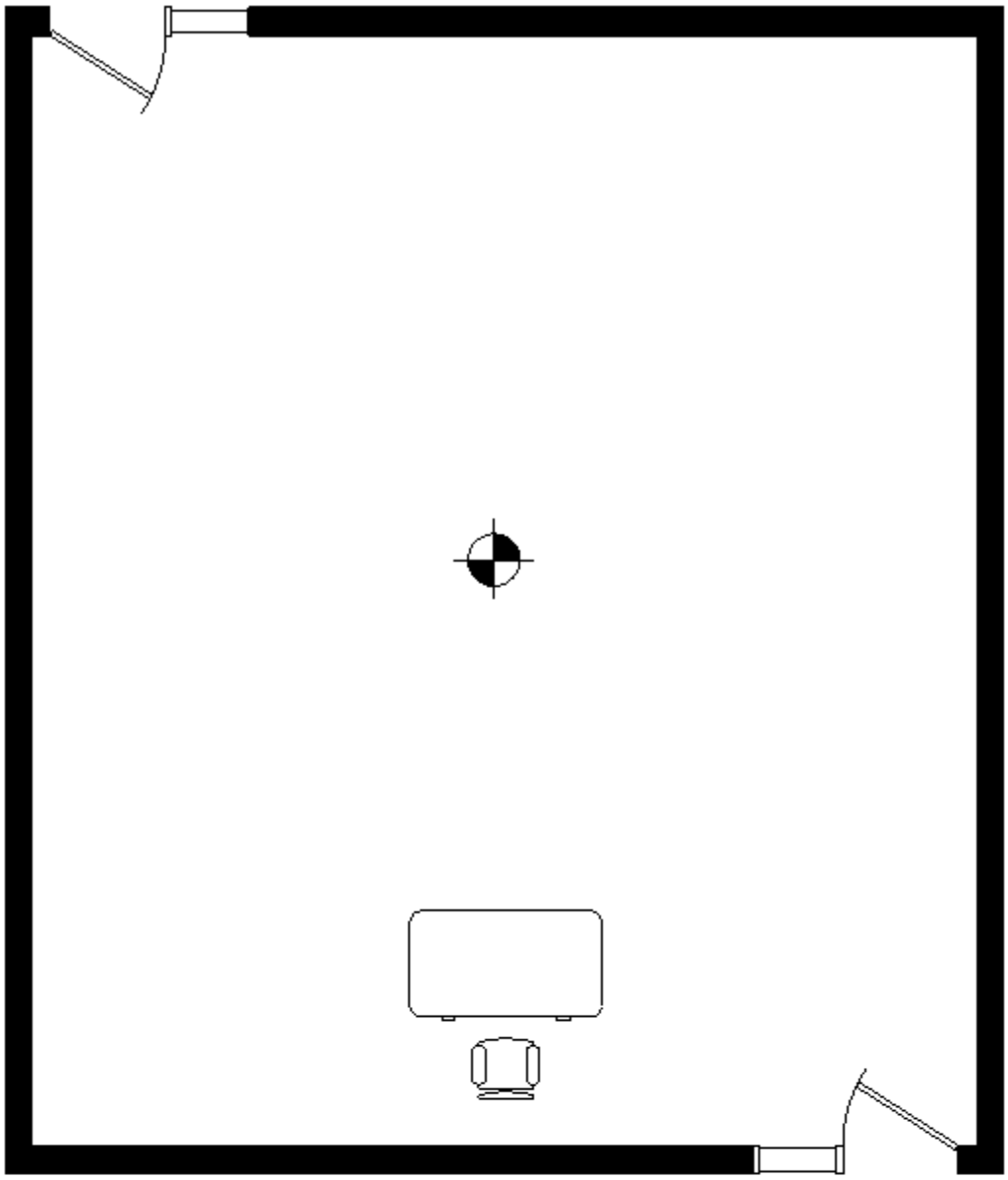
HVAC Charts for Classroom 124, Classroom 401, and Outdoor Environment

Room #	Dry Bulb	Wet Bulb	RH	BTU/#	Actual Humidity
Room 401	83	74	68	36.8	112
Room 124	68	64	82	29.4	82
Outdoor	86	77	67	40.6	128



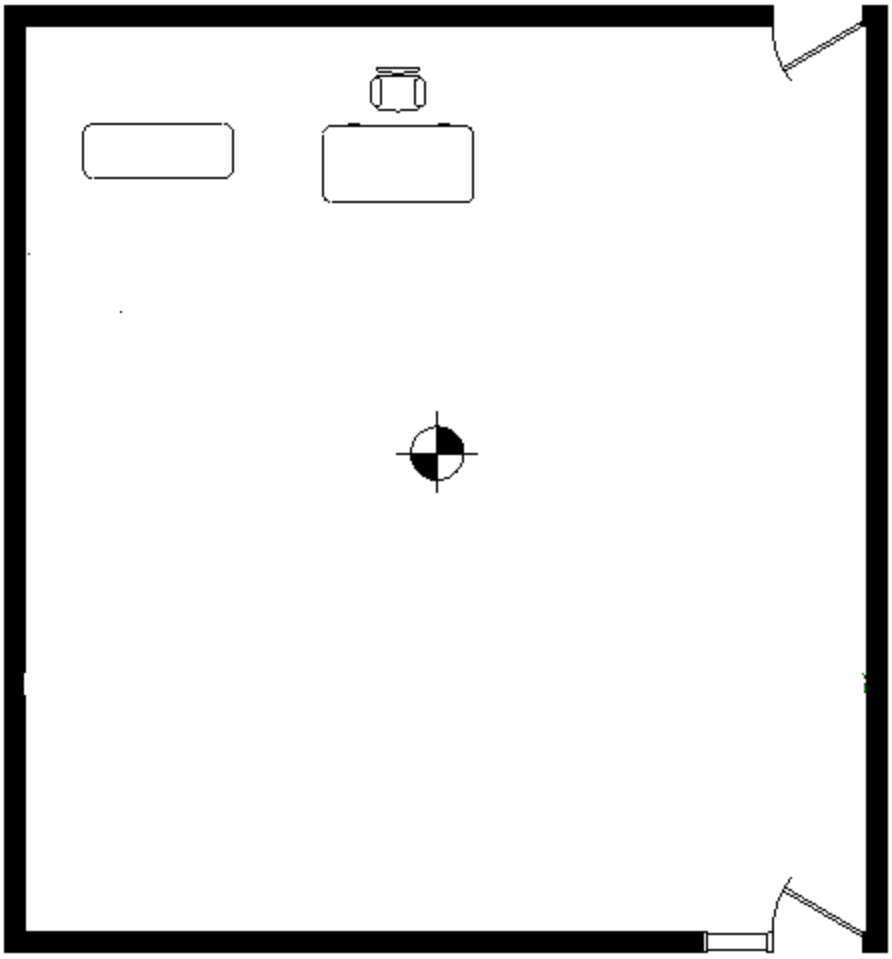
Measurement data above indicated above indicates that the air conditioning in Classroom 124 did not reduce the relative humidity although the actual humidity was reduced. The BTU/# of air was reduced in classroom 124 resulting in a lower energy level. This resulted in a better comfort level because of the improved evaporation rate in classroom 124. The perceived comfort level is more related more to humidity than to the actual temperature in the classroom.

HVAC Data Plan Classroom 401



All data taken in the center of Classroom 401 NORTH

HVAC Data Plan Classroom124



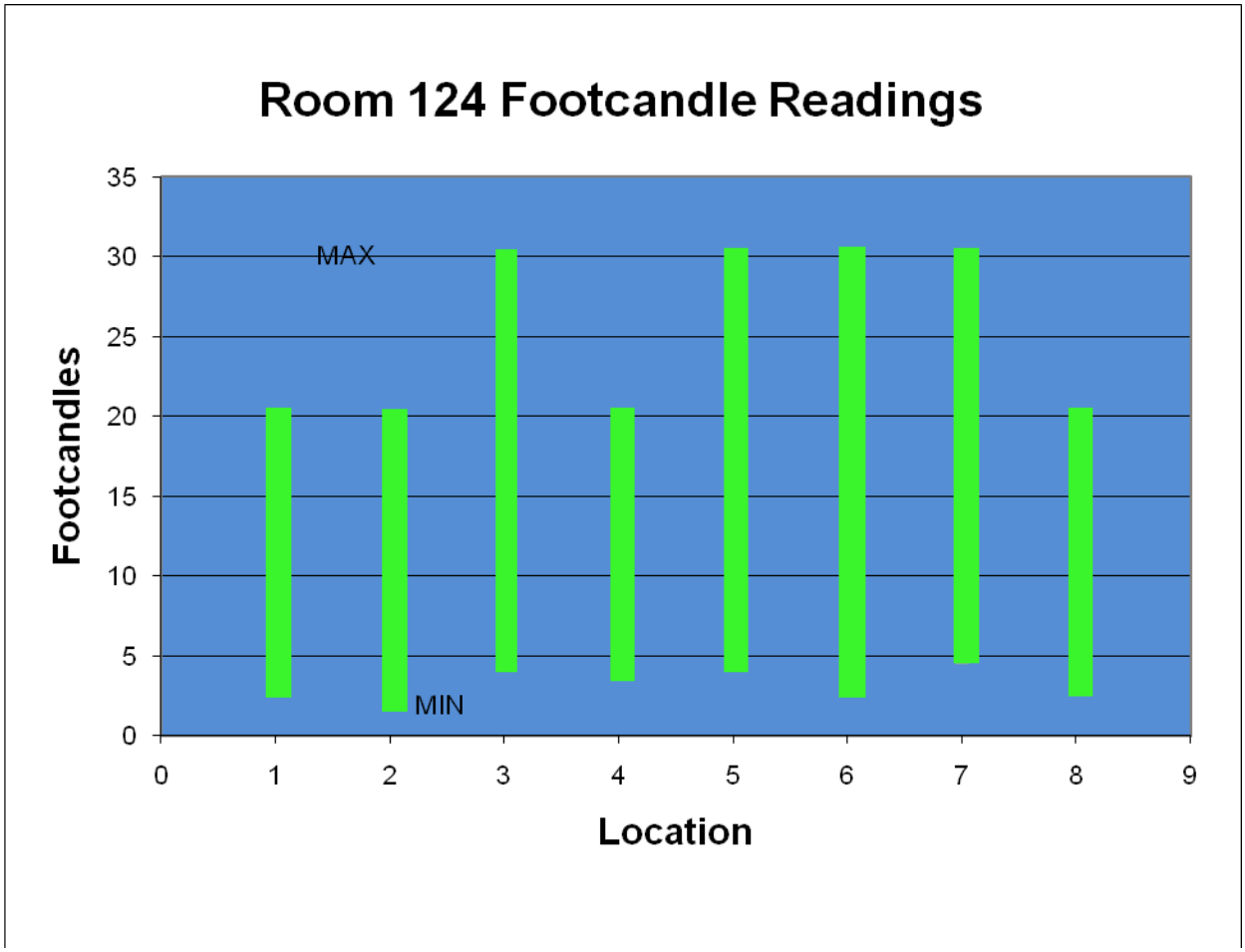
All data taken in center of Classroom 124

NORTH

Appendix K

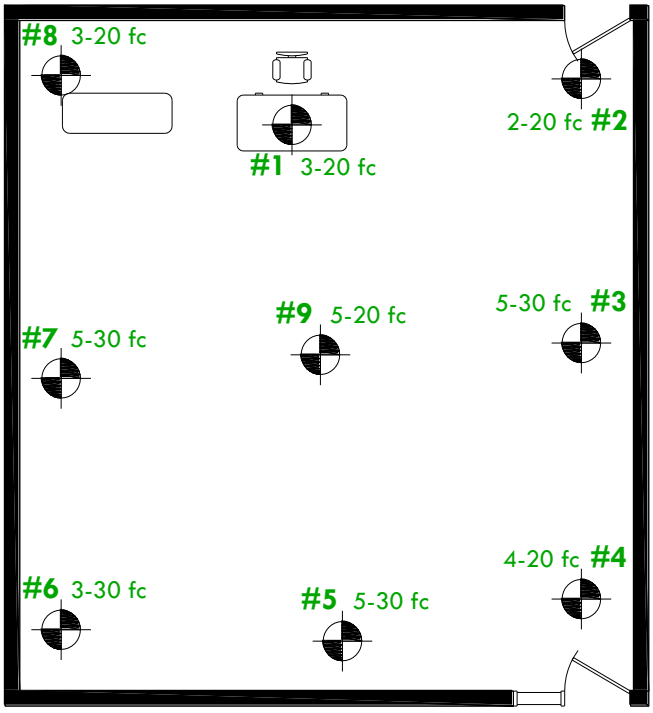
Illumination

Illumination Chart for Classroom 124



Classroom 124, the "smart classroom", is illuminated by both incandescent and fluorescent lighting. The foot candle intensity at the student work surfaces is varied by dimmer switches at the room entrance. The teacher's station area is at the opposite wall. At any given dimmer switch setting, the foot candle intensity at the student work surfaces is uniform. While providing a high level of brightness in the student area of the room, the teacher's station area can be made quite dark, providing opportunity for high contrast projections at the adjoining wall.

Illumination Data Plan Classroom 124



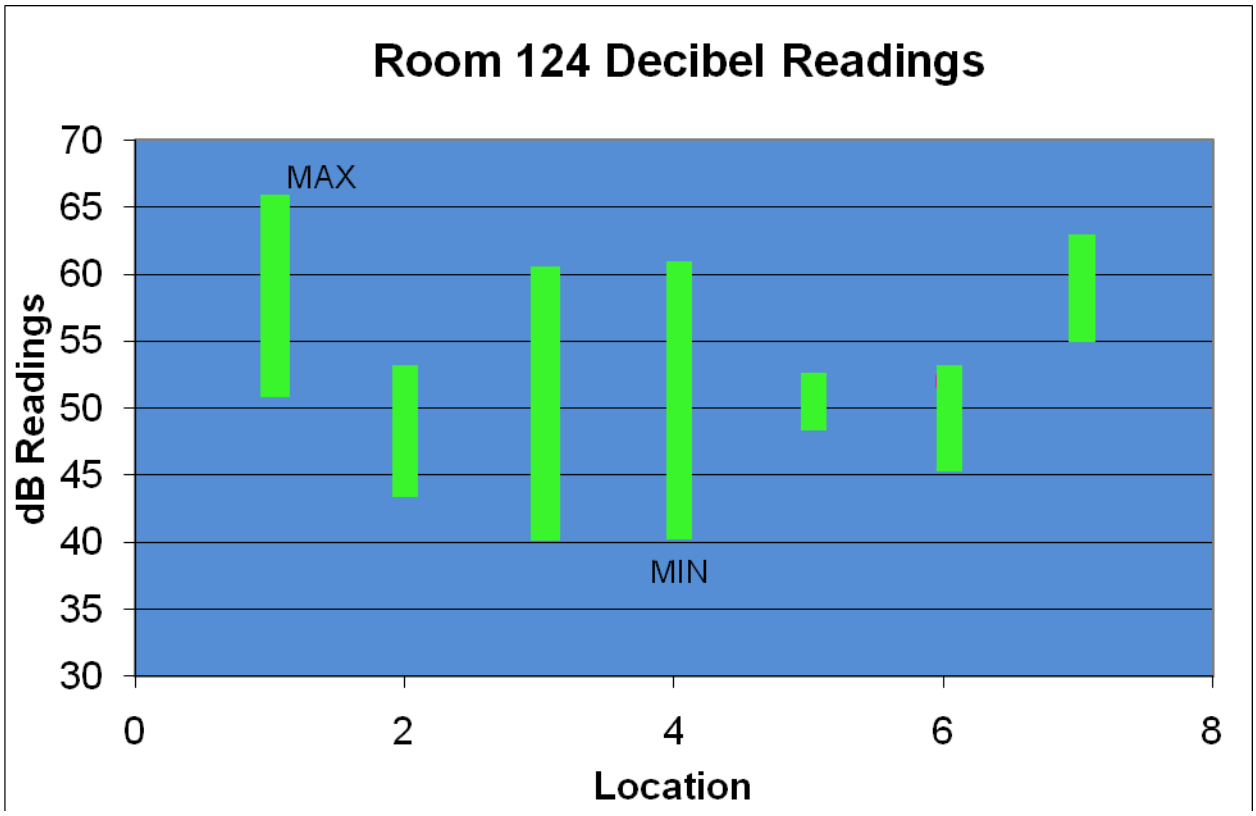
PLAN OF ROOM 124 WITH DATA LOCATIONS

NORTH ⇨

Appendix L

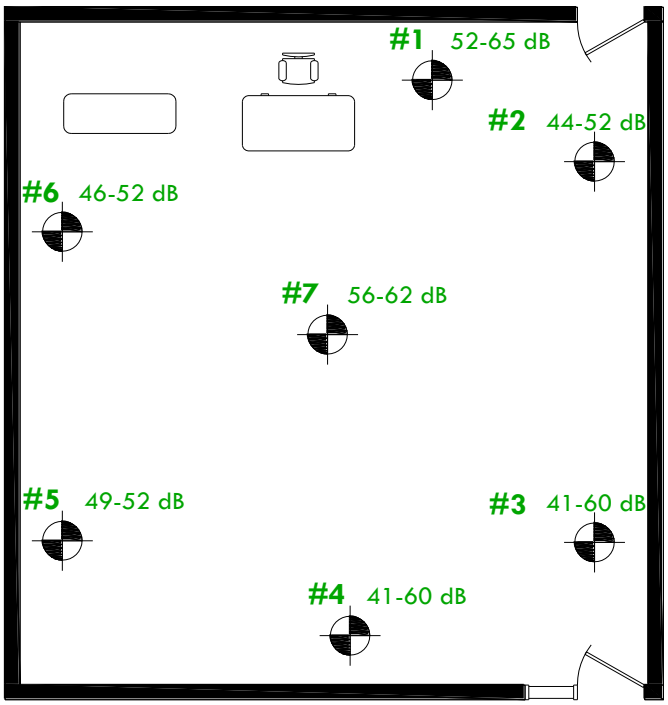
Acoustics

Acoustics Chart Classroom 124



Sound level readings were taken with an "A" weighted meter which resembles the human ear response o sound pressure. The readings in classroom 124 varied between 3 and 19 decibels with the largest loss of power at the rear, except the left wall.

Acoustics Data Plan Classroom 124



PLAN OF ROOM 124 WITH DATA LOCATIONS

NORTH

Appendix M

Survey questions for Educators, Students, and Professionals

For Educators:

1. Teaching in a "smart classroom" is more effective than in a conventional classroom

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Disagree

2. Students are more attentive in a "smart classroom."

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Disagree

3. Students are more alert in a "smart classroom."

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Disagree

4. Students appear to be happier in a “smart classroom” than in a conventional classroom.

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Disagree

5. Given the same quizzes in a conventional classroom or “smart classroom,” students in a “smart classroom” perform better.

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Disagree

6. A teacher’s lecture is more effective using software technology in a “smart classroom.”

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Disagree

7. Students learn more when teachers sketch details using a computer tablet connected to a media console and projecting the image onto a screen.

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Disagree

8. Attendance is better in a “smart classroom.”

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Disagree

9. Students are less restless when sitting in ergonomic chairs.

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Disagree

10. Students are more focused on projected media on a screen than on material written on a chalkboard.

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Disagree

For Students:

1. I prefer having classes in a "smart Classroom".

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Disagree

2. I understand the lecture better when it is projected on a screen with use of special software in a "smart classroom."

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Disagree

3. I am more attentive sitting on an ergonomic chair.

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Disagree

4. I am more attentive in an air conditioned space.

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Agree

5. My attention span is better is better in a “smart classroom.”

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Disagree

6. I look forward to having a class in a “smart classroom.”

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Disagree

7. I participate more in a “smart classroom.”

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Disagree

8. I like a 2- foot by three foot desk in front of me in a “smart classroom” better than a 14-inch by 19- inch work area surface with a chair in a conventional classroom.

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Disagree

9. The lectures are presented better in a “smart classroom.”

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Disagree

10. A “smart classroom” sets a mood conducive to better learning.

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Disagree

For Professionals:

1. I am less tired at the end of a workday when I sit on ergonomically designed chair.

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Disagree

2. The controlled environment (HVAC) has an effect on my productivity.

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Disagree

3. I am more productive in a well illuminated environment.

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Disagree

4. I am more productive in a spacious environment compared to a confined environment.

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Disagree

5. I like to look out a window and keep in touch with the environment.

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Disagree

6. Music via a ceiling intercom system relaxes me.

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Disagree

7. My mood is influenced by the décor (color, paintings, and accessories) in my workspace.

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Disagree

8. The pleasantness of my workspace has an influence on my mood.

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Disagree

9. My productivity is proportional to my mood.

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Disagree

10. My attitude in the workplace would improve if the workplace was very inviting and accommodated my preferences.

a. Strongly Agree

b. Agree

c. Disagree

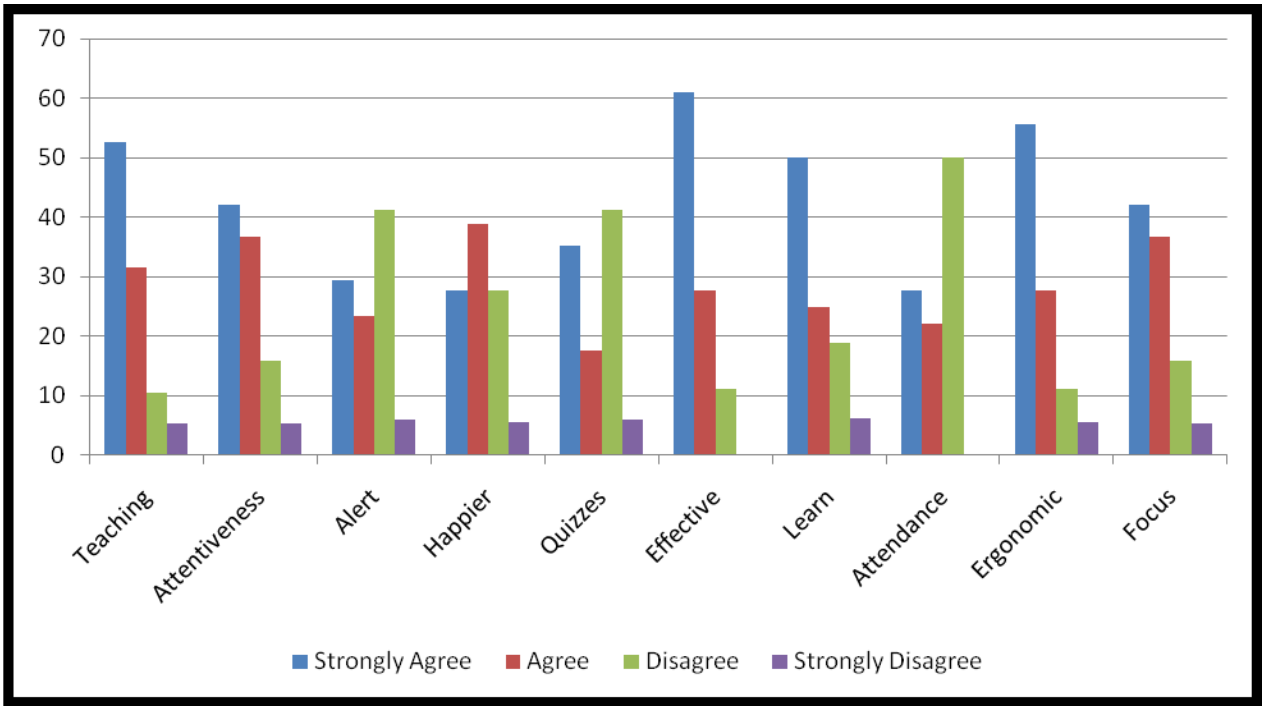
d. Strongly Disagree

Appendix N

Survey Data and Charts for Educators, Students, and Professionals Surveys

Chart and Graph from Educators

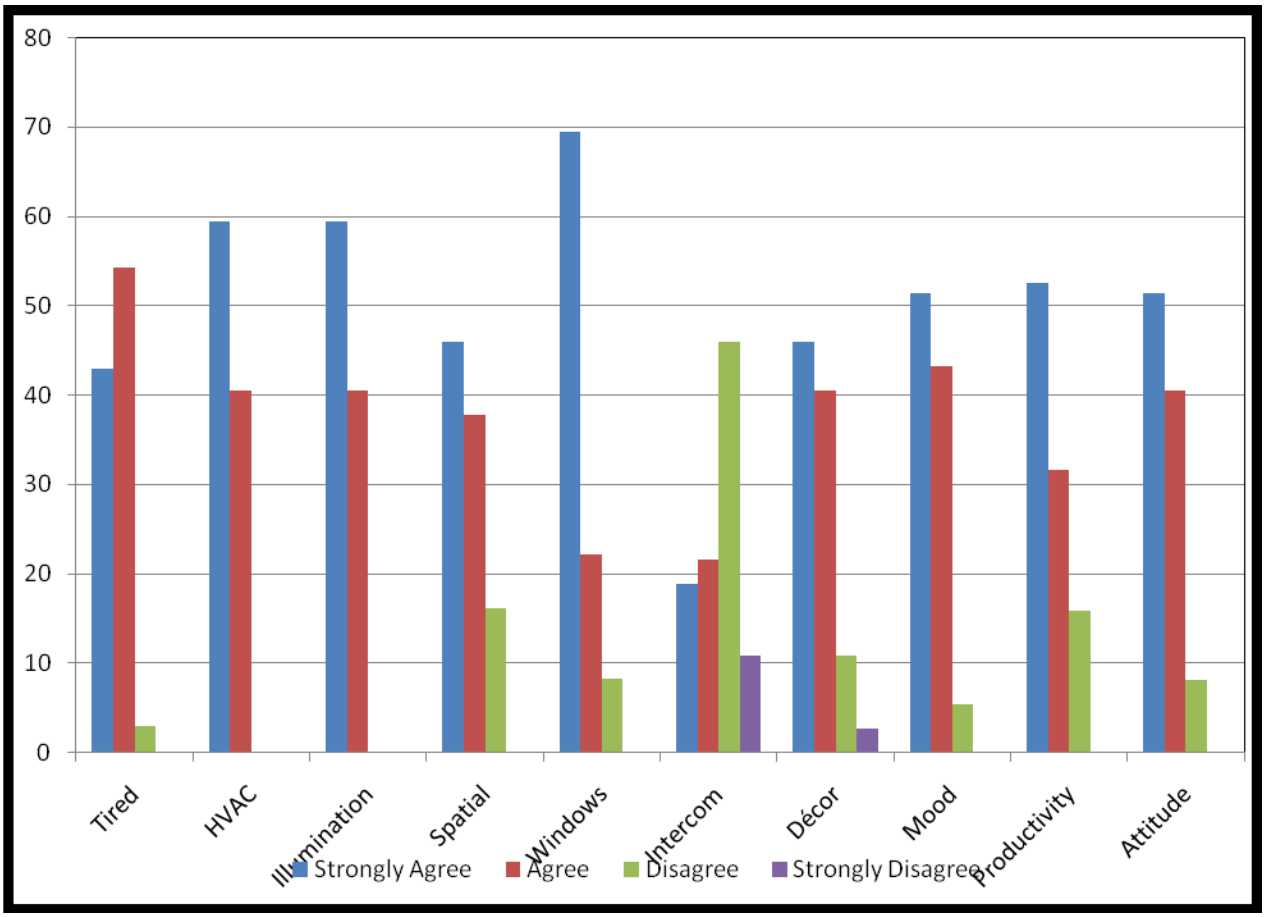
Educators	Teaching	Attentiveness	Alert	Happier	Quizzes	Effective	Learn	Attendance	Ergonomic	Focus
Strongly Agree	52.6	42.1	29.4	27.8	35.3	61.1	50	27.8	55.6	42.1
Agree	31.6	36.8	23.5	38.9	17.6	27.8	25	22.2	27.8	36.8
Disagree	10.5	15.8	41.2	27.8	41.2	11.1	18.8	50	11.1	15.8
Strongly Disagree	5.3	5.3	5.9	5.6	5.9		6.3		5.6	5.3



Research data from a survey sent to educators were compiled, analyzed, and illustrated above in the two charts which strongly suggests that an architect can design a space that will unconsciously create a mood that would motivate people to be more productive

Chart and Graph from Professionals

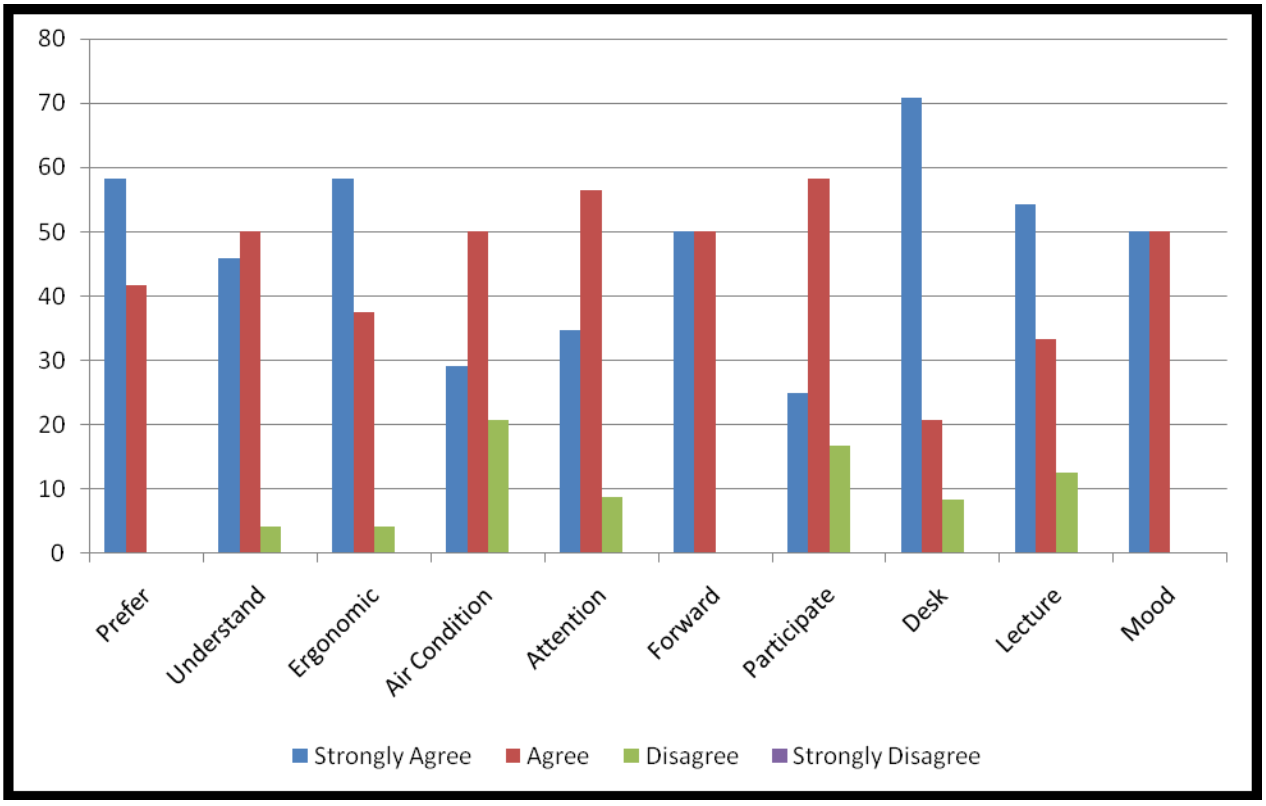
Professionals	Tired	HVAC	Illumination	Spatial	Windows	Intercom	Décor	Mood	Productivity	Attitude
Strongly Agree	42.9	59.5	59.5	45.9	69.4	18.9	45.9	51.4	52.6	51.4
Agree	54.3	40.5	40.5	37.8	22.2	21.6	40.5	43.2	31.6	40.5
Disagree	2.9			16.2	8.3	45.9	10.8	5.4	15.8	8.1
Strongly Disagree						10.8	2.7			



Research data from a survey sent to professionals were compiled, analyzed, and illustrated above in the two charts which strongly suggests than an architect can design space that will unconsciously create a mood that would motivate people to be more productive.

Chart and Graph from Students

Students	Prefer	Understand	Ergonomic	Air Condition	Attention	Forward	Participate	Desk	Lecture	Mood
Strongly Agree	58.3	45.8	58.3	29.2	34.8	50	25	70.8	54.2	50
Agree	41.7	50	37.5	50	56.5	50	58.3	20.8	33.3	50
Disagree		4.2	4.2	20.8	8.7		16.7	8.3	12.5	
Strongly Disagree										



Research data results from a survey sent to students were compiled, analyzed, and illustrated above in the two charts which strongly suggests that an architect can design a space that will unconsciously create a mood that would motivate people to be more productive.

Appendix O

Personal Interviews

Interviews were conducted with professionals from different occupations for whom environmental psychology is part of their routine function. The interviews with each participant included a discussion of environmental psychology after which the author of this research paper asked, "Based on this interview and any other experiences you may have had concerning environmental psychology, please comment on the following question briefly. The question is "In your opinion, can an architect design a space that will unconsciously create a mood that would motivate people to be more productive?" In order to insure accurate documentation, the persons who were interviewed were told that the author's research question and their responses would be sent via e-mail.

Dr. Charles Wall

Dr. Charles Wall, President of Massasoit Community College, was interviewed on June 16, 2011. Dr. Wall was interviewed because of his involvement in the renovations and improvements of conventional classrooms into "smart classrooms." This included computer consoles, large projection screens, computers with software applicable to class needs, air conditioning, variable illumination, and ergonomic furniture.

Dr. Wall's comments were "I believe that a combination of space, color, lighting—both ambient and natural—and furnishings all can contribute to a positive learning environment. Said another way, a space that is cramped and drab without natural lighting is not an inducement. As to space, I personally like open spaces with good ceiling height."

Dr. David Z. Starr

Dr. David Z. Starr, MD, Medical Director of the Starr Psychiatric Center in Brockton MA,

was interviewed on June 26, 2010. Dr. Starr was interviewed because environmental psychology evolved as a collaboration of architects and psychiatrists to provide a better environment for patients in mental institutions.

Dr. Starr's comments were "With regard to your question about architects creating a mood in a room that would be conducive to work, as I told you in our interview, I do think this is not only possible but probable. The layout, ambience, window structure, view, furniture, etc. can all unconsciously or consciously affect one's attitude towards one's work and create an atmosphere where one can be more productive and creative. In my field of psychiatry, one deals with feelings and mood as part of the very fiber of the work, so the overall feeling evoked by the ambience and layout of the room can be very important. I hope these brief remarks are of help."

Professor Arthur Rigor da Eva

Professor Arthur Rigor da Eva, Professor Emeritus of the Architectural Technology Department of Massasoit Community College was interviewed on June 23, 2011. Professor Rigor da Eva was interviewed because of his more than fifty years of experience as an architect and as an educator. During his tenure as a professor, he taught in many different classroom environments and his professional experience as well as designing buildings.

Professor Rigor da Eva's comments were "My personal experience in reference to the question definitely supports the premise that design does affect productivity. Public Service of NH built the Newington power plant according to a design that absorbed reverberant noise and increased natural light while diffusing both artificial and natural light to minimize shadows. This design bears a direct relationship to the fact that this plant has one of the best safety records in the New England grid for over forty years with various managers and crews."

Dr.Sheldon Stick

Dr. Sheldon Stick, was interviewed on July 10, 2011. Dr. Stick was interviewed because of his experience and expertise as a professor and administrator at the University of Nebraska. His position at the university of Nebraska included Department Chairperson; Director for an Inter-Disciplinary Graduate program, College-Wide Coordinator for a First-Year Experience program and a faculty member in the following areas on the University of Nebraska-Lincoln campus: Speech-Language Pathology & Audiology, Linguistics, Elementary & Secondary Education, Instructional Technology, Educational Administration, and the Joint Doctoral program in Architecture and educational Administration.

The following are Dr. Stick's comments, "I do not know if it can be done but believe that architects are the only professionals who should have the knowledge for doing so. Understanding how contextual relationships impact a person and enhance or mitigate performance requires some understanding of cognitive and learning psychology. On the premise that an architect has the kind of background leads me to believe it could and should enable them to create spaces conducive to greater productivity, regardless of the venue. What I'm trying to convey is that with the proper preparation it should be expected that a professional architect would know how to design environments best suited for enabling persons to perform a task regardless of its final form; academics, putting widgets in on a conveyor belt, checking to ensure cans have labels, etc.

That means that it is necessary for such professionals to understand the dynamics of how material and human factors interact to mitigate or enhance outputs. For example, standing on a hard concrete floor in a dim room with considerable noise reasonable should be expected to depress a worker's performance. Putting that same individual in an environment with reduced

noise or maybe even having the person wear ear covers and creating a positive environment by studying the lighting to ensure it is beneficial, that the odor of the room is favorable, and that a provision is available for sitting or maybe standing on a padded floor would seem to be inducements for increased performance.

Access to the world beyond the walls of work might be a positive or negative. On one hand it could be helpful for a person to periodically relax during the work process by looking at the outside through an available window, assuming that what is seen is not a stone wall. Alternatively, such a context could be distracting for the fine detailed work such as in a hospital operating room. Architects, if they assume the responsibility for creating favorable work climates, need to juxtapose the nature of the work with the degree of perfection expected and essentially become match-makers."

Dennis Pieprez

Dennis Pieprez was interviewed on June 24, 2011. Dennis Pieprz is the President of Sasaki Associates, a 270- person firm in Watertown, MA with international recognition in architecture, interior design and planning, and urban design. His experience and opinion is valued because of his expertise in bringing nature into a building and creating exterior spaces.

Mr. Pieprz's comments are as follows: "I certainly believe that a good architect can design spaces that enhance productivity. Natural light and ventilation are clearly positives in creating a pleasant working environment. Basic relationships, a good balance of shared and private space, and comfortable furnishings all reinforce the potential for more productivity."

Leo McCormack

Leo McCormack, NCARB, AIA, was interviewed on June 23, 2011.Leo McCormack is a registered architect with over forty years of experience in the architectural profession and in academia. His opinion is valued as an architect because of his dual experiences.

Mr. McCormack's comments were as follows: "With reference to our conversation on Thursday June 23rd, concerning the productivity of workers, and accommodations of tenants, patients, and students, it has been proven over the past forty to fifty years that the creation of pleasant spaces through color, light, acoustics and HVAC systems will unconsciously create a mood that will motivate people to be productive. A good recent example is the six year old Genzyme Corporation Headquarters Building located in the Kendall Square, Cambridge Bio-Tech area. The Platinum certified LEED building has reduced absenteeism to below 5%, and I have been told that team work and productivity have increased tenfold. Professor John Eberhard, FAIA has conducted extensive research since the early 1960's on this subject as the founder of "The Neuroscience and Architecture Institute." The Quickborner Team from Germany first developed open space planning in the mid 1950's that was originally utilized in Germany and Scandinavia before making its way to the United States in the early 1960's."