A COMPARATIVE STUDY ON COLOR PREFERENCES OF CHILDREN FOR

THEIR SCHOOL ENVIRONMENTS:

TWO PRIVATE SCHOOLS IN ANKARA

A THESIS

SUBMITTED TO THE DEPARTMENT OF

INTERIOR ARCHITECTURE AND ENVIRONMENTAL DESIGN

AND THE INSTITUTE OF FINE ARTS

OF BİLKENT UNIVERSITY

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS

FOR THE DEGREE OF

MASTER OF FINE ARTS

By

Zeynep Başoğlu

February, 2002

I certify that I have read this thesis and that in my opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Masters of Fine Arts.

_____
Dr. Sibel Ertez Ural (Principal Advisor)

I certify that I have read this thesis and that in my opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Masters of Fine Arts.

_____
Assoc. Prof. Dr. Cengiz Yener

I certify that I have read this thesis and that in my opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Masters of Fine Arts.

_____
Assoc. Prof. Dr. Feyzan Erkip

Approved by the Institute of Fine Arts

_____
Prof. Dr. Bülent Özgüç, Director of the Institute of Fine Arts

ABSTRACT

A COMPARATIVE STUDY ON COLOR PREFERENCES OF CHILDREN FOR

THEIR SCHOOL ENVIRONMENTS:

TWO PRIVATE SCHOOLS IN ANKARA

Zeynep Başoğlu

M.F.A. in Interior Architecture and Environmental Design

Supervisor: Dr. Sibel Ertez Ural

February, 2002

In this study, abstract single color and color scheme preferences of children for their school environments and the effects of age, gender, and functions on preferences have been analyzed. Also, the importance of the use of the appropriate and preferred colors in the environments has been explored. For the study, two urban private schools with different color scheme applications in Ankara have been chosen and examined according to the objectives. The two chosen schools are the ODTÜ Geliştirme Vakfı İlköğretim Okulu and Özel Bilkent İlköğretim Okulu. Depending on the outcomes of the results, comparisons between the subjects of the two chosen schools have been done, the reasons for differences in the preferences have been discussed and suggestions for color applications in the school environments have been done.

Keywords: Color in architecture, Color schemes, Color preferences, Elementary school environments, Elementary school children.

ÖZET

ÇOCUKLARIN İLKOKUL ÇEVRELERİNDE RENK TERCİHLERİ ÜZERİNE

KARŞILAŞTIRMALI ÇALIŞMA:

ANKARA'DA İKİ ÖZEL OKUL

Zeynep Başoğlu

İç Mimarlık ve Çevre Tasarımı Bölümü

Yüksek Lisans

Tez Yöneticisi: Dr. Sibel Ertez Ural

Şubat, 2002

Bu çalışmada, ilkokul çocuklarının soyut renk tercihleri ve okul çevreleri için renk tercihleri ve yaş, cinsiyet ve fonksiyonun bu tercihler üzerindeki etkisi araştırılmıştır. Ayrıca, rengin mekanda doğru kullanımının ve tercih edilen renklerin mekanlarda kullanımının önemi araştırılmıştır. Çalışma için farklı renk düzenlerine sahip iki özel ilkokul seçilmiş, ODTÜ Geliştirme Vakfı İlköğretim Okulu ve Özel Bilkent İlköğretim Okulu, ve amaçlar doğrultusunda incelenmiştir. Sonuçlar gözönünde bulundurularak iki okulun öğrencilerinin tercihleri arasında karsılaştırma yapılmış, nedenleri tartışılmış ve okullarda kullanılması öngörülen renk düzenlerine dair öneriler yapılmıştır.

Anahtar Sözcükler: Mimaride renk, Renk düzenleri, Renk tercihleri, İlkokul çevreleri, İlkokul öğrencileri.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1 INTRODUCTION

1.1 Objectives and Methodology of the Study

Color is an important topic for all the disciplines, in art, architecture, physics, chemistry, psychology, physiology, biology, literature, and health. It is also an undistinguishable aspect of everyday life. It has major effects on plants, animals, insects, as well as the human beings. Studies have been and are being conducted about the influence of color on humans, the resulting psycho-physiological responses, which are variously measured or defined, and the social aberrations of color. Color is also a language, it conveys the messages faster than anything else. "It (color) is stronger than words and faster than speech. It is a language all in itself" (Neal, 2000, p.24).

Color is first and foremost an experience. Color is a given gift to the human beings to enhance the total experience of the world around. The contacts of the human beings to the world are through the senses. People with normally functioning visual systems obtain perhaps the largest amount of information about their surroundings from the visual sense and color plays a very important part in this flow of communication. As stated before, color is an experience. Not only does it provides vital information about the surroundings, but like the effluences of the other senses, it gives considerable

pleasure to the observers. Being able to use the sense of color at its best advantage in the visual arts, clothing, external architecture, landscape architecture and interior architecture is one of the distincive features of the human kind (Kuehni, 1983).

Color is an immensely evocative medium, possesing in herent powers to provoke immediate and marked reactions in the viewer, as such it has been developed as a language of symbol in both the natural and man-made worlds. "Color is conceptual. There is no building technology for color, no hi-tech of color. Color is just pure idea, pure intellectuality, pure emotion. Color animates, bringing past and the future in the present. Color makes things come toward life" (Linton, 1999, p.83).

Color is one of the most important architectural elements that affect the quality of environments, and not only that it has major influences on the psychology and physiology of people. Its use in architecture and the built environment is serving to dramatically affect perception of architectural space and from. However, when incorporated into these disciplines color's highly subjective nature is also emphasized. Its use has been one of the most unpredictable areas of architectural decoration; each individal's experiences differ, and no amount of analysis can succesfully foretell how people will respond to the same color. Almost any generalization that can be made about color can be overturned into practice (Linton, 1999). The responses to colors may vary with each person depending on age, gender, race, cultural background, education, psychology, and physiology.

Color is important for all the living things. It is a vital aspect of perception of life. For humans it is a form of representation of mood, behavior, psychology, and physiology. With children the issue of color is even more sensitive. Children are very pure, excited, and full of imagination, and they are always learning new things and discovering new emotions. Color is one of the best ways they can represent these feelings they realize. Therefore the effects of color on children are vital for a psychologically and physiologically healthy life in their adult years.

Children are more color dominant than being form dominant, regarding this the application of color in the spaces where children occupy requires extra professional attention. One of the most important places where children occupy is the elementary school. Elementary schools are not only learning environments, but also the places where children socialize, interact, perform, and grow up to be healthy citizens. Children, after the age of six or seven, start spending most of their time at schools. Therefore, the school environments are very important places for children. The quality of the student life and the quality of education are affected directly by the quality of the school environment (Sanoff, 1994). The schools ought to have positive effects on children, in order to increase the ability to learn and perform, desire to stay, explore and interact with other children and their teachers, also on their moods and behaviors.

Regarding these aspects, the use of color in the schools becomes a very sensitive issue. Even though color is such an important application in the school environments, it is the one thing that is disregarded the most. There are many reasons lying behind this, the

major factor is that color is not considered as a design element but as paint on the surfaces. The functional aspects of color are hardly considered, leave aside the aesthetical and psychological aspects. This is a problem in many elementary schools not only in our country but also in the schools around the world. Yet, colorful is not a solution like colorless is not. "Color for the sake of color accomplishes little that is constructive, just as bleak environments accomplish nothing constructive either" (Mahnke, 1996, p.180). The use of appropriate colors is important in protecting eyesight, creating surroundings that are conductive to study, and in promoting physical and mental health. Unconscious application of multicolor can create problems on the issues of function, aesthetics, and psychology, similar to no application of color. Also the economical problems, especially in Turkey, affect the application of colors in environments. Many schools do not have enough money to apply color to school buildings. Even though it is not a very expensive application school administrations overlook the effects of colors and prefer to spend the money on other necessities.

Preference for color is an important issue as a design criteria in the case of applying color in environments. The preference for color also varies with age, gender, education, race, cultural background, psychology and physiology. The use of preferred colors in an environment would increase the attractiveness of the environment and the sense of belonging to that environment. Regarding this, the use of preferred colors and color schemes in the school environments is also necessary. Children's preference for color should be regarded while choosing the colors to be applied in the school buildings. But this issue is generally or almost always disregarded. The schools are painted with

certain colors concerning the maintenance aspect generally, not concerning the preferences of children. But the school environments should be designed so that, they become preferred environments by children. If they are painted with the preferred colors of children, it is obvious that they would enjoy their time more, the sense of belonging to the environment would increase and the education process would be more fruitful.

This study aims at analyzing the children's preferences for color schemes for the spaces in their school environments. The reasons why a study as such is important is mostly because education, children and psychology are issues that are interrelated and can not/should not be disregarded or considered apart. One of the places where these three aspects intersect is the school environment; therefore the design of the school environment would have a great impact on children's education and psychology and should be done accordingly.

The primary education in Turkey is coeducational. With the new regulations, the primary education has been extended to eight years. As a result of this situation, students in a wider range of age group are expected to use the same educational buildings or facilities for longer periods. Also with the efforts of spreading the education to whole day, the needs for spaces that serve different functions and activities have increased. All these aspects bring forth the importance of choosing color schemes in relation to the gender and age of the users and the functions of the spaces, as well as the preferences of the users.

The main aim of this experimental study is to find out the abstract color preferences and the color scheme preferences of elementary school children in their school environments, in their classrooms, corridors, and cafeterias and to observe probable differences depending on gender and age if there is any. In the duration of the change in the primary education curriculum, the school buildings are also going through certain changes. These changes can be observed in the colors of the school buildings at the first glance. Observing that the government schools have not either completed or started their renovations, the private elementary schools have been exemplified in the study. Accordingly, the students of two private elementary schools in Ankara with different color applications have been tested about their preferences for their school environments. The results of the study have been analyzed and examined. Comparisons have been made between the existing school environments and the preferred school environments in relation to age, gender, and differences in functions.

The objectives of the study are:

   (1) To find out the abstract color preferences and the color scheme preferences of elementary school children in their school environments, and the effects of age and gender on the preference of color.

   (2) To observe the changes in the color scheme preferences in the given spaces with different functions (classroom, corridor, cafeteria).

   (3) To compare the existing and the preferred color schemes in the specified spaces in the school environments.

(4) To compare the differences in preferences of children who occupy school environments with different color applications.

The study is consisting of two major sections; literature search and research based on observation and survey. The research is based on the field survey. As a first step in the research, an observation was made in all of the private elementary schools downtown Ankara. The observation was done through a checklist (Appendix D), consisting of the spaces in a school; and according to the results of the observation two schools were chosen for further studies. The schools were chosen according to their application of color, also regarding the socio-economic levels of the students and the populations of the schools. The schools chosen are Özel Bilkent İlköğretim Okulu and ODTÜ Geliştirme Vakfı İlköğretim Okulu.

For the survey the classrooms, corridors, and cafeterias of the two schools have been photographed. Alternative color schemes for these spaces have been prepared depending on the literature search and the color theory. Then the schools have been revisited with the alternatives for the survey. A total of 275 subjects have been questioned. The subjects are the second (8 year olds), fourth (10 year olds), and seventh (13 year olds) grade students of the chosen schools. The resulting data have been analyzed depending on the objectives of the study.

1.2 Structure of the Study

Following the first chapter introducing the objectives, methodology and structure, the second chapter, "Color", deals with the general and architectural aspects of colors. In this chapter, the basics of color are presented along with definitions of color. Also, the role of color on human beings is discussed, which covers the physiological and psychological effects of color on people, and the psychological and physiological reactions of people towards color. The color systems and the color harmonies are also presented in this chapter with definitions, explanations, and examples. The architectural aspects of color are studied and finally the color preferences as a criterion for architectural coloring are discussed. The aspects of color preferences and the studies that have been conducted about the color preferences of humans are presented.

The third chapter is called "The Elementary School Environments". There are two main discussions in this chapter. The effects of elementary schools on children and the use of color in the elementary school environments. The effects of elementary school environments are discussed from the point of the effects on children's behaviors, learning and performing abilities, and psychology. The use of color in the school environments is discussed along with the expert views on the proposed appropriate use of color in the school environments and the effects of appropriate use of color on children in relation to the color preferences of children.

The fourth chapter covers the research, which consists of the experimental study and the data analysis. The objectives are presented again and then, the research is explained and finally the data analysis is done.

The final chapter is the "Conclusion" where the results of the study will be discussed and tied to certain conclusions.

2 COLOR

2.1 General Aspects of Color

2.1.1 Color Basics

Color is a subjective sensation caused by the light and it is not a quality of the object itself. Colors cannot exist without light since the color is a sensation that is conveyed through the medium of energy in the form of light waves within the visible spectrum. The light waves do not constitute color in them. The eye and the brain of the observer interpret the meanings of these energy messages and perceive them as a sensation of color (Porter and Mikkelides, 1976). Color is the enhancer and modifier of space and form, it is a symbol and it is the generator of mood. It has psychological and physiological effects on humans and even on insects and animals (Davey, 1998). Color is a very powerful tool in everyday life. It deeply affects the emotions and can convey any mood, from delight to despair. Color can be subtle or dramatic, capture attention or stimulate desire (Zelanski and Fisher, 1989).

Itten (1970, p.8) states that, "Color is life; for a world without colors appears to us as dead. Colors are primordial ideas, children of the aboriginal colorless light and its counterpart, colorless darkness. As flame begets light, so light engenders colors.

Colors are the children of light, and light is their mother. Light, that first phenomenon of the world, reveals to us the spirit and living soul of the world through colors." Kuehni (1983) makes another approach to the definition of color, where he says that the colors are not real and the world is actually not colorful. He claims that the brain creates the sensations of colors often from the quantities and qualities of electromagnetic radiation that strikes the sensory organ, the eye. Some scientists provide a definition for color that considers color as a perception: "…perceived color is the attribute of visual perception that can be described by color names: white, gray, black, yellow, orange, brown, red and so on or by combinations of such names" (Kuehni, 1983, p.7).   Porter and Mikkelides (1976, p.13) have another definition of color close to Itten's approach; "Color is a part of total sensory experience of our environment and contributes immeasurable beauty to the visual world. As an integral part of our perceptual system it helps us to identify and define objects in space and acts as a signaling device, which is evidence of certain conditions, conveying information about our surroundings."

The problems of color are examined by several disciplines; physics, chemistry, physiology, psychology, and art. The physicist examines the nature of the electromagnetic energy vibrations and particles that are involved in the phenomena of light. The chemist studies the molecular structure of dyes and pigments. The physiologist studies the various effects of light and color on the visual apparatus (eye and brain) and their anatomical relationships and functions. The psychologist is interested in the problems of color radiation on the mind and spirit of the human heart.

And finally the artist examines the color effects from their aesthetic aspect in the light of both physiological and psychological information (Itten, 1970).

A very basic terminology of color is presented to give brief information about certain terms in the color terminology. Hue, value (brightness), and saturation (chroma) are the three dimensions of the contemporary color systems. They help the observer to describe specific colors. Hue is a synonym for color. It is the dominant wavelength of light reflected by a colored object. It is also the quality or characteristic by which the colors are distinguished from each other. Value (brightness) is the lightness or the darkness of a color. Brightness varies inversely with the amount of black contained in the color. Saturation (chroma) it describes the intensity of a color; that is what amount of gray the color contains. It is the strength, intensity or purity of a color. There are also two other terms explaining the monochromatic changes of a single hue; tint and shade. Tint is the mixture of a saturated color (pure hue) with white. Shade is the mixture of a fully saturated color (pure hue) with black (Eiseman, 1990)

2.1.2 The Role of Color for Human Beings

The role of color for all living things is very important. Color affects the living both psychologically and physiologically. All the plants and animals as well as the human beings, have their own responses towards color and are affected by color.

"Color effects are in the eye of the beholder. Yet the deepest and truest secrets of color effect are invisible even to the eye, and are beheld by the heart alone. The essential eludes conceptual formulation" (Itten, 1970, p.7).

Color is a creation of light. It is therefore a form of energy and this certain energy affects the bodily functions, and in relation to that it influences the mind and emotion (Mahnke and Mahnke, 1987). Color is unique in its own way in triggering reactions, which are both physical and psychological in nature; therefore it is both physically and psychologically a vital part of the human life. "…it (color) motivates people in a way that is largely subconscious and it is difficult to say where physical, visual processes end and mental processes begin" (Danger, 1987, p.54). Itten (1970) makes an analogy between color and force, saying that colors are radiant energies that affect the humans positively or negatively, with or without the consciousness of the human brain. He also suggests that the effects of colors should be experienced and understood not only visually but also psychologically and symbolically. Color has a definite and psychotherapeutic value in life but the ones who are skeptical of the physiological and psychological effects of color generally overlook it. Color helps to draw attention from the self to the environment, or vice versa, which affects the mood of the humans. "In effect, the cheerful colors are relaxing and diverting; neutral colors are a big bore" (Birren, 1983, p.169).

Color is necessary for the total man, both the physical and the spiritual one. Color has a very important role in the design of the environments. It is ahead of form in the man's

unconscious regard. According to the studies done on psychology and psychiatry, it has been found that response to form is seems to arouse intellectual process, whereas the reactions to color are more impulsive and emotional. David Katz claims that color is more closely related emotion than space (Birren, 1988).

Mahnke and Mahnke (1987) state that there have been many studies conducted on the effects of color on human body and it is known that color affects cortical activation (brain waves), functions of the autonomic nervous system (which regulates the internal environment of the body), muscular tension, heart rate, respiration, and hormonal activity. Also it is found that color arouses definite emotional and aesthetic associations. The response of the human to color is total; color affects the humans both psychologically and physiologically (Manhke and Mahnke, 1987). The psychological reactions to color can be grouped as follows: sensitivity to brightness and dimness, to lightness and darkness, and to warmth and coolness of color. These reactions are considered as physical, visual reactions but their interpretations made in the brain are psychological. So, the psychological reactions can be defined as the way in which color affects the mind and the emotions and are partly the result of the physical reactions described. Psychological reactions affect the body as a result of interpretation, experience, association and tradition. Color also affects the appetite and behavior of humans and these reactions vary with age, race, culture, nationality, gender, seasons, locations, economic conditions, and personal characteristics (Danger, 1987).

The physical reactions of humans to color are similar to the psychological reactions. The reactions to the saturation (intensity) of the color are more towards to light than to color. There should be light for the color to exist. The human organism shows a significant reaction to the presence or absence of light, and this affects the eye, the brain and the whole body. The high-saturated light conditions the human body for vigorous muscular activity, but it hinders the mental tasks. It can be so that under certain conditions where the degree of the brightness is very high, the concentration can become impossible. The saturated the light the more body tends to direct its attention outwards. "A high degree of saturation demands attention, consumes bodily energy, and stimulates the nervous system to such an extend that energy is directed from the task to the environment itself, and if this happens, seeing and concentration become difficult" (Danger, 1987, p.55). With lower levels of light and saturation, the body turns away from the environment towards itself, there is less distraction and the individuals are able to concentrate better on the visual and mental tasks.

Lightness and darkness of color affect the humans the same way the intensity of light do. Lightness or the value of color is the quality by which a light color is differentiated from a dark color. The brightness produced by the light color depends partly on the intensity of the light falling on a colored surface or object. But it mainly depends on the percentage of that light reflecting from the colored object or surface. In general terms, the light colors stimulate a greater extent than dark ones; they increase size whereas the dark colors reduce size; they make an object look lighter in weight, the dark colors

make an object look heavier; and light colors are generally preferred to dark colors and this is due to their greater brightness. (Danger, 1987)

The reaction to the warmth and coolness of a color is a reaction relying on the wavelength of color. Unlike the previous two groups, which are physiological reactions to light and to the intensity of light, this reaction is to the color, therefore radiation. Hues with different wavelengths cause different effects on humans. The reactions are towards the two ends of the color spectrum, towards the red end and towards the blue end. Due to these characteristics, the colors are grouped into two categories according to their wavelengths; red, orange and yellow being the warm colors, blue, green, and violet being the cool colors. (Danger, 1987)   The warmth and the coolness of the colors are the dynamic qualities of color. From emotional standpoint, the red end of the spectrum is exciting and in contrast the blue end of the spectrum is calming. This aspect is true in the physical reactions. The reds tend to increase the bodily tension, stimulate body and nervous system. The greens and the blues release tension and have a subduing effect. These reactions are automatic, and take place independent from the consciousness of the human mind (Birren, 1963).

It has been found earlier that individuals readily associate colors with adjectives of emotions, regarding the visual stimuli. This holds true across cultures as well. The speakers of unrelated languages tend to relate colors and emotions in similar ways, this means that there was a cross-cultural agreement detected as to which colors were regarded as strong, weak and so on. In the study conducted by D'Andrade and Egan in

1974, it was found that the color-emotion associations were not predominantly due to a hue but to the degree of saturation and brightness (Hupka et al, 1997). The emotions are grouped into two; the primary emotions, which are the inherited emotions and the compound emotions, which are the learned emotions. Anger and fear, for example are primary emotions and they have strong roots in evolution and are genetically based. Whereas, envy and jealousy are emotions that are compound emotions and are learned in time. Thus, the primary emotions that are common to all human beings should arise similar color-emotion associations (Hupka et al, 1997).

2.2 Color Systems and Harmonies

The dimensions of color have been described by systems that model its variability according to a variety of schemes. The well-known systems take the three major attributes of color into consideration, hue (red, blue, etc.), brightness (value), saturation (chroma), and arrange them three dimensionally. The most well-known and detailed color system is The Munsell system. It is shaped like a tree and it has an axis, which is a vertical scale of values or gradations of brightness, from which hues radiate outward in a series of planes arranged around it as a circle. The distance of a given hue on this radial coordinate from the vertical axis of brightness, defined the saturation of the hue. The Munsell system is modeled asymmetrically in account of the discrepancies between hue, saturation and brightness. The Otswald system is a variant on the Munsell system. It displaces the hues on the radial axis, so that any hue at its maximum saturation is placed equally distant from the vertical scale of values. The symmetry of the Otswald system depends on visual experience unlike the Munsell system (Swirnoff, 1988).

The basis of the standard twelve-hue color wheel lies in the color continuum that includes all the primary colors and all the intermediate hues, which are produced as each hue overlaps the adjacent hue. The red end of the spectrum can be joined to the purple end to form the complete color wheel. These twelve basic pigment colors can be divided into three groups: primaries, secondaries, and tertiaries. There are three primary colors (blue, red, and yellow), three secondary colors that are the combinations of any two primary colors (violet, orange, and green), and six tertiary colors that are the combinations of one primary and one secondary color (blue-violet, red-violet, red-orange, yellow-orange, yellow-green and blue-green) (Fehrman and Fehrman, 2000).

Colors are not isolated entities; they exist in the presence of each other, in a certain combination, and they are affected by each other's presence. The color is perceived together with the environment. The art of combining colors to produce pleasing harmonies has been the concern of both the artists and the scientists. Certain color groups were thought to be more aesthetically appropriate than others, and there were many attempts to list and prescribe the relations that seemed to work best (Zelanski and Fisher, 1989). As Albers (1975) stated a color can not be conceived as what it actually is physically. Without the use of special devices a color can never be seen singly, or by itself, as a single tone may be heard, but only in relation to the many factors that influence the human vision, which transfer the optical (physiological) influence into a psychological effect (perception).

The color harmonies are developed in relation to the color contrasts. There are seven basic color contrasts: the pure color contrast, the light-dark contrast, the cold-warm contrast, the complementary contrast, the simultaneous contrast, the contrast of quality, and finally the contrast of quantity. The pure color contrast occurs when pure colors are used in random combinations. The light-dark contrast is based on the use of different brightnesses and tone values of the colors. The colors are lightened by adding white and darkened by adding black. The cold-warm contrast is made by using cold and warm colors together in a combination. The most effective contrast is achieved with colors orange-red and blue-green. The complementary contrast consists of colors that are across from each other in the color wheel and when these colors are mixed together the result is a neutral gray-black. The simultaneous contrast's effect is derived from the law of the complementary colors. The law recalls that each pure color physiologically demands its opposite color and in the absence of that color the eye will produce it simultaneously. For example, a strong green would make the adjacent neutral gray look reddish gray and vice versa. The contrast of quality is the contrast between the luminous and dull colors. The contrast of quality is based on the opposition of colored areas of different sizes (Itten, 1975). These principles of the color contrasts determine how a color is perceived, how objects are highlighted or partially concealed, and how a color scheme is developed (Mahnke and Mahnke, 1987).

Color schemes are color harmonies that are composed of either closely related chromas or of different colors in the same shades that meet without sharp contrasts. The achievement of harmony or discord depends on an agreeable-disagreeable or attractive-

unattractive scale. Itten (1970) defines harmony as the craft of developing themes from systematic color relationships capable of serving as a basis for composition.

According to the findings of Chevreul in his famous 1839 work, there are six distinct color harmonies, comprised in two kinds: the harmonies of analogy and the harmonies of contrast. The harmonies of analogy consist of the harmony of scale, in which closely related values of a single hue are used together; the harmony of hues, where analogous colors of similar value are used together; and the harmony of a dominant colored light, where a combination of different hues and values is pervaded as if by a dominant tinted light. The harmonies of contrast consist of the harmony of contrast of scale, where different values of a single hue are combined; the harmony of contrast of hues, in which related colors are used in strongly different values; and the harmony of contrast of colors, where colors belonging to scales very far asunder are featured, meaning the complementaries, split-complementaries, triad and tetrad combinations (Birren, 1987). The color harmonies that are being considered in this study are the harmony of scale, monochromatic color scheme; the harmony of hues, analogous color schemes; and the harmony of contrast of colors, complementary color schemes.

The simplest color scheme is the monochromatic color scheme. Monochromatic color schemes use only one hue in varying tints, shades, and intensities, and this is done to avoid a very possible monotony (Eiseman, 1990).

Analogous color schemes are the most harmonious and foolproof color schemes. These color schemes offer more variety than the monochromatic color schemes. They are made up of the combination of the colors, which are immediately adjacent to each other that literally flow into each other, for example: red, red-orange, orange. The three hues are unified due to the use of a shared color (Eiseman, 1990). Also, analogous colors have emotional quality because they favor either the warm or the cool side of the color spectrum if they are arranged properly (Birren, 1987).

Complementary color schemes consist of colors that lie directly across from each other on the color wheel. When the complements are placed side by side they appear more intense. Some examples of this color scheme are blue-green and red, yellow-red and blue, purple-blue and yellow. These combinations introduce both warm and cool colors into the environment and offer more contrast, exhibiting a natural balance (Eiseman, 1990). There are three types of complementary color schemes. The first one is the analogous-complementary scheme. This harmony is achieved by using two colors that are next to each other and the complementary of one of the two colors. Split-complementary harmonies are made up of one color and the two colors that are next to the complementary of that color. The last scheme is the double-complementary scheme. This scheme is achieved by the use of two closely related hues and their complements (Mahnke and Mahnke, 1987). The complementary colors have a visual quality for they generally set a warm color against a cool color, causing a positive quality to offset a passive one (Birren, 1987).

2.3 Architectural Aspects of Color

2.3.1 The Use of Color In Architecture and Design

In order to be able to communicate an overall impression in an architectural space to the viewer, the use all architectural elements- color, light, pattern, furnishings, accessories- is necessary. This sort of an impression engenders a reaction, which carries some type of emotional content. This reaction can be positive or negative depending on the use of the named architectural elements. The designer's goal in this case must be to avoid choices that will trigger negative emotional reactions (Mahnke, 1996). Along with the other design elements, color has an important effect on the impression of the environments. Color not only produces mood associations and subjective and objective impressions, but also influences the estimation of volume, weight, temperature, time, and noise in the environments. Unfortunately, the concept of color is mostly disregarded or taken into consideration at a late level of design. Therefore the environments either lack the intended impression or the impression turns out to be less impressive than what has been intended. The correct use and application of color in the environments is vital in creating the desired or intended impression as well as providing the required psychological and physiological comfort for the users. "…the atmosphere of a space can be manipulated to align it with the function of the space. The degree of mood creation depends on particular color use" (Danger, 1987, p.64).

Color has physical qualities that present how color can be translated into real space. The use of color can be grouped into six elements: definition, progression, emotion, aesthetics, manipulation and dimension (Ladau, 1988). *Definition* essentially fixes the

limits or boundaries of an object in space. Color has the ability to define; it allows the eye to precisely identify the shape of a form and the position of an object in a space. Light and shadow provide a great deal of information about a three dimensional object and color completes the image, giving the form a more precise shape as well as expressive impact.

Progression tells how to move in a space, literally or visually. It provides sequence or succession for a space. Color influences the way to move through a space. It tells the way to go, when to turn or to stop. The sense of progression occurs when there is a comparative color change; that is moving from dark to light, from one color to another, from tints to shades, or from one point of interest to another. All of these illustrate a continued series of changes that lead through space.

E*motion* attacks the senses providing strong feelings or causing strong reactions to color in a space. Color elicits response, which occurs on both the physical and the cultural level. Color preference is generally a cultural phenomenon, whereas the response to color is a combination of reactions to physical phenomena and cultural associations. Together they affect the feeling of the color and the way it is used.

Aesthetics uses light and color to elicit a response based in history or creative sources. The aesthetic qualities of a color define its relationship to culture, style and design. Culture gives color associations that are comfortable and reassuring because of their familiarity. Style gives color choices dictated by the trends of the moment in fashion

and art. Design provides color choices based on the contrast between non-specific colors for particular effects. All of these three elements can be combined to formulate the aesthetic taste.

Manipulation modifies the perception of a form or space to suit a particular purpose. Color can manipulate in both physical and mental ways in convincing one to see a different reality. Every color has its own vast array of associations that give information about how to respond to that color, both in and out of context. Color also manipulates the perception of space.

Dimension defines the focus of an object or space in terms of adjacent objects or surroundings. It establishes the relative size and importance. Color alters both time and measurement in a space. The dimensional effects influence how long a person can comfortably stay in a space or environment. Color affects measurement through illusion. A distant object has a lighter color than an up close object. If a warm color is placed against a cool color, the warm color would advance whereas the cool color would recede. Also colors look more intense when they are applied on a large surface than a small one. Color can be used to affect the dimensions of a space very effectively (Ladau, 1988).

As mentioned before, color along with form, texture, layout, scale and size, is a design element that creates the communication in architecture. All of the elements of design help the designer convey to the observer the various aesthetic, social, political, and

historical messages that are purposefully injected in the structure. Color plays the major role in conveying the messages of the man-made structures. In most cases, it is easier to understand these messages through color than the design itself. This understanding relies on past experiences, associations and acquired cultural knowledge. The concern of the architect and the designer is to create a healthy and livable environment for the users. The architect is more interested in color as an aspect of architectural composition- "something to attract interest and to induce movement, but also, essentially, to create restfulness, in spaces in which the potential of life, work and human continuity are embedded" (Lloyd, 1987, p.47), therefore as a part of the design composition. Since this is the case, the architect and the designer should be aware of the psychological and physiological effects of the colors as well as the meanings attached to colors. Also, it should be kept in mind that the colors could not be seen in isolation except in special laboratory conditions. All the colors are in relation to each other in the environments.

The use of color in the spaces is an important factor in the design of the environments. Color is used to serve more important functions than mere beauty and pleasure, as the designer and the client realize the importance of color. In general, the reaction to color is emotional but it may be studied objectively. The color is being applied in all of the public and private spaces, schools, industry, hospitals, hotels and homes. It has a tremendous value in dealing with human moods. It is used for promoting greater comfort and lessening neurotic tension and anxiety. The lessons learned from its use in the public places can be applied in homes as well. "With allowances made for human

likes and predilections, color may be engineered intelligently to make any interior a more comfortable place in which to live, read, work and relax" (Birren, 1955).

Color serves many aesthetic purposes in the design of the buildings. Color creates atmosphere and mood in the environments. It suggests either unity or diversity. It expresses the character of the materials used in the spaces. It defines form, and affects the proportions in the environments, as well as giving a sense of weight and bringing out scale (Faulkner, 1972).

There are two major reactions to the use of color and light in the environments. The first one is the centrifugal action, which is an action that is away from a person's self to his environment. This action takes place in environments where there is high illumination, warm and luminous colors (yellow, peach, pink). In such environments, the body tends to direct its attention outward, towards the environment and such an environment is conductive to muscular effort, action and cheerful spirit. These environments are suitable for factories, schools and homes where there are manual tasks are performed or where sports are engaged in. The second reaction is the centripetal action, which is the action that is away from the environment toward the self. These environments are necessary to perform difficult visual and mental tasks, with maximum concentration and least distraction from the work at hand. This can be achieved by softer surroundings, coolers hues (gray, blue, green, turquoise), and lower levels of brightness. Environments that have such requirements are offices, study rooms, fine assembly in industry and bedrooms (Birren, 1963). Birren (1983, p.168) also quotes

that "…a dull environment tends to prod adverse human reactions; a colorful environment tends to lessen them and to lead to a slower heart rate. The prodded activity in a monotonous setting may well induce anxiety, fear, distress."

The effects of color on both the exterior and the interior spaces are tremendous. For proper mental and emotional balance, there should be a resourceful and dynamic use of color in the environments. The use of color in the man-made spaces serves two important realms; visual realm and emotional realm. The visual realm can remove glare from the field of view, and in the emotional realm color can introduce sensory stimulation, break up monotony, and establish an interesting change of pace (Birren, 1976).

The location of the color within the space makes a great change in influencing a room's character, the way it is perceived psychologically, and subsequent reactions to it. A color that is suitable for the wall may have a very different effect when applied to the ceiling or the floor.

2.3.2 The Factors Affecting the Color Decisions in Architecture

There are two basic questions that need to be asked in order to realize the factors affecting the design considerations. The first question is: what are the major design goals for the given environment? The second question is: how can these goals be met with some measure of predictable accuracy? In the answers of these two questions lie the information about the type of the building or space, and the function the space it

serves. It is evident that different environmental criteria and design objectives exist for various environments. Naturally, the design of a school and a bar, and the supporting ambience for each of the designs are vastly different. Also, the sections in a given structure are treated very differently, according to their functions. A classroom, school corridor, cafeteria, library, auditorium, gymnasium all serve different functions and should be treated differently; according to the functions they serve and the requirements of those functions (Mahnke,1996).

There are some fundamental rules and considerations that must be regarded. These are; (1) the need to consider psychological and physiological effects in design for the well being of the user, in some cases disregarding the personal tastes of the user, should be clarified. (2) the balance between unity and complexity, color variety within reason, must be respected. (3) visual ergonomics depend on the colors used and on the contrasts. These rules of visual ergonomics should especially be kept in mind in the education facilities, hospitals, industry, and the offices. (4) the mood or atmosphere desired on the specification of the colors based on their psychological content must be satisfied (Mahnke, 1996).

A color design that serves a purpose in an environment has three simple rules that must be adhered to; (1) the color design supports the function of a building or the given space, and the given tasks that it carries out. (2) the color design avoids over stimulation and under stimulation. (3) the color design helps to avoid negative psychological and physiological effects (Mahnke, 1996).

2.4 Color Preferences as a Criterion for Architectural Coloring

The preference for color is one of the most intensively researched areas within the field of color. The investigations have explored the relationship between feelings, emotions and color for almost over a hundred years. The common problem of such studies in this area is determining exactly what is being studied in color preference. The researchers have looked for the answers to the question of whether certain color were able to elicit certain emotional responses consistently. "They (the researchers) have wondered whether there was an inherent physical relationship between color and people that resulted in consistent emotional reactions, or if the linkage between specific and emotions was a purely cognitive one. They wanted to discover whether the color-emotion link was biological or learned" (Fehrman and Fehrman, 2000, p.78). According to the results obtained from these studies, some of the factors that influence the color preference are the learned color bias, variations in the saturation or value of the color under study, the interaction between light source, background color, and the color of the object being viewed, the contrast between colors in combination, and the size and placement of light sources. There are culturally learned associations and there are true biological associations of colors. In order to understand color, it is important to be able to differentiate between these two associations (Fehrman and Fehrman, 2000).

There are many aspects of color preferences other than the aspects mentioned above. These aspects are culture, education level, past experience, memories, history, perception of color, the meanings attached to colors, color symbolization, age and gender, aesthetic attributes, values and value judgments, the psychological and

physiological conditions of the perceiver, and the sub-consciousness. Each color has its own meaning, denotation, symbol and emotional association for each person. Every color connotes a different meaning, feeling or emotion to the perceiver of the color in relation to his associations with colors. Even though this seems to be the proper way of color preference, there are accepted meanings, connotations and effects of certain colors on humans, relying on the experiments done and being done throughout the years. These studies try and find an objective approach to color from the preference point of view, a common color preference scale, regardless of the culture, race, history, education, age, gender, and the other factors mentioned previously.

The most important and fruitful study about finding a color preference scale has been carried out in 1941 by Hans Eysenk. He has used 21,060 subjects from different races, ages, and cultural backgrounds. He came up with the result that there is a universal scale for color preference and that there is some strong biological basis for color preference. The resulting universal scale was (1) blue, (2) red, (3) green, (4) violet, (5) orange, and (6) yellow. He also came up with the suggestion that short wavelength colors are generally preferred to long wavelength colors and this has a biological reason. However, a more recent study conducted by Acking, Kuller, and Sivik in 1973, has resulted differently. In that study the researchers have investigated the dimensions of brightness and saturation using semantic differential techniques. According to the outcomes of the study, they found no significant order for preference, but they claimed that the liking or preference for color did not rely on the hue but on the saturation and brightness dimensions, that there is no correspondence between the color experience

and wavelength (Porter and Mikkelides, 1976). In the current study that is being followed, the concern is on the hue and brightness dimensions of preferences of children rather than the saturation dimension. Therefore Hans Eysenk's study is taken into consideration in more detail.

The color spectrum is divided into two parts, as mentioned earlier. The colors of long wavelength (red, orange) and the colors of short wavelength (green, blue) with yellow occupying the middle position. According to Birren (1961), the humans therefore can be categorized into two distinct groups in their preferences. The people who prefer the clear and distinct hues which are usually the warm hues and the ones that prefer the cooler hues and tones of less saturation. The warm color dominant subjects are generally characterized by an intimate relation to the visually perceptible world. These subjects are receptive and open to outside influences. They seem to submerge into the social environments rather readily. The emotional lives of these subjects are characterized by warm feelings, suggestibility and strong affects. The cool color dominant subjects are characterized to have a detached attitude to the outside world. They find it difficult to adopt themselves freely to new circumstances and to express themselves freely. The emotional lives of such subjects are cold and reserved (Birren, 1961).

In a study conducted by Heinrich Freiling of the Institute of Color Psychology, color preferences of children, according to their ages, has been tested. The study has been conducted on ten thousand children in all corners of the world between ages 5 to 19.

The general results are that black, white, gray and dark brown are rejected by children between the ages of 5 and 8; whereas red, orange, yellow and violet are preferred. At ages 9 and 10, gray, dark brown, black, pastel green, and blue are rejected and red, red-orange, and blue-green are preferred. The 11 and 12 year olds rejected the achromatic colors, olive, violet and lilac. The 13 and 14 year olds preferred blue, ultramarine, and orange (Mahnke, 1996). "As a rule, most persons, young or old, will prefer light colors to dark ones, pure colors to grayish ones, and primary colors to intermediate ones" (Birren, 1963, p.186).

Small children are more color dominant than form dominant. During the early years of life, warm colors- red, pink, yellow, and orange- seem to be preferred more. As the age progresses, the preference turns to blue, red and green, and this occurs regardless of race, nationality, and culture. The color preferences during the childhood years of life are in the order of yellow, pink, red, orange, blue, green, and purple. After childhood and into adolescence the order changes to red, blue, green, pink, purple, yellow, and orange (Birren, 1963).

In a practical sense, young people, who are more adventurous in their choice of colors than their elders, usually prefer brighter and stronger colors than their elders. They are willing to experiment and have a less conservative approach to the use of color in their environments. They choose colors on the assumption that they will be able to change it after a short period of time. Youngsters react favorably to the enterprising use of strong

colors and to unusual color combinations, but there are periods when they are attracted to earthy and depressing colors, which last in short time spans (Danger, 1987).

Danger (1987) claims that although color preferences vary with age, it is difficult to draw a hard-and-fast line between children and adults. If people were grouped as children and adults and asked which colors they like, the results of the poll would be consistent and more and less true worldwide. The order of preference of children is yellow, white, pink, red, orange, blue, green, violet. The order of preference of adults is blue, red, green, white, pink, violet, orange, yellow. There two orders show the changes in preference as the age increases. For example, blue is quite down the list of preferences of young children but the liking increase with age and blue reaches the top with the preference of the adults (Birren, 1976).

The preferred color of the users who will inhibit the spaces must always be considered. The psychological benefits of living with the preferred colors are inestimable (Fehrman and Fehrman, 2000). Even though it may be quite difficult to reach a consensus with big groups generalizations can be done and neutral colors may be used. In the case of the school environments, the use of correct and preferred colors will decrease the problems of nervousness, irritability, lack of interest, and behavior, as well as facilitating learning new subject matters (Birren, 1988)

3 ELEMENTARY SCHOOL ENVIRONMENTS

3.1 The Effects of Elementary School Environments on Children

The environments are more than just simple physical settings. They include "all the external conditions and factors potentially capable of influencing an organism" (Greenman, 1988, p.5). The environments structure the time, and assign roles to the users of the environments; they also structure the behaviors and the physical surroundings (Greenman, 1988). The same environment may affect different people in different ways. Some reasons for this is that people may have different physiological make ups, they may differ in attitudes toward, and past experiences with, various places; also in the ways people cognitively process the information they receive from their surroundings (Mehrabian, 1976).

The built environment is deficient in two important respects, competence and cognition. The following statements best summarize the environmental situation regarding competence and cognition. "(1) we are immersed in a physical environment upon which it is very difficult to have any impact, (2) we are immersed in a physical environment which is very difficult to know and understand" (Friedman, 1976, p.31). Competence may be defined as an organism's capacity to interact effectively with its environments,

the organism's capacity to have both the social and physical environment. Cognition may be defined as the mental processes organisms perform in order to know or understand an object or event and psychological theories that place such processes at the center of their explanations of behavior. If people's desires to know (cognition) and have impact upon (competence) are not satisfied in the built environments, two general solutions may come to mind to reduce this dissatisfaction. First is the policy solution, which aims directly at influencing and changing organisms and their behaviors. The second can be called the technological solution, which refers to the design of the environments that are both easier to know and to have impact upon. " … knowing and understanding an environment is a necessary precondition of having impact upon it, and conversely, the process and products of having impact upon an environment enable us to know it more fully" (Friedman, 1976, p.34).

The amount of time young people spend in the learning environments, from preschool to high school (first to twelfth grade), is very long and significant in the life span of humans. It is important to realize that much of this time is devoted to living as well as learning. The quality of the student life and the quality of the education are directly affected by the quality of the school environment (Sanoff, 1994). The elementary school years are critical years in a child's life. The children start looking for tasks that they can carry through to completion. A great development in the sense of accomplishment is seen. The child wants to settle down and learn exactly how to do things and how to do them well (Binter and Frey, 1972).

The school environments are important places for they are very influential on children. It has an important and potent cultural force in the life of the children because it systematizes the child's experiences according to some organizational plan. But the schools are generally organized and designed according to traditional administrative lines that meet the needs of the adults rather than the children's. It is indicated that the children's needs and feelings must be taken into account when designing something for them (Binter and Frey, 1972). Children who learn in environments that are designed to elicit and reinforce their development will enjoy schooling more than children who learn in an environment designed with other criteria in consideration (Sturck, 1992). The look and feel of a school matter to children and they are deeply connected to their attitudes and behavior. The self-esteem, sense of belonging, and ambivalent needs of children both for control over their world against boundaries and to guide that control can be shaped trough the thoughtful design of the school and the classroom environments. "When children experience a school with obviously designed with their needs in mind, they notice it and demonstrate a more natural disposition toward respectful behavior and a willingness to contribute to the classroom community" (Herbert, 1998, p.69).

The schools, therefore, must have positive effects on the children's ability to learn and perform, increase the desire to stay, explore and interact with others. To be able to achieve these results, the environmental design of the school should be done accordingly (Mehrabien, 1976). Color plays an important role in the achievement of these results. The modern application of color to the school environments improves the

scholastic performance of the school students. The school children are extraverted by their nature. The use of correct and preferred colors will decrease the problems of nervousness, irritability, lack of interest, and behavior, as well as facilitating learning new subject matters (Birren, 1988).

3.2 Use of Color in the Elementary School Environments

The quality of the environment can have a direct impact on human behavior. In conjunction with this belief, it has been suggested that the use of appropriate use of color can enhance the overall quality of the environment and thus, influence behavior, especially in environments where people are confined for long periods of time under artificial conditions. Many prisons, hospitals, companies and schools have adopted systematic color schemes that have been designed to produce particular performance states in their inhabitants (Etnier and Hardy, 1997). The use of functional color gains great importance in environments as such. The term functional color can be described as the art or science of increasing efficiency, profitability, and safety through the use of color in industrial, commercial, and institutional environments (Danger, 1987). Birren (1961, p.243) proposes another approach to functional color. According to him, the functional color is concerned with measurable facts. Color problems are handled through technical methods rather than artistic methods as the "… : beauty in a decorative color scheme has no criterion other than taste or opinion; functionalism in a color scheme is entirely dependant upon tangible evidence"

The children start to recognize their environments through the use of color. Color also has a definite message conveyed to it about the nature of learning process and the comprehensibility of the environment. The colors of the environmental components draw attention towards these components, demanding that the children utilize them as elements of learning. "Color and object are united, each being primary to the understanding of the environment" (Friedman, 1976, p.34). An application of color coding in the primary school environments would help the children come to understand and recognize the environment where their education is taking place (Friedman, 1976).

School environments are places where children spend most of their time. Previous studies have shown that the use of color in the schools is in the realm of psychology. Small children are generally outwardly directed and nervous, as stated before. Birren (1963) claims that these facts should not be disregarded and considering these he says that the school environments should match the children's spirits. The children would relax and concentrate on work in actively colored environments, and the reason for this is that the visual and emotional excitement in such environments match the spirits of the children and set them at ease. Using passive or cool colors to calm children down or to make them concentrate on their tasks would be no help, but only make them more nervous and anxious. Careful selection of paint color can help increase the students' attention spans and brighten a facility. Certain color schemes can have tremendous effects on students' concentration levels, eye fatigue, attention span and morale (Trent, 1995).

Small children are extroverts by their nature. They are impulsive, physically active, and responsive to what goes on around them, but with short attention spans. For example, putting children in a blue room with hopes of quieting down their restless and impetuous ways is an ill-advised and wrong suggestion. The melancholy of the blue environment would "bottle up the agitated spirit of the child, even prompting the child to burst forth in bitter crying" (Birren, 1983, p.168). The anxiety of the child should be released to quiet him down and this can be accomplished by a bold and vivid use of color. The bright environment would match the nervousness in the child and therefore he would feel relieved and comforted in the environment (Birren, 1983). The results of the study performed by Fehrman (1986) has indicated that colors of equal value produce comparable arousal and performance results, therefore the color balance of an environment is of greater significance than a specific hue.

Children at different grade levels respond to color in different ways. Therefore this case should be taken into consideration while choosing a color scheme for a classroom. Early-elementary years are the most active and lively years of a child. The colors and designs selected for their school environments, classrooms, should reflect these traits. To be able to convey vitality without overwhelming a room, bright warm colors could be used on doors, cabinets, furniture and other accent areas. Upper-level students need to concentrate for longer time spans. Since this is the case, a calming environment with sophisticated accent colors using light-to mid-value cool colors for walls could be considered. Wall colors can include blue-greens, teal blues, greens, warm beiges and grays (Trent, 1995).

Pile (1997) claims that classrooms and lecture rooms require color that would be comfortable for the students as their attention moves from desktop to teacher, from teacher to the board. He claims that in general, use of mild colors for the walls and floors would minimize the undesirable excessive brightness contrast between paperwork and surroundings. A more intense color may be used on the front wall, from the sidewalls, which is related to or contrasting with the color of the board. He also suggests that the gymnasiums, auditoriums, and cafeterias are best in lighter tones, warm to neutral, with possible bright color accents in small areas. Small areas, such as ends of areas or doors, on stairways and corridors could also be painted in bright accent colors to provide variety and stimulation while passing between spaces.

Birren (1988) lists a group of requirements that are necessary for school environments. In school environments, the brightness ratios in the general field of view, which consists of walls, floor, furniture, and equipment, should be fairly uniform. And it should be painted in colors that reflect 50 and 60 percent light, which have Munsell values around 7.5-8. The ceiling should be white or off-white for good reflection and the reduction of shadows. The colorless environment consisting of grays has little outward appeal. It leads to subjective moods, inner tension and monotony. In contrast, the colorful environment provides release, excitement and pleasure. The use of bright and warm colors –soft yellow, coral, peach- in the school environment will have a diverting effect. The use of such bright and warm color schemes will bring the visual and emotional interest that is necessary for schools outward. The cool colors – chartreuse, light green, aqua with ample illumination- have reverse effects on children. The passive effect of

the surroundings will allow better concentration. These cool and passive colors are more appropriate for upper and secondary grades, study rooms and the school library.

The use of color on the front walls should be considered carefully, especially in the classroom arrangements where students face one direction. The suggested application is using a tint like oyster white, sandstone and beige for side and back walls, and medium tones such as terra cotta, old gold, avocado, emerald green, turquoise, sapphire blue for the front wall. The advantages of having colored front wall are (1) relaxing the eyes of the students upon looking up from their tasks; (2) adding greater visibility to the teacher and to the lessons and educational materials displayed, (3) breaking up monotony by giving the classroom a different appearance from different directions (Birren, 1988)

The information presented above is the experts' opinion on how a school environment should be colored according to physical and psychological characteristics of children in creating both physically and psychologically healthy learning environments. The information is technically correct when the effects of color on humans are considered. There is something lacking in these studies, which is the color and color scheme preferences of children in the school environments. This is an issue that should be studied thoroughly and the information that would be obtained should be taken into consideration while applying color to school environments.

In a study that has been conducted by Jennifer L. Etnier and Charles J. Hardy, to test the effects of environmental color on task performance, some evidence have been found to suggest that the preferred color has a more significant impact on performance than does color as a function of wavelength (Etnier and Hardy, 1997). In a similar study as the current one, that was conducted by Fehrman and Fehrman (2000), a group of kindergarten children have been tested on their color scheme preference in their classroom environments. There were fifty children and they were provided with lots of different colors of construction paper. The colors have included the bright primary and secondary colors along with a wide range of pastels and neutralized gray tones. The children were asked to choose their favorite colors from these construction papers. The children have selected a very sophisticated color palette with an excellent color balance. The classrooms were painted according to this palette and the children have expressed pride in having been able to participate in the repainting of their classroom.

4   RESEARCH

The issue of color is very complicated and hard to deal with. There have been many studies conducted on the subject of the effects of color and preference for colors. There cannot be very specific results about color, but still there are universal findings on the effects of certain colors and preferences for certain colors through out the studies conducted in the previous years by experts. Relying and depending on the results of these studies, new experiments and studies are being performed. This dissertation and research covers one of the most important fields within the studies of color, color preferences of children in their school environments, and also will be opening new basis for further researches and researchers.

The objectives of the study are:

(1) To find out about the color and color scheme preferences of elementary school children in their school environments, regarding the effects of age and gender for the preference of color.

(2) To observe the changes in the color scheme preferences in the given spaces with different functions (classroom, corridor, cafeteria).

(3) To compare the existing and the preferred color schemes in the specified spaces in the school environments.

(4) To compare the differences in preferences of children who occupy school environments with different color applications.

4.1 Experimental Study

The research that has been conducted in this study aims to find out the color and color scheme preferences of children of different age groups in urban private schools, in different spaces of their school environments, such as their classrooms, corridors, and cafeteria, as well as their abstract color preferences. It is also a comparative study, which tests the use of color in two urban private schools in Ankara that have different application of color in their spaces, and the children's preferences for the use of those colors.

As a first step in the study, an observation was made in 20 of the urban private elementary schools and some of the government schools in downtown Ankara to document the use of color in elementary school environments as an overview. The items that have been looked for are the location of the color in the spaces. Where has color been applied the most in the environments? (on walls, ceiling, floor, desks, chairs, curtains, windows, doors, details as accent). What has the color been used for? Has different colors been used for different spaces with different functions? Are there different applications of color in classrooms, corridors, and cafeterias?

The observation was done through a checklist (Appendix D), consisting of the spaces in a school, classrooms, corridors/inside playing areas, cafeteria, library and auditorium, and the items in those spaces. The color of each item in each space was noted down. According to the outcome of the observation it has been realized that the use of color in the urban private schools of Ankara is not following the accepted rules of color theory. In 70% of the schools that have been visited, the color that is used in majority is white and it is applied on almost all of the surfaces in any of the spaces regardless of its aesthetical and functional aspects. The ceiling and walls are painted to white with a darker color for the floor. This kind of application is generally for the maintenance requirements, it is cheaper and easier to repaint white. In these schools, color has been hardly used, but when used it has been applied to the details in the spaces such as the legs of the desks and chairs or curtains. The classrooms, corridors, and cafeterias are all painted to same colors. There is no difference in the color of the spaces with different functions.

In 20% of the schools, color has been applied consciously and obviously been planned from the onset. In these schools, the complimentary or the similar color schemes have been applied in a certain order, or a certain scheme has not been applied but still there was an order in the application of colors to the spaces. The color has been carefully applied on walls, ceiling, floors, and the details. The use of color here is for functional and aesthetical requirements. Different colors have been applied to different spaces in some cases. Generally the classrooms and corridors have been painted to same schemes but a different scheme has been applied to the cafeterias. In one case in which color

was very carefully used, Aykan Kolleji, even the classrooms of different grades were colored to different colors. There was one case, Tevfik Fikret İlköğretim Okulu, where the identifying color of the school has been consciously applied to the details of the school. In 10% of the schools where color has been applied, color was used in large amounts but without any sort of order. Color has been applied on all the surfaces and all the details. Color has probably been applied considering the aesthetical requirements but it has not been planned from the onset. Different colors have been applied in different spaces. The classrooms, corridors, and cafeteria have been painted to different colors. But the problem with these schools is that as Mahnke (1996) stated, the use of multicolor in the environments does not add much to the users just as bleak environments.

According to the results obtained through the observations, two schools with similar settings and campuses (both are elementary schools of universities), serving to similar social-economic levels and similar population of students along with their use of color in the spaces were chosen. These schools are good examples to show the appropriate and inappropriate ways to apply color in the school buildings, which are colored considering and not considering the accepted rules of color theory. The schools that have been found appropriate for the scope of this study are Özel Bilkent İlköğretim Okulu, and ODTÜ Geliştirme Vakfı İlköğretim Okulu.

4.1.1 Site Characteristics

The school managements have kindly asked for not using the photographs taken in the dissertation that will be published. Respecting that, the color schemes of the schools are presented verbally. Özel Bilkent İlköğretim Okulu was found appropriate because the application of color seemed to be consciously done. Analogous complementary color scheme has been applied in the classrooms and corridors, consisting of yellow-orange and blue-violet, with accents of red-orange on the floors and details. The desks and the chairs are white with blue-violet legs. The curtains and details in the classrooms are also blue-violet. There is a conscious application of color in classrooms and corridors. The walls and ceilings are off-white in general. The color, which is used in the cafeteria is off-white on every surface except for the legs of the chairs and the tables and the shades, which are in dark blue. The Bilkent elementary school is one schools in which the color application is done very well.

ODTÜ Geliştirme Vakfı İlköğretim Okulu was found appropriate for the study because the application of color is very poor. White is the dominant color on walls and ceilings, where dark gray is used on the floors of the classrooms and corridors. The desks and chairs are wooden with black legs. So no color has been applied on any surface, the color scheme is achromatic with wooden accents. So for the case study there are two schools with completely different color schemes. With these schools in hand to be tested, the reactions of the students to the color schemes of their school environments will be questioned.

4.1.2 Research Procedure

To be able to realize the abstract single color preferences of children a color chart has been prepared. The color chart has been prepared in Adobe Photoshop 5. It consists of the chips of the three primary colors (red, blue, yellow), three secondary colors (orange, violet, green) of the color wheel and achromatic colors (black, white) in their tints and shades. (see figure 1). These six colors are chosen regarding Hans Eysenk's study on color preference. He, too, had used these six colors of the color wheel in his study and had obtained his universal color preference scale.

To test the color scheme preferences of children in their school environments, alternatives for the existing color schemes of the schools have been prepared. The alternatives are the perspectives of the classrooms, corridors and the cafeterias of the two schools rendered in six color schemes: the existing color scheme, two similar schemes, two contrasting schemes and an achromatic scheme. The similar schemes are warm similar scheme that consists of red and orange, and cool similar scheme that consists of blue and green. The complementary schemes consist of red-green, and blue-orange for the classrooms, and yellow-purple for corridors and cafeterias. The photographs of the spaces have been taken. Out of these photographs perspectives of the spaces have been drawn. Finally, these perspectives have been scanned and transferred into computer space to be rendered. Adobe Photoshop 5 has been used for rendering the perspectives. The RGB (red, green, blue) color system has been used to code the colors. (see figures 2-7).
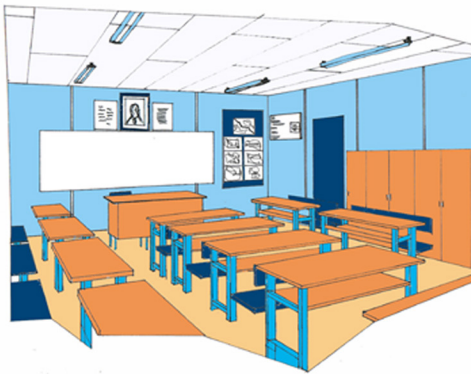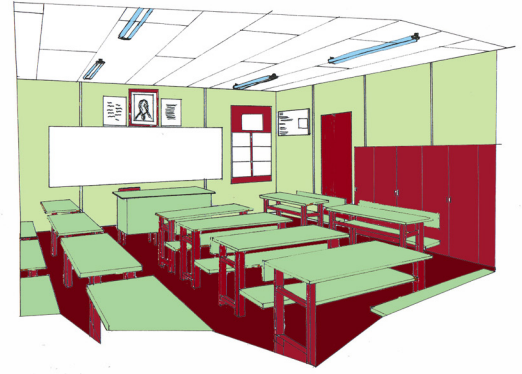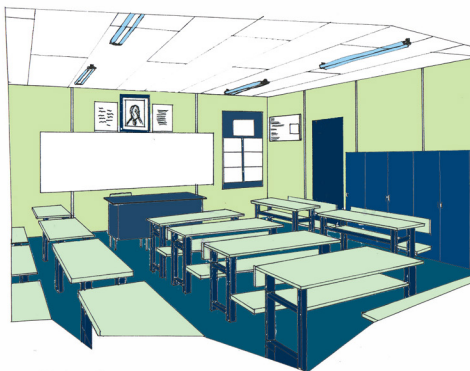
Figure 1 - Color Chart
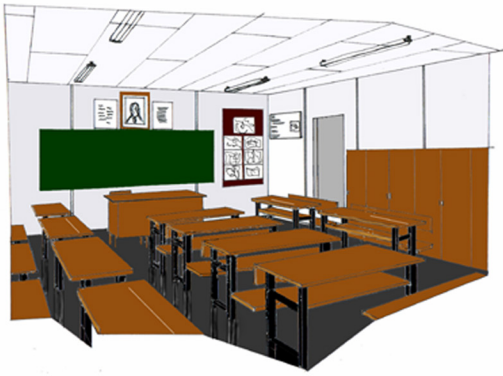
Existing scheme

Monochromatic-achromatic scheme

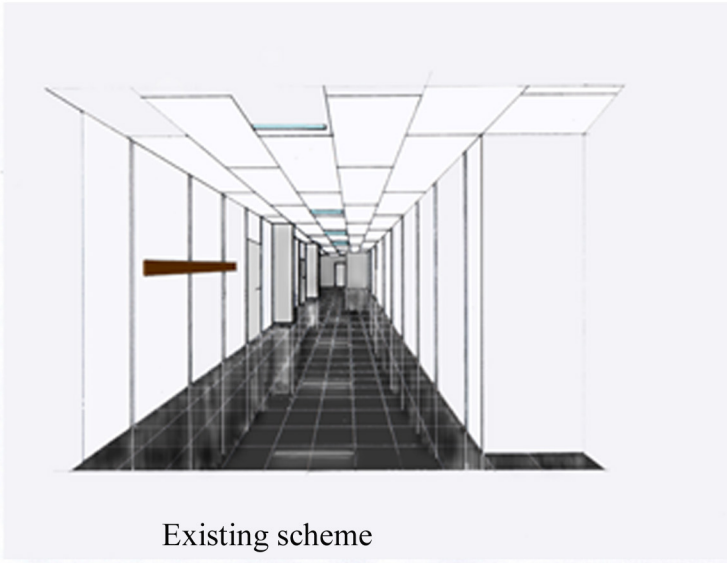Blue-orange scheme

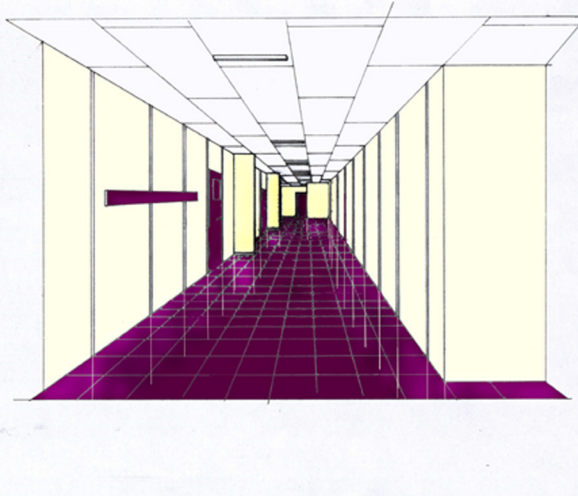Red-green scheme

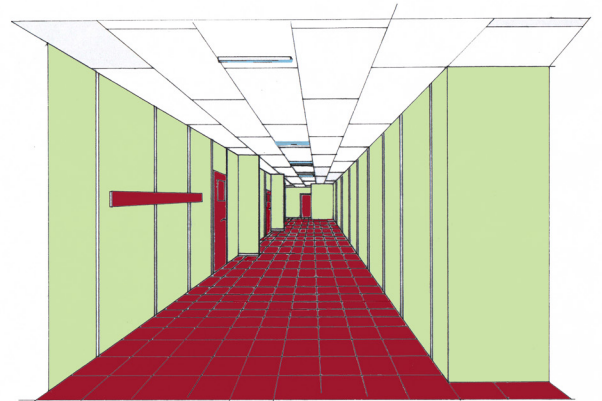Blue-green scheme

Red-orange scheme

Figure 2 - Classroom alternatives for ODTÜ

Existing scheme

Yellow-purple scheme

Red-green scheme

Blue-green scheme

Red-orange scheme

Figure - 3 Corridor alternetives for ODTÜ

Existing scheme

Yellow-purple scheme

Red-green scheme

Blue-green scheme

Red-orange scheme

Figure 4 - Cafeteria alternatives for ODTÜ

Existing scheme

Monochromatic-achromatic scheme
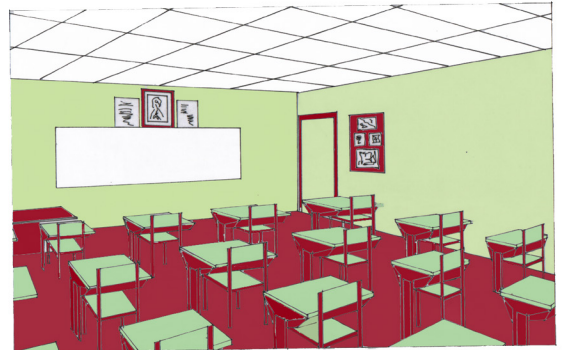
Blue-orange scheme

Red-green scheme
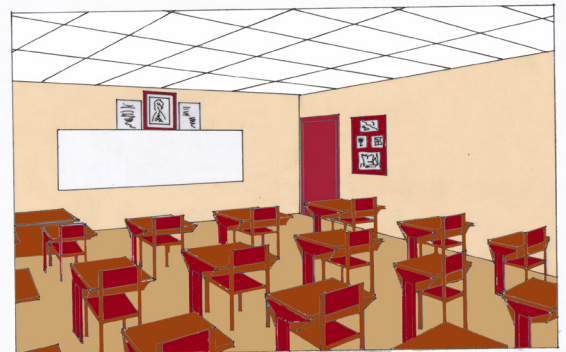
Blue-green scheme

Red-orange scheme

Figure 5 - Classroom alternatives for Bilkent
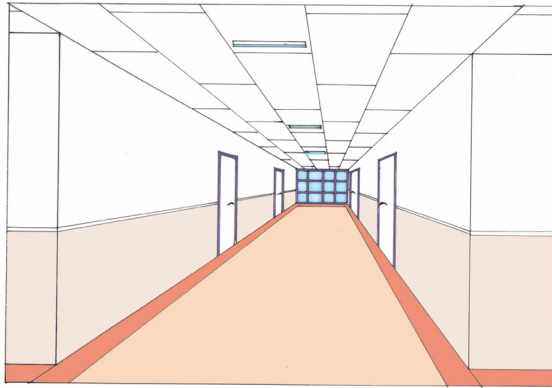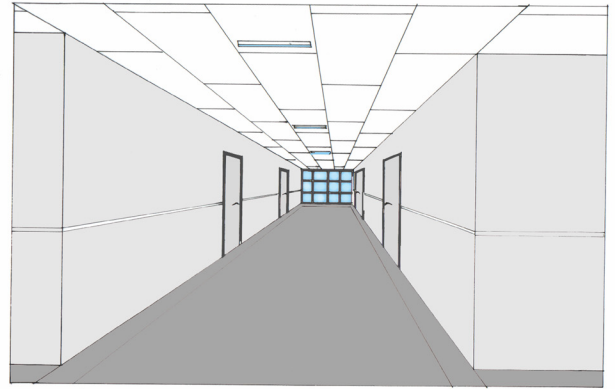
Existing scheme

Monochromatic-achromatic scheme
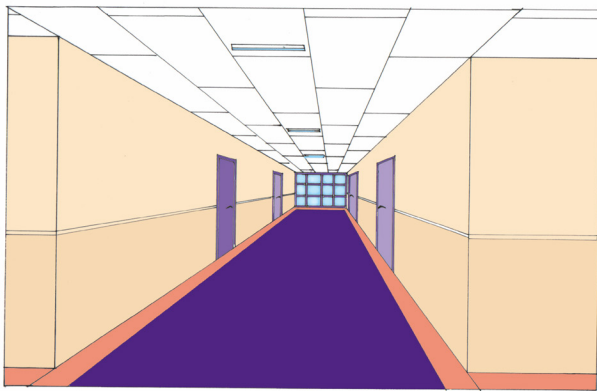
Yellow-purple scheme
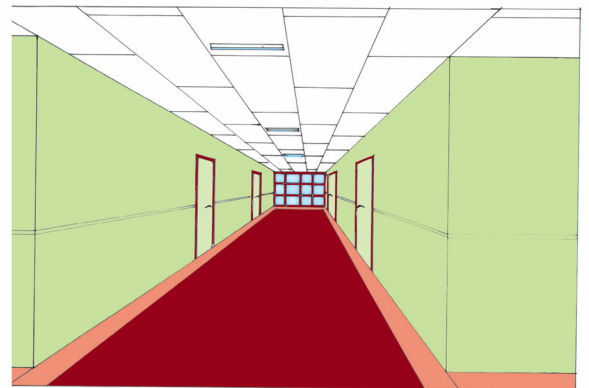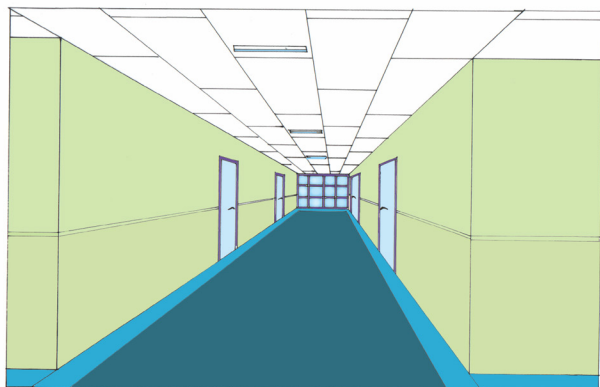
Red-green scheme
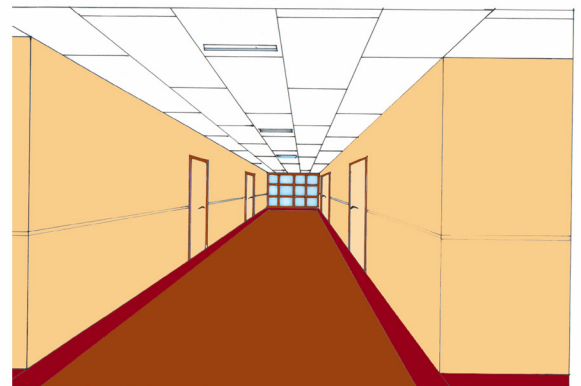
Blue-green scheme

Red-orange scheme

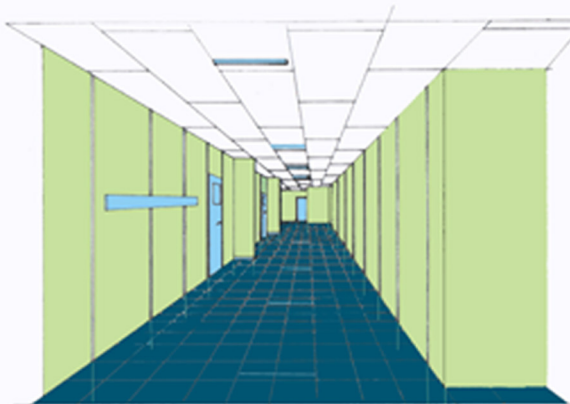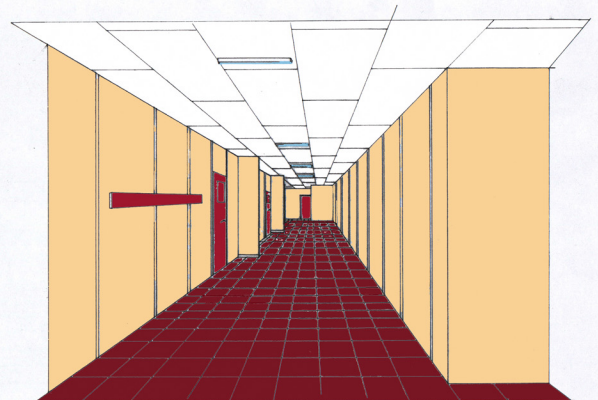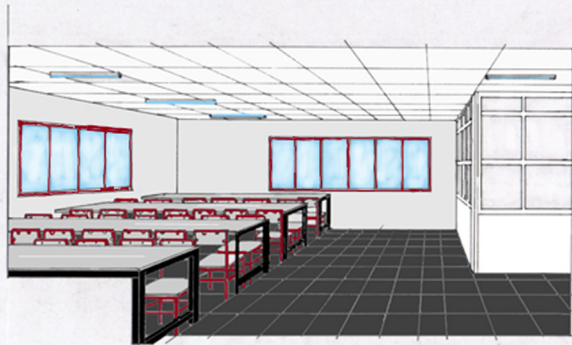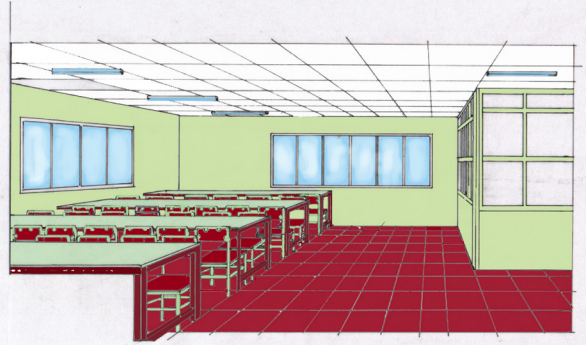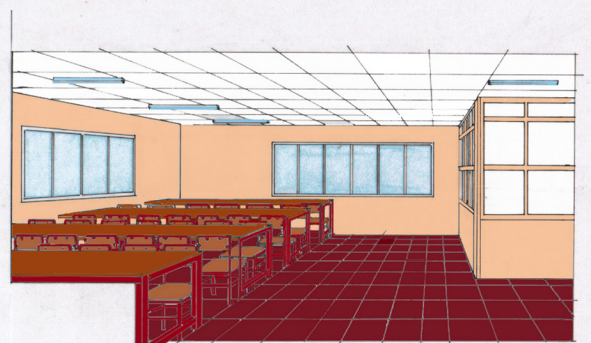Figure 6 - Corridor alternatives for Bilkent
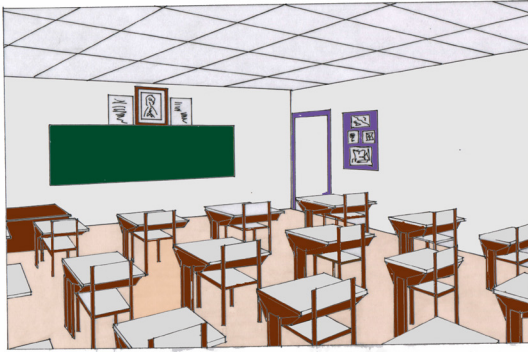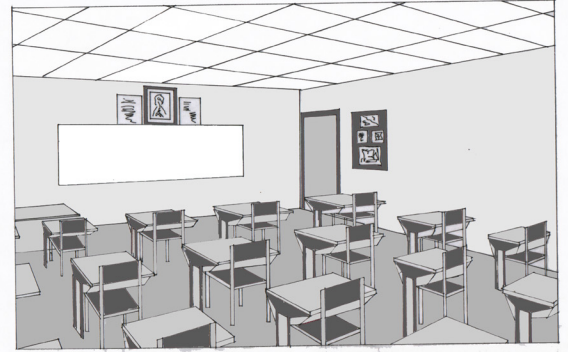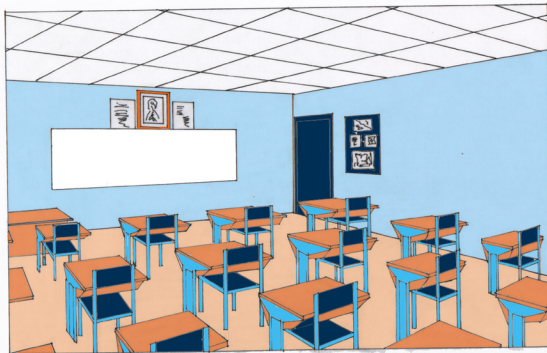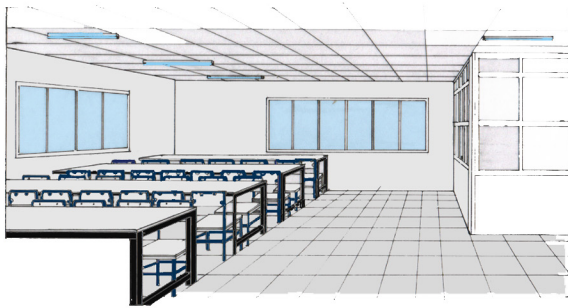
Existing scheme
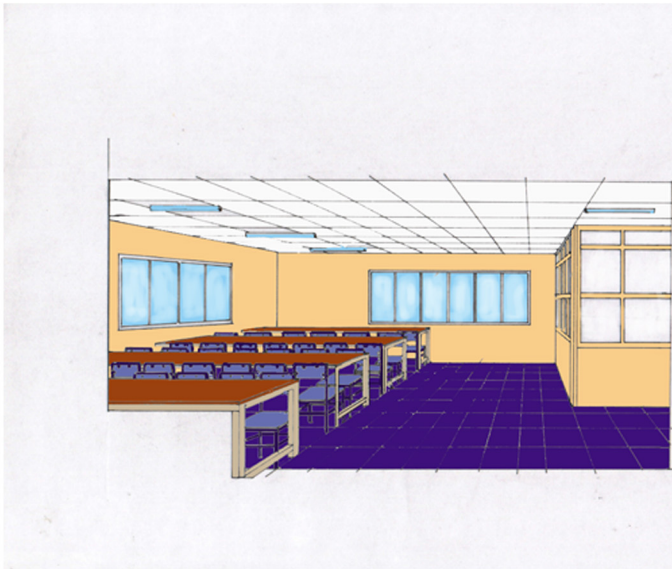
Yellow-purple scheme
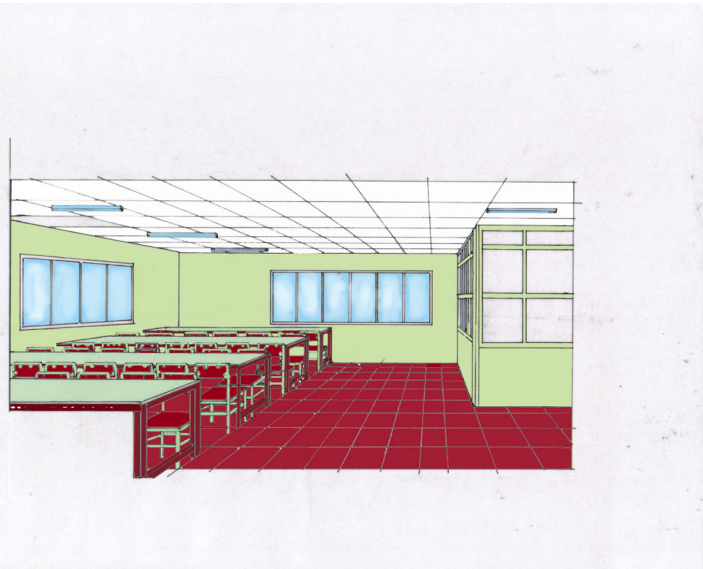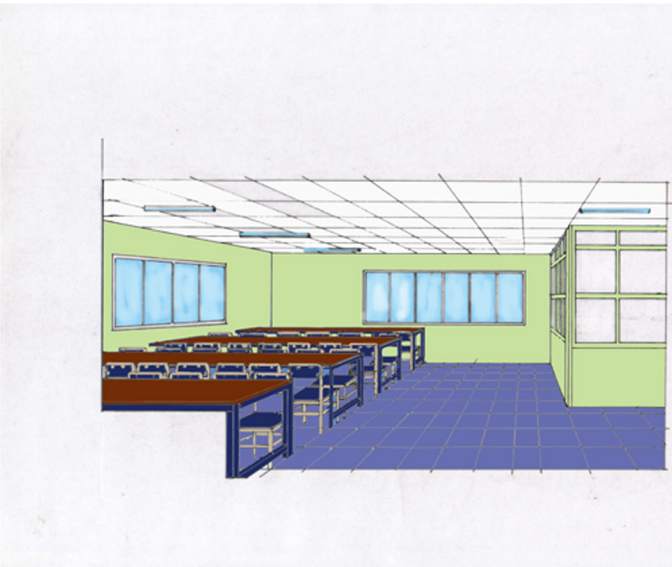
Red-green scheme

Blue-green scheme
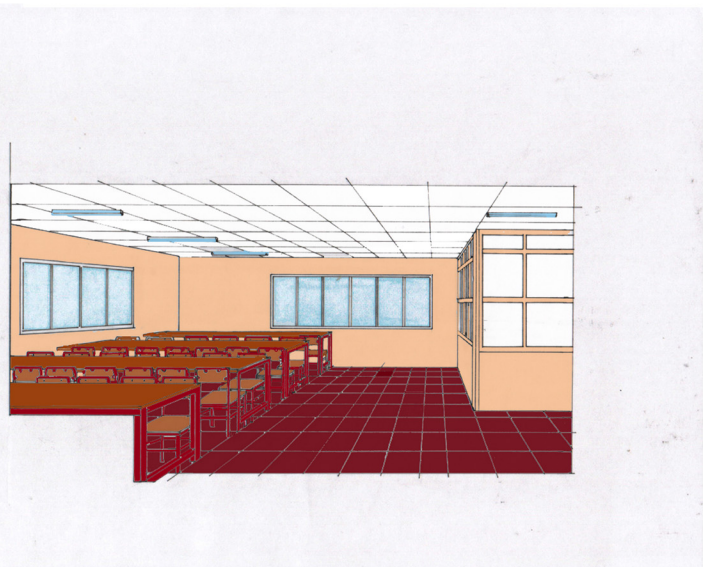
Red-orange scheme

Figure 7 - Cafeteria alternatives for Bilkent

4.1.3 Subjects

In this experiment 275 students in three different age groups were tested. These age groups are chosen according to the development stages of children during their elementary school years.

The development in the duration of elementary school years in a child's life can be divided into three major age groups. 1st and 2nd grades (7 and 8 years), 3rd and 4th grades (9 and 10 years), 5th to 7th grade (11 to 13 years). Accordingly, the chosen age groups of the subjects were the 8 year-olds (2nd grade), 10 year-olds (4th grade), and 13 year-olds (7th grade) (Kehnemuyi, 1995).

The general properties of children in 1st and 2nd grades:

- Naturally extraverted, easily excited.
- Likes to learn.
- Restricted interest span. Easily gets tired and bored.
- Proud of the things he does but can be easily broken.
- Still living in his private mystery world.
- Likes tricky games.
- Enjoys or detests group works simultaneously.

The general properties of children in 3rd and 4th grades:

- Realizes the differences among people.
- Gains a status in the society.

- Learns to take responsibility, being neat, and make new friends.

- Children of different sexes make separate groups from each other.

- Concentration on the work at hand increases.

- Starts to realize the funny things around.

The general properties of children in 5th to 7th grades:

- Understanding of what is right and wrong.

- Chooses activity according to his sex.

- Becomes more free and understanding.

- Wants to finalize the work at hand beautifully and completely, therefore seeks for guidance.

- Starts to gain interest in things outside of school.

- Likes group works.

- Recognizes oneself and criticizes oneself.

- Is passing through strong emotional and physical change.

- The girls become more mature than the boys (Kehnemuyi, 1995).

4.1.4 Questionnaire

The questionnaire consists of two parts. The first part is about the abstract color preferences of children. The children are asked to pick their favorite color from the color chart provided and note its code number down.

The second part questions the children about their color scheme preferences in their classrooms, cafeterias, and corridors. The subjects are asked to choose the color scheme of their classrooms, corridors, and cafeterias, along with the color scheme they prefer for the specified spaces. Then they are asked to note down the code number of the scheme. (see Appendix B and C).

4.1.5 Application of the Research

Two classes from each grade in each school were picked randomly and tested. The first part of the experiment was to find the favorite colors of the children. In the first question the children were asked to choose their favorite color from the color chart provided for them. In the second part the children were shown the six different pictures of their classrooms, corridors, and cafeterias in six different color schemes that were mentioned before. From these six schemes they were asked to pick the one they thought was the same as their existing color scheme and also the color scheme they preferred to have in the specified space.

4.2 Data Analysis

For the data analysis the subjects, have been grouped according to their ages, gender, and schools. The results have been calculated using chi-square tests, percentages and correlations, and presented as percentages. The results of the abstract single hue preferences, brightness preferences, and warm-cool color preferences of the subjects have been examined for all of the subjects. For the results of the color scheme preferences for their classrooms, corridors, cafeterias and their liking or disliking for their school environments, the subjects have been grouped according to their ages and

genders as well as according to their schools. Also, the effects of function on the color preferences have been tested. For this analysis, the data has been grouped according to the functions of the spaces and examined accordingly. The subjects have been grouped according to their schools to be able to compare the differences of color scheme preferences between the students that occupy school environments with different applications of color and to realize the importance of the colors applied in the environments in making the spaces more desirable.

4.2.1 Abstract Single Color Preferences

To be able to realize the abstract single color preferences of children, the color chart has been shown to the subjects. They were asked to choose the chip of their favorite color from the chart. The resulting data have been examined to observe the changes in abstract single color preferences in different age groups and gender.

Figure 8 shows the distribution of the abstract single color preferences of all the subjects in percentages.
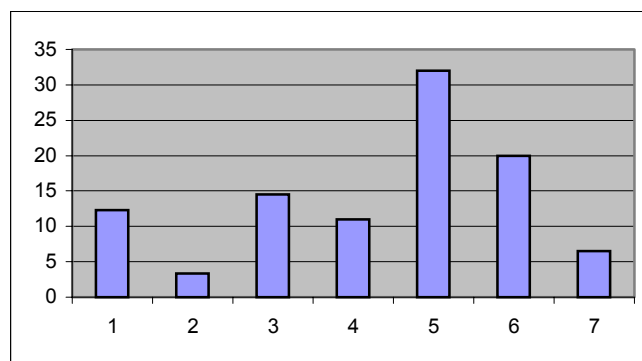
Figure - 8 Hue preferences. (1:yellow, 2:orange, 3:red, 4:purple, 5:blue, 6:green, 7:achromatics)

52

According to the figure the most preferred color among all the subjects is blue. The order of preference is: (1)blue, (2)green, (3)red, (4)yellow, (5)purple, (6) achromatic colors, and (7)orange. It can be observed that the tendency in preferences is towards the cool colors, rather than warm colors. Warm colors are preferred by 30% of the subjects, cool colors 63% of the subjects, and monochromatic colors are preferred by 7% of the subjects.

Table 1 - Abstract single color preferences according to age groups

Age	Yellow	Orange	Red	**Warm**	Purple	Blue	Green	**Cool**	Achr.
8	15%	3%	18%	36%	9%	19%	25%	53%	7%
10	13%	4%	13%	30%	9%	33%	22%	64%	3%
13	8%	2%	11%	21%	14%	41%	13%	68%	8%

The results when all the age groups are tested showed no evidence of association between hue preferences and age, in both chi-square test and correlation. According to the percentages, the tendency of preference is towards blue and then green. As the age increases the preference for blue also increases but the opposite holds true for green, as age increase the preferences for green decreases. Cool colors are preferred to warm colors in all age groups. The preference for cool colors increase with age whereas the preference for the warm colors decrease as the age increase. The order of preference for age group 1 is: (1)green, (2)blue, (3)red, (4)yellow, (5)purple, (6)achromatic colors, (7)orange. The order of preference for age group 2 is: (1)blue, (2)green, (3)red and yellow, (4)purple, (5)orange, (6)achromatic colors. The order of preference for age

group 3 is: (1)blue, (2)purple, (3)green, (4)red. (5)yellow and achromatic colors, (6)orange.

Table 2 - Abstract single color preferences according to gender

Gender	Yellow	Orange	Red	**Warm**	Purple	Blue	Green	**Cool**	Achr.
Girls	11%	4%	14%	29%	14%	26%	23%	63%	6%
Boys	13%	3%	15%	31%	8%	35%	18%	61%	7%

When gender is tested the results showed no evidence of association between hue preference and gender, both chi-square tests and correlation. According to percent charts, the tendency in preferences is towards blue in both genders and green the second. Cool colors are preferred to warm colors in both genders. The order of preference for the girls is: (1)blue, (2)green, (3)purple and red, (4)yellow, (5)achromatic colors, (6)orange. The order of preference for the boys is: (1)blue, (2)green, (3)red, (4)yellow, (5)purple, (6)achromatic colors, (7)orange.

The brightness levels of the preferred colors were also examined. According to the study performed by Kuller, Acking, and Sivik human beings prefer the saturated colors. Therefore the saturation dimension of the preferences has not been taken into consideration; instead the brightness dimension has been questioned.

Figure 9 shows the distribution of the brightness preferences of all subjects in percentages.
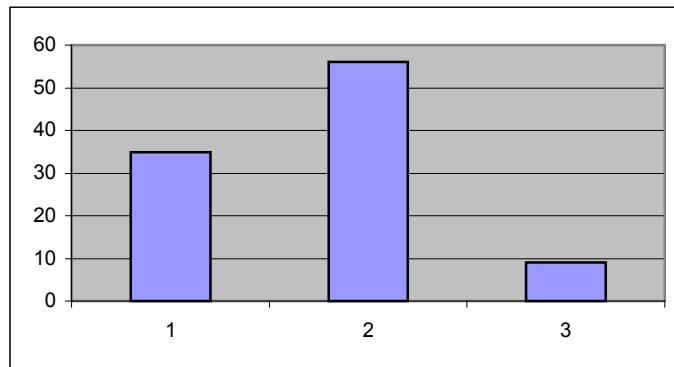
Figure 9 - Brightness preferences (1:light colors, 2:medium bright colors, 3:dark colors)

According to the findings the medium bright colors are preferred the most (56%), followed by the light colors (35%) with the dark colors preferred the least (9%).

Table 3 - Brightness preferences according to age groups.

Age group	Light colors	Medium colors	Dark colors
8	34%	59%	7%
10	41%	55%	3%
13	29%	53%	17%

The results when the age groups are tested showed no evidence of association between brightness preferences and age both in chi-square tests and correlations. In all the three age groups, the medium bright colors are preferred the most but there is a decrease in the preference for the medium bright colors as the age increases. The preference for the light and dark colors in age groups 1 and 2 are close to each other, but in age group 3 there is a noticeable drop for the preference of the light colors and a jump in the preference of the dark colors.

Table 4 - Brightness preferences according to gender

Gender	Light colors	Medium colors	Dark colors
Girls	52%	39%	9%
Boys	23%	68%	9%

When the gender is tested the results showed no evidence of association between brightness preferences and gender in chi-square test. But the correlation between gender and brightness preferences is significant. (Corr: 0.234, sig=0.001, significant at the 0.01 level). It can be said that girls generally prefer the light colors whereas the boys tend to prefer the medium bright colors. The dark colors are preferred by same amount of subjects in both genders.

4.2.2 Color Preferences for School Environments

4.2.2.1 Like-Dislike of the color of the school environments

The subjects have been questioned about their liking or disliking towards the colors used in their school environments. In ODTÜ elementary school, there is no application of color whereas in Bilkent elementary school there is a planned application of color. The distribution of the results in percentages is given in Figure 10.
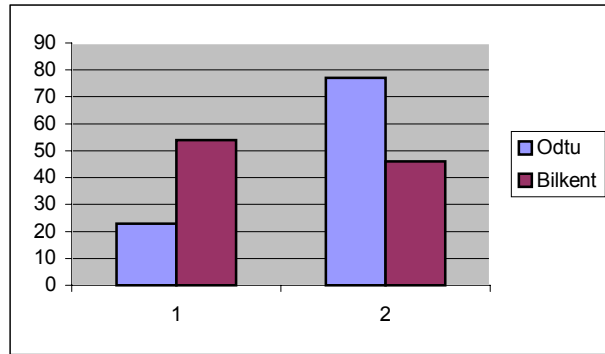
Figure - 10 Like/dislike of the school environments (1:like, 2:dislike)

Even though the statistical results showed no evidence of association between schools and like-dislike in chi-square tests, there is a significant correlation between architectural color of the schools and the like/dislike decisions of the subjects. (Corr: 0.965, sig=0.017, significant at 0.05 level). Also, it can be observed from the figure that the subjects of ODTÜ elementary school dislike their school environment more than the subjects of the Bilkent elementary school. Regarding these results, it has been supported that the use of color has an important effect on the like/dislike values for the environments.

In table 5, the distribution of the results according to gender is given. The results of ODTÜ when the gender is tested showed no evidence of association between liking or disliking the color of the school environment and gender. Similarly, the results of Bilkent when the gender is tested showed no evidence of association between liking or disliking the color of the school environment and gender. The amount of liking and disliking is close to each other in both schools for both genders.

Table - 5 Like-dislike of the school environments according to gender

Gender		ODTÜ			Bilkent	
	Girls	Boys	Total	Girls	Boys	Total
Like	25%	21%	23%	48%	59%	54%
Dislike	75%	79%	77%	52%	41%	46%

In table 6, the distribution of the results according to age groups is given. When the age is tested in ODTÜ, the results showed no evidence of association between liking or disliking the color of the school environment and age. When the age is tested the results of Bilkent showed no evidence of association between liking or disliking the color of the school environment and age. The liking of the school environment decreases as age increases in both schools, except for the age group 2 of ODTÜ elementary school, where the liking of the school environment increases noticeably.

Table - 6 Like-dislike of school environments according to age groups

Ages		ODTÜ				Bilkent			
	8	10	13	Total	8	10	13	Total
Like	33%	8%	29%	23%	69%	45%	50%	54%
Dislike	67%	92%	71%	77%	31%	55%	50%	46%

4.2.2.2 Classroom preferences

The classroom color scheme preferences of the subjects have been questioned. The subjects have been shown the alternative color schemes for the classrooms and asked to choose the scheme they prefer for their classroom environments.

Figure 11 presents the distribution of the classroom color scheme preferences of all the subjects in percentages.

Figure 11 - Classroom preferences of all subjects (1:existing, 2:monochromatic-achromatic, 3:blue-orange, 4:red-green, 5:blue-green, 6:red-orange)

According to the figure, the blue-orange scheme is the most preferred scheme (51%) among all the subjects for the classroom environment, whereas the monochromatic-achromatic scheme is the least preferred.

Figure 12 shows the distribution of the classroom preferences, in ODTÜ and Bilkent elementary schools in percentages.
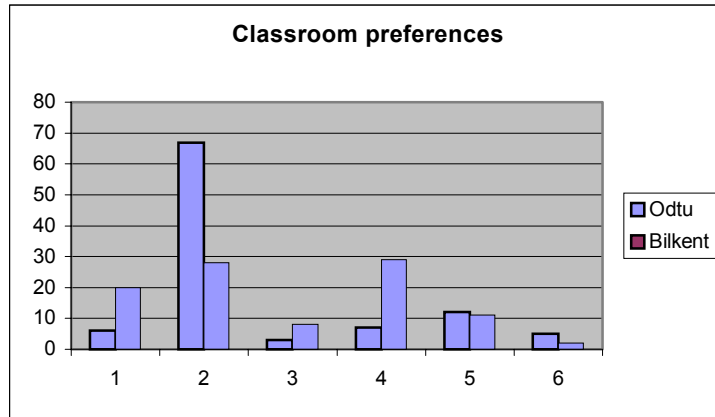
Figure - 12 Classroom preferences (1:existing, 2:blue-orange, 3:red-green, 4:blue-green, 5:red-orange, 6:monochromatic-achromatic)

The statistical results showed no evidence of association between schools and classroom color scheme preferences. Even though the results are not significant, it can be said that, regarding the figure, the blue-orange scheme is the most preferred color scheme for the classroom environments of the subjects of the ODTÜ elementary school. The subjects of Bilkent elementary school prefer the blue-orange scheme and the blue-green scheme almost equally for their classroom environments.

In table 7, comparison of the two schools for classroom preferences according to gender is given. When all the subjects are tested the results showed no evidence of association between classroom color scheme preferences and gender. When gender is tested the results of ODTÜ showed no evidence of association between classroom preferences and gender. The results of Bilkent also showed no evidence of association between classroom preferences and gender. The results show that the blue-orange scheme is the most preferred scheme in both genders in ODTÜ elementary school. In Bilkent

elementary school the preference for the blue-orange scheme and the blue-green scheme is distributed evenly in both genders. In the case of Bilkent, the preference for the existing scheme is also high in both genders.

Table - 7 Classroom preferences according to gender

Gender		ODTÜ			Bilkent	
	Girls	Boys	Total	Girls	Boys	Total
Existing	7%	5%	6%	21%	20%	20%
B-O	70%	65%	67%	27%	30%	28%
R-G	2%	4%	3%	6%	9%	8%
B-G	8%	6%	7%	35%	25%	29%
R-O	9%	14%	12%	8%	14%	11%
Monochr.-achr.	4%	5%	5%	2%	1%	2%

In table 8, comparison of the two schools for classroom preferences according to age groups is shown. When all the subjects are tested the results showed no evidence of association between age and classroom color scheme preferences of children. When the age groups are tested the results of ODTÜ showed no evidence of association between classroom preferences and age. The results of Bilkent also showed no evidence of association between classroom preferences and age. The blue-orange scheme is the most preferred scheme in all the age groups in ODTÜ elementary school, noticeably high in age group 2. In Bilkent elementary school the preference for the blue-orange

scheme and the blue-green scheme is distributed close to each other in all the age groups. The preference for the existing scheme is highest in age group 1 in both schools and it decreases as the age increases.

Table - 8 Classroom preferences according to age groups

Age groups		ODTÜ				Bilkent		
	8	10	13	Total	8	10	13	Total
Existing	14.5%	0	3.5%	6%	41%	15%	5%	20%
B-O	65.5%	88.5%	48%	67%	27%	27%	30%	28%
R-G	5.5%	0	3.5%	3%	8%	5%	11%	8%
B-G	5.5%	4%	11%	7%	16%	42%	27%	29%
R-O	9%	4%	23%	12%	5%	10%	19%	11%
Monochr.-achr.	0	4%	11%	5%	0	0	5%	2%

4.2.2.3 Corridor preferences

The corridor color scheme preferences of the subjects have also been questioned. The subjects have been shown the alternative color schemes for the corridors and asked to choose the scheme they prefer for their corridor environments.

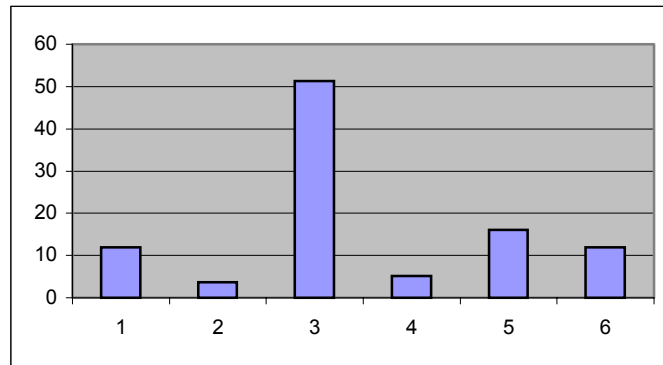Figure 13 shows the distribution of the corridor color scheme preferences of all the subjects in percentages.
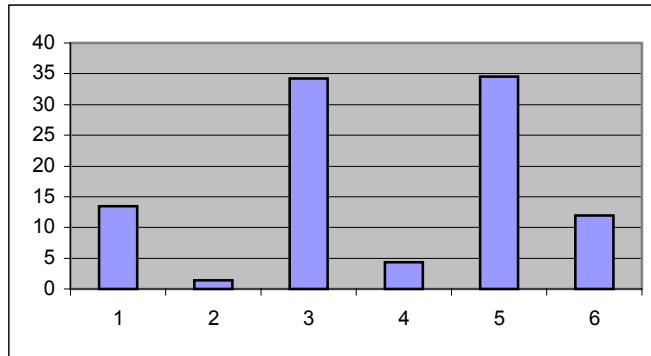
Figure 13 - Corridor preferences of all subjects (1:existing, 2:monochromatic, 3:yellow-purple, 4:red-green, 5:blue-green, 6:red-orange)

According to the figure the yellow-purple scheme and the blue-green scheme are the most preferred schemes for the corridors and they are preferred almost equal amount of subjects. The least preferred scheme for the corridors is the monochromatic-achromatic scheme, similar to the classroom preferences.

Figure 14 shows the distribution of the corridor preferences, in percentages, in ODTÜ and Bilkent elementary schools.
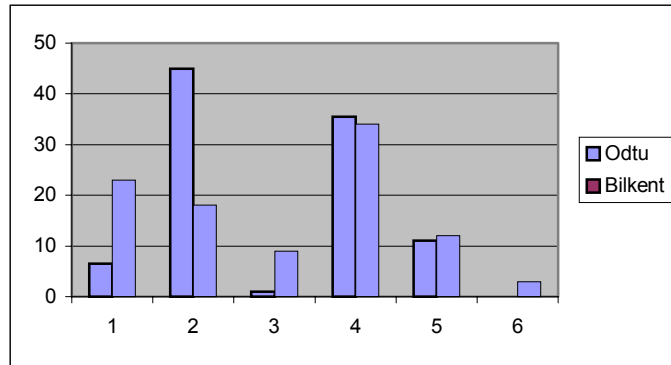
Figure-14 Corridor preferences (1:existing, 2:yellow-purple, 3:red-green, 4:blue-green, 5:red-orange, 6:monochromatic-achromatic)

The statistical results showed no evidence of association between schools and corridor color scheme preferences. Regarding the figure, it can be said that the yellow-purple scheme is the most preferred scheme for the subjects of ODTÜ elementary school. The blue-green scheme is preferred almost evenly by the subjects of the two schools. In the case of Bilkent elementary school, there is a high tendency for the existing color scheme as well.

In table 9, distribution of the two schools for corridor preferences according to gender is presented. The results when all the subjects are tested together according to gender showed no evidence of association between corridor color scheme preferences and gender. The results of ODTÜ showed no evidence of association between corridor preferences and gender. The results of Bilkent similarly showed no evidence of association between corridor preferences and gender. According to the table, the most preferred scheme for both girls and the boys in ODTÜ is the yellow-purple scheme, followed by the blue-green scheme. Things are different for Bilkent elementary school

where the most preferred scheme for the corridors is the blue-green scheme for both genders. The second most preferred scheme is the existing color scheme in Bilkent elementary school.

Table - 9 Corridor preferences according to gender

Gender		ODTÜ			Bilkent	
	Girls	Boys	Total	Girls	Boys	Total
existing	6%	7%	6.5%	31%	17%	23%
Y-P	54%	40%	45%	13%	23%	18%
R-G	1%	1%	1%	8%	9%	9%
B-G	34%	35%	35.5%	40%	30%	34%
R-O	4%	17%	11%	6%	17%	12%
Monochr.-achr.	0	0	0	2%	5%	3%

In table 10, the comparison of the two schools for corridor preferences according to age groups is given. The results when all the age groups are tested showed no evidence of association between the preference of corridor color scheme and age. The results when the age groups are tested in ODTÜ showed no evidence of association between corridor preferences and age. The results of Bilkent when the age groups are tested also showed no evidence of association between corridor preferences and age. The yellow-purple scheme is the most preferred scheme of all the age groups in ODTÜ elementary school. In Bilkent elementary school the most preferred scheme is the existing color scheme in

age group 1. The most preferred scheme of the other two age groups is the blue-green scheme followed by the yellow-purple scheme.

Table - 10 Corridor preferences according to age groups

Age groups		ODTÜ				Bilkent		
	8	10	13	Total	8	10	13	Total
Existing	9%	0	11%	6.5%	28%	17%	25%	23%
Y-P	49%	38%	48%	45%	19%	15%	19%	18%
R-G	0	0	3.5%	1%	8%	12%	5%	9%
B-G	34.5%	38.5%	32%	35.5%	22%	45%	33%	34%
R-O	7%	23%	5%	11%	19%	8%	11%	12%
Monochr.-achr.	0	0	0	0	3%	2%	5%	3%

4.2.2.4 Cafeteria preferences

The cafeteria color scheme preferences of the subjects have been questioned. The subjects have been shown the alternative color schemes for the cafeterias and asked to choose the scheme they prefer for their cafeteria environments.

Figure 15 gives the distribution of the cafeteria color scheme preferences of all the subjects in percentages.
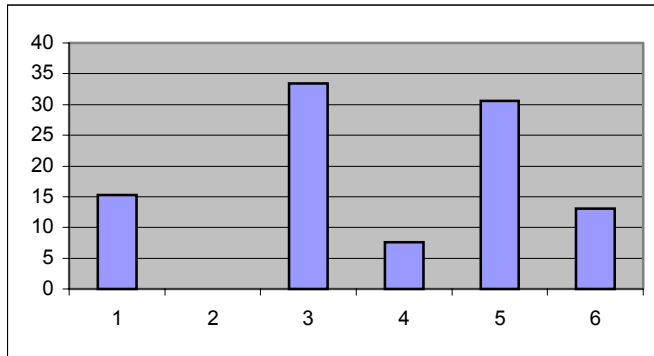
Figure 15 - Cafeteria preferences of all subjects (1:existing, 2:monochromatic-achromatic, 3:yellow-purple, 4:red-green, 5:blue-green, 6:red-orange.)

According to the figure the most preferred scheme for the cafeteria is the yellow-purple scheme (33%), followed very closely by the blue-green scheme (30%).

Figure 16 shows the distribution of the cafeteria preferences, in percentages, in ODTÜ and Bilkent elementary schools.

Figure - 16 Cafeteria preferences (1:existing, 2:yellow-purple, 3:red-green, 4:blue-green, 5:red-orange, 6:monochromatic-achromatic)

The statistical results showed no evidence of association between schools and cafeteria color scheme preferences. According to the figure, the most preferred scheme for the cafeteria environment in ODTÜ elementary school is the yellow-purple scheme. The blue-green scheme is preferred by nearly the same amount of subjects in both schools.

The comparison of the two schools for cafeteria preferences according to gender is given in table 11. The results when gender is tested for all subjects showed no evidence of association between cafeteria color scheme preferences and gender. The results when the gender is tested in ODTÜ showed no evidence of association between cafeteria color scheme preferences and gender. Similarly the results of Bilkent showed no evidence of association between cafeteria color scheme preferences and gender. Even though the results are not significant, the most preferred scheme of the girls in both schools is the blue-green scheme, whereas for the boys it is the yellow-purple scheme. The preference for the existing color scheme in Bilkent elementary school is also high.

Table - 11 Cafeteria preferences according to gender

Gender		ODTÜ			Bilkent	
	Girls	Boys	Total	Girls	Boys	Total
Existing	16%	10%	13%	19%	19%	19%
Y-P	37%	46%	42%	10%	28%	20%
R-G	0	5%	3%	10%	17%	14%
B-G	42%	21%	30%	45%	20%	31%
R-O	4%	16%	12%	14%	15%	15%
Monochr.-achr.	0	0	0	0	0	0

In table 12, the distribution of the preferences according to age groups for both schools is given. The results when all the age groups are tested for all subjects showed no evidence of association between cafeteria color scheme preferences and age. The results when the age is tested in ODTÜ showed no evidence of association between cafeteria color scheme preferences and age. Similarly, the results of Bilkent when the age is tested, too, showed no evidence of association between cafeteria color scheme preferences and age. The existing color scheme is preferred the most along with the yellow-purple scheme for age group 1 in Bilkent elementary school. The preference for the existing scheme in Bilkent decreases as the age increases. For age group 2, in Bilkent the yellow-purple scheme and the blue-green scheme are preferred equally, and in age group 3, the most preferred scheme is the blue-green scheme. In ODTÜ

elementary school the most preferred scheme in age groups 1 and 3 is the yellow-purple scheme, for age group 2 it is the blue-green scheme.

Table - 12 Cafeteria preferences according to age groups

Age groups		ODTÜ				Bilkent		
	8	10	13	Total	8	10	13	Total
Existing	14%	4%	19%	13%	25%	17%	14%	19%
Y-P	56%	30%	39%	42%	25%	32%	3%	20%
R-G	3%	4%	2%	3%	19%	7%	17%	14%
B-G	18%	46%	27%	30%	16%	32%	44%	31%
R-O	7%	15%	13%	12%	14%	10%	22%	15%
monochromatic	0	0	0	0	0	0	0	0

4.2.2.5 Preferences according to function

The obtained data has been grouped and analyzed according to the preferences for the functions. Figure 17 shows the distribution of the preferences according to the functions of the spaces.
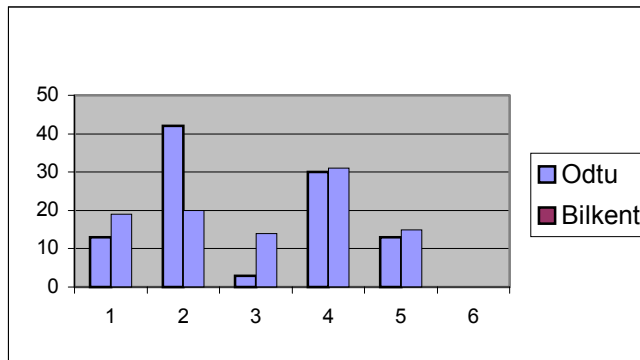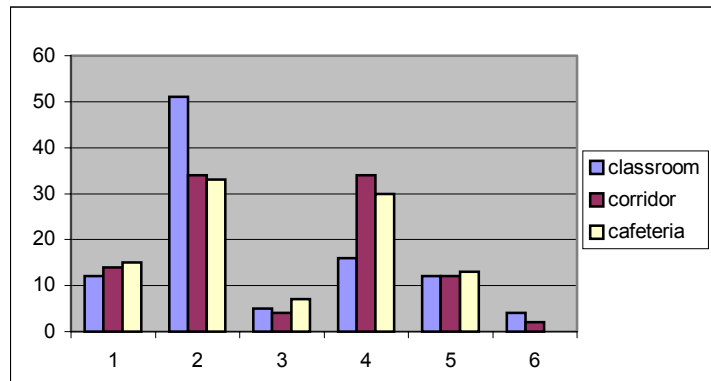
Figure - 17 Preferences according to function (1:existing, 2:blue-orange/yellow-purple, 3:red-green, 4:blue-green, 5:red-orange, 6:monochromatic-achromatic)

The statistical results showed no evidence of association between the function of the spaces and color scheme preferences. Even though not statistically significant, the preference for the blue-orange scheme for the classrooms is noticeably high. The yellow-purple scheme and the blue-green scheme are preferred almost equally for the corridor and cafeteria environments. Regarding these results, it can be said that children do prefer different color schemes for spaces with different functions. Even though statistically not supported, the preference for a different scheme for the classrooms is noticeably more than the corridors and cafeterias. This can be interpreted as children spend most of their time in their classrooms during a school day. Therefore their sense of belonging towards the classrooms are higher than the other spaces, regarding this they prefer their classroom environment to be different from the other spaces they occupy for shorter period of times.

Table 13 shows the distribution of the color scheme preferences according to the functions of the spaces in percentages.

Table - 13 Preferences according to functions

All subjects	Classroom	Corridor	Cafeteria
existing	12%	14%	15%
B-O/Y-P	51%	34%	33%
R-G	5%	4%	7%
B-G	16%	34%	30%
R-O	12%	12%	13%
Monochr.-achr.	4%	2%	0

Table 14 shows the distribution of the preferences according to functions in the two schools. The statistical results showed no evidence of association between function and color scheme preferences both for ODTÜ elementary school and Bilkent elementary school. The majority of the subjects of ODTÜ elementary school prefer the blue-orange scheme for their classrooms. In Bilkent elementary school, the blue-orange scheme and the blue-green scheme are preferred almost equally by the subjects of age group 1 for their classrooms. The preference for the existing scheme is noticeably high in Bilkent elementary school for all of the three spaces with different functions. For the corridors and cafeterias, the preference for the blue-green scheme is almost the same in both schools; but it is the most preferred scheme for both of the spaces in Bilkent elementary

school, whereas it is the second most preferred scheme in ODTÜ elementary school. In ODTÜ elementary school the most preferred scheme for the corridor and cafeteria is the yellow-purple scheme.

Table - 14 Preferences for functions according to schools

Function		ODTÜ			Bilkent	
	Classroom	Corridor	Cafeteria	Classroom	Corridor	Cafeteria
Existing	6%	6.5%	13%	20%	23%	19%
B-O/Y-P	67%	45%	42%	28%	18%	20%
R-G	3%	1%	3%	8%	9%	14%
B-G	7%	35.5%	30%	29%	34%	31%
R-O	12%	11%	12%	11%	12%	15%
Monochr.-achr.	5%	0	0	2%	3%	0

To be able to see the relationship between preferring the existing color scheme and the applied color scheme of the school, a correlation has been done among the variables in table 14. According to the results, the correlation between the applied colors in the school environment and preferring the existing color scheme is significant. (Corr: 0.925, sig=0.009, significant at the 0.01 level). This means that when there is a certain color scheme applied in the school environments, the preference for the existing scheme is statistically significant. The preference for the existing color scheme of the classrooms

is highest among the spaces examined. (Corr: 0.994, sig=0.006, significant at the 0.01 level).

4.3 Discussions

The results of the study have been grouped in two groups, the results of the abstract single color preferences and the results of the color preferences for the school environments.

The first group of the results is the abstract single color preferences of children. The data analysis has been done to realize the hue and brightness preferences of children. According to the data analysis, there was no evidence of association between hue preferences and gender in total. Also there was no evidence of association between hue preferences and age. Even though the results are not significant, the distribution of the preferences gives a certain order for hue preferences. According to the results the most preferred color among all the subjects is blue. The order of preference for all the subjects is: (1)blue, (2)green, (3)red, (4)yellow, (5)purple, (6) monochromatic colors, and (7)orange. Also it has been observed that the tendency in preferences is towards the cool colors, rather than warm colors. The preference for cool colors increases with age whereas the preference for the warm colors decreases as the age increases. The order of the preferences shows changes in different age groups and for boys and the girls. But in all the groups blue and green are the top position in the order interchangeably, with the monochromatic colors and orange at the end. Hans Eysenk's universal color preference order is: (1) blue, (2) red, (3) green, (4) violet, (5) orange, and (6) yellow. The two

orders do not exactly overlap with each other but the most preferred colors are the same in both of the orders: blue. The abstract single color preferences of children show a tendency for the preference of cool and medium bright colors. The preference for the blue color very high. This reflects on the children's preferences for the color preferences for the schools environments. The color schemes they prefer in their environments the most include blue and the cool colors, green and purple. The preference for the blue-orange complimentary, the blue-green similar, and the yellow-purple complimentary schemes is high and these schemes all include cool colors in their shades and tints.

There was no evidence of association between brightness preferences and gender in all the age groups and in total. Also there was no evidence of association between brightness preferences and age. The medium bright colors are the most preferred colors for all the subjects, in all the age groups and in both genders, followed the light colors and dark colors being the least preferred.

The second group of the results is the color preferences of children in their school environments. The results are given relying on the comparison of the preferences of the two examined elementary schools, ODTÜ elementary school and Bilkent elementary school, as well as the preferences of all the subjects.

When the two schools are compared there is a great difference for the liking or disliking the colors of the school environments, even though the statistical results showed no significant difference. The students of ODTÜ elementary school dislike the colors used

in their school environments in both sexes and in all the age groups. The students of Bilkent elementary school like the colors used in their school environment noticeably more than the students of ODTÜ elementary school. Even though this is the case, the liking for the existing scheme decreases as the age increases in Bilkent. 23% of the students in ODTÜ elementary school like their school whereas 77% of the students dislike it. Accordingly, the preference for the existing schemes of the school is low. For the classroom 6% of the students, for the corridor 6.5% of the students, and for the cafeteria 13% of the students prefer the existing schemes. The situation in Bilkent elementary school is different, 54% of the students like the color scheme of the school whereas 46% of them dislike it. Therefore the preference for the existing schemes is higher in Bilkent elementary school. For the classroom 20% of the students, for the corridor 23% of the students, and for the cafeteria 19% of the students prefer the existing schemes.

For the color preferences of children for their classrooms, children have been shown alternative color schemes to the existing scheme of the classrooms and asked to choose the scheme they prefer for the classroom. From the data analysis it has been found that the blue-orange scheme is the most preferred scheme (51%) among all the subjects for the classroom environment whereas the monochromatic-achromatic scheme is the least preferred. When the two elementary schools are compared, the statistical results showed no evidence of association between schools and classroom color scheme preferences. Even though the statistical results are not significant, it can be said that the blue-orange scheme is the most preferred color scheme for the classroom environments of the subjects of the ODTÜ elementary school. The subjects of Bilkent elementary

school prefer the blue-orange scheme and the blue-green scheme almost equally for their classroom environments. The monochromatic scheme is the least preferred scheme along with the red-green scheme.

The statistical results show no evidence of association between classroom color scheme preferences and gender, and also between preferences and age in both schools. But it is observed that the blue-orange scheme is the most preferred scheme in both genders in ODTÜ elementary school. In Bilkent elementary school the preference for the blue-orange scheme and the blue-green scheme is distributed evenly in both genders. In the case of Bilkent, the preference for the existing scheme is also high in both genders. The blue-orange scheme is the most preferred scheme in all the age groups in ODTÜ elementary school, noticeably high in age group 2. In Bilkent elementary school, the preference for the blue-orange scheme and the blue-green scheme is distributed close to each other in all the age groups. The preference for the existing scheme is highest in age group 1 in both schools and it decreases as the age increases. According to the results obtained it has been realized that the children prefer the schemes, which have blue color, cool colors, in majority.

For the color preferences of children for their corridors, children have been shown alternative color schemes to the existing scheme of the corridors and asked to choose the scheme they prefer. According to the results, the yellow-purple scheme and the blue-green scheme are the most preferred schemes for the corridors and they are preferred almost equal amount of subjects. The least preferred scheme for the corridors

is the monochromatic-achromatic scheme, similar to the classroom preferences. When the two schools are analyzed separately, the statistical results show no evidence of association between schools and corridor color scheme preferences. Regarding the results, it can be said that the yellow-purple scheme is the most preferred scheme for the subjects of ODTÜ elementary school. The blue-green scheme is preferred almost evenly by the subjects of the two schools. In the case of Bilkent elementary school, there is a high tendency for the existing color scheme as well.

The statistical results show no evidence of association between corridor color scheme preferences and gender, and similarly between the preferences for the corridors and age in both schools. Accordingly, the most preferred scheme for both girls and the boys in ODTÜ is the yellow-purple scheme, followed by the blue-green scheme. Bilkent elementary school is different where the most preferred scheme for the corridors is the blue-green scheme for both genders. The second most preferred scheme is the existing color scheme in Bilkent elementary school. Depending on the results it can be said that similar to the preferences of the classrooms, the children prefer the schemes that have blue and purple, cool colors, in majority.

For the color preferences of children for their cafeterias, children have been shown alternative color schemes to the existing scheme of the cafeterias and asked to choose the scheme they prefer. The results show that the most preferred scheme for the cafeteria is the yellow-purple scheme (33%), followed very closely by the blue-green scheme (30%) by all the subjects. The monochromatic-achromatic scheme is not preferred by any of the students whereas the red-green scheme is preferred the least by

the subjects. When the two schools are compared, the statistical results show no evidence of association between schools and cafeteria color scheme preferences. According to the distribution of the results, the most preferred scheme for the cafeteria environment in ODTÜ elementary school is the yellow-purple scheme. The blue-green scheme is preferred by nearly the same amount of subjects in both schools. The preference for the existing schemes is also high in ODTÜ as well as Bilkent.

 The statistical results show no evidence of association between cafeteria color scheme preferences and gender, and similarly between the preferences for the cafeterias and age in both schools. Even though the results are not significant, the most preferred scheme of the girls in both schools is the blue-green scheme, whereas for the boys it is the yellow-purple scheme.   The preference for the existing color scheme in Bilkent elementary school is also high for both genders. The subjects of ODTÜ elementary school prefer the existing scheme of the cafeteria noticeably higher than the existing schemes of the classroom and corridor. The existing color scheme is preferred the most along with the yellow-purple scheme for age group 1 in Bilkent elementary school. The preference for the existing scheme in Bilkent decreases as the age increases. For age group 2 in Bilkent the yellow-purple scheme and the blue-green scheme are preferred equally, and in age group 3 the most preferred scheme is the blue-green scheme. In ODTÜ elementary school the most preferred scheme in age groups 1 and 3 is the yellow-purple scheme, for age group 2 it is the blue-green scheme. Even though the preferences show changes in the order in age groups, similar to the classroom and

corridor preferences, the most preferred schemes for the cafeterias include blue and purple colors, cool colors, in majority.

When the color preferences are considered regarding the comparisons between the two chosen private schools, it has been observed that there is a big difference in the liking and disliking the school environments and preferences for the existing color schemes of the spaces of the students between ODTÜ elementary school, where there is no application of a certain color scheme, and Bilkent elementary school, where there is the application of a planned color scheme. The liking and the preferences for the existing schemes of the children are noticeably high in the school with the planned color scheme, Bilkent elementary school, whereas the opposite holds true for the school with no planned application of color, ODTÜ elementary school.

The color preferences for spaces with different functions do show differences even though not significant. The results show that the children have chosen the same color schemes for their corridors and cafeterias but they have chosen a different scheme for their classrooms. The reason for this could be that since children spend most of their time at school in their classrooms so their senses of belonging towards their classrooms is much higher than corridors and cafeterias, where the time spent in these spaces is very little compared to the classrooms.

5 CONCLUSION

This study has been conducted to understand and show the effects of age, gender, and differences in the functions of the spaces on color preferences of children in their school environments. The preferences of the subjects in the two private schools, ODTÜ elementary school and Bilkent elementary school, with different color applications have been compared in order to examine the effects of applied colors in the environments on the preferences for color schemes. ODTÜ elementary school has no certain color application whereas Bilkent elementary school does have a planned color scheme. This study also aims at emphasizing the importance of the color preference as a criterion for architectural coloring in elementary school environments and forming a new basis in the area of color research. It covers one of the most important topics in the field of color research, color preferences and its application in private and public environments.

It had been foreseen that the application of the colors in the school environments are not done regarding the color and color scheme preferences of children for the specified environments. According to the observation, the results of the survey and the interpretation of the data analysis, it has been observed that the colors applied in the

urban private schools have not been done regarding the color and color scheme preferences of children.

The results of the data have been analyzed to find the abstract single color preferences of children and the effects of age and gender on these preferences; and to test the effects of age, gender and function on color preferences of children in their school environments. The results showed that age and gender had no significant effect on the abstract single color preferences of children. The relation between the brightness preferences and gender was found to be significant, girls preferred the light colors and boys preferred the medium bright colors. But age had no significant effect on the brightness preferences. The effects of age, gender and differences in function on the color preferences for the school environments also have not been found statistically significant in this study.

Even though the results are not significant in most of the situations, they give an idea of what could be done to improve the school environments and make those spaces more preferred environments by children. Since the education is coeducational and since the results regarding the gender for the color preferences showed no significance in this study, the color application in the elementary school environments can be done disregarding the gender. The situation is similar for the age groups. Since the results regarding the age for the color preferences showed no significance in this study, same color schemes and patterns could be used for different age groups. Certain differences in the color scheme applications may be necessary for the aspect of identification,

which has not been tested in this study. The children have not been asked whether they would prefer different color schemes for different age groups.

The color preferences for spaces with different functions do show differences even though not significant. The results show that the children have chosen the same color schemes for their corridors and cafeterias but they have chosen a different scheme for their classrooms. The reason for this could be that since children spend most of their time at school in their classrooms so their senses of belonging towards their classrooms is much higher than corridors and cafeterias, where the time spent in these spaces is very little compared to the classrooms. So the students want their classrooms to be different from the other spaces, which they share with the other students.

When the existing and the preferred color schemes are compared in the two schools, it is observed that the preferred color schemes and the existing color schemes are different from each other. The existing color scheme of the Bilkent elementary school is blue-violet, red-orange complimentary scheme in classrooms and corridors with achromatic-monochromatic scheme for the cafeteria. The existing color scheme of the ODTÜ elementary school is achromatic-monochromatic scheme in all the spaces. The most preferred schemes of the subjects in this study for the classrooms is the blue-orange complimentary scheme and for the corridors and cafeterias the most preferred schemes are the yellow-purple complimentary scheme and the blue-green similar scheme. Regarding the preferences of children and the positive effects of the use of the preferred colors in the environments, the use and application of the given preferred color schemes for the specified spaces are suggested. The monochromatic-achromatic schemes are the

least preferred schemes for all the spaces by the subjects. Considering that this scheme is used in 70% of the urban private schools visited and almost all of the government schools, the situation does not seem very promising for the elementary school children in Ankara.

When the results are compared regarding the differences of preferences of children who occupy school environments with different color applications, it can be observed that the preferences of the children are very similar to one another. The preference for the existing color scheme by the students in Bilkent elementary school is noticeably higher than the students in ODTÜ elementary school. The correlation results were found to be significant between the preferences for the existing scheme and the architectural color application of the school buildings in this study. Despite this case, the preferences of children other than the existing schemes are close to each other. This is one of the most interesting results of this study. If there were more schools involved in the study, the results could have turned out to be similar to the obtained results in this study.

The results obtained in this study overlap with some of the expert views presented and do not overlap with others. There is an inconsistency among the expert views presented, not on the functional aspects but on the psychological aspects of color. Some of the researchers suggest the use of the cool colors in the school environments to calm children down and concentrate on their work (Trent, 1995; Pile, 1997), whereas Birren (1983, 1988) is strongly against the idea of using cool colors because he claims that the use of cool colors would make the children turn to their inner worlds and make them more nervous. He suggests the use of warm and bright colors in the school

environments to match the spirits of children. In this study that had been carried out on the color preferences of children in their school environments, the children have preferred the schemes that dominate cool colors, but they also preferred a balance by the use of a complimentary color in the schemes. The reason for preferring schemes with cool colors could be that their abstract single color preferences, cool and medium bright colors, reflect on the color preferences for the school environments. Regarding this situation, it is suggested that the opinions of the users of the environments, in this case the children, should be taken into consideration before applying color in the spaces along with the experts' views. Reaching a consensus with big groups in public spaces is quite difficult, but regional studies should be designed and the results should be interpreted carefully and accordingly.

Another important result of the study is that the color aesthetic of the spaces is very effective on the preference for the spaces. This fact has been shown once more in this study. There are many variables within a space; light, both natural and artificial, location, direction, climate, function the space serves, and the occupiers of the space. In this study only the users have been taken into consideration and the other variables have not been considered. The results may differ depending on the components and the contextual characteristics of the spaces. Studies including all of the components of a space as variables would form a basis for more detailed discussions, and the out-coming results would be more significant and accurate, as the simulations get closer to the reality. Also, the effects of the use of the preferred color on motor tasks, behavior, and

performance could be tested in order to observe the psychological effects of architectural color on the users.

There are many factors affecting the color preferences within a space. The preferences are personal and are directly affected by the psychology of the users along with the other factors; culture, education, socio-economic level, physiology. Therefore the results require the combination of all of the variables affecting the color preferences in a space. Each case would have its own special situation. Making generalizations is quite difficult, but studies conducted on the color preferences could be combined to achieve accepted color patterns for the spaces.

WORKS CITED

Albers, Josef. (1975). <u>Interaction of Color.</u> New Haven: Yale U.P.

Binter, Alfred R., Sherman H. Frey. (1972). <u>The Psychology of the Elementary School Child.</u> Chicago: Rand McNally and Company.

Birren, Faber. (1955). <u>New Horizons in Color.</u> New York: Reinhold Pub. Corp.

--- (1961). <u>Color Psychology and Color Therapy.</u> New Jersey: Citadel Press.

--- (1963). <u>Color.</u> New Jersey: Citadel Press.

--- (1976). "The need for color and light in future man-made spaces". <u>Color for Architecture.</u> London: Cassel and Collier Macmillan Publishers Ltd.:18-19.

---   (1978). Color and Human Response. New York: Van Nostrand Reinhold Company Inc.

---   (1983). "Color and psychotherapy". Interior Design. Dec. v54: 166-170.

---   (1987). Principles of Color. Pennsylvania: Schiffer Publishers, Ltd.

---   (1988). Light, Color and Environment. Pennsylvania: Schiffer Publishers, Ltd.

Danger, E.P. (1987). The Colour Handbook. Vermont: Gower Publishing Company.

Davey, Peter. (1998). "True colors: the glorious polychromy of the past suggests a strong historical need for color, despite current reductive fashions." The Architectural Review. Nov. v204 i1221: 34-8.

Eiseman, Leatrice, Lawrance Herbert. (1990). The Pantone Book of Color. New York: Harry N. Abrams, Inc., Publishers.

Etnier, Jennifer L., Charles J. Hardy. (1997). "The effects of environmental color." Journal of Sport Behavior. Sept. v20 n3: 299-313.

Faulkner, Waldron. (1972). Architecture and Color. New York: John Wiley and Sons, Inc.

Fehrman, Kenneth R. (1986). The Effects of Interior Pigment Color on School Task Performance Mediated by Arousal. Michigan: UMI Dissertation Services.

---, Cherie Fehrman. (2000). Color, the Secret Influence. New Jersey: Prentice Hall.

Friedman, S., Susan Thompson. (1976). "Color, Competence, and Cognition: Notes Toward a Psychology of Environmental Color". Colour for Architecture. London: Cassel and Collier MacMiller Publishing Ltd.:31-34.

Greenman, Jim. (1988). Caring Spaces, Learning Places. Redmond, WA: Exchange Press Inc.

Herbert, Elizabeth A. (1998). "Design matters: how school environment affects children." Educational Leadership. Sept. v56 n1: 69-73.

Hupka, B. Ralph, Zbigniew Zaleski, Jurgen Otto, Lucy Reidl, Nadia V. Tarabrina. (1997). "The colors of anger, envy, fear, and jealousy: a cross-cultural study." Journal of Cross-Cultural Psychology. March v28 n2: 156-172.

Itten, Johannes. (1970). The Elements of Color. New York: Van Nostrand Reinhold Company Inc.

---   (1975). Design and Form. London: Thames and Hudson.

Kehnemuyi, Zerrin. (1995). Çocuğun Görsel Sanat Eğitimi. İstanbul: Yapı Kredi Yayınları.

Kuehni, Rolf G. (1983). Color: Essence and Logic. New York: Van Nostrand Reinhold Company Inc.

Ladau, Robert F. et al. (1988). Color in Design and Architecture. New York: Van Nostrand Reinhold.

Linton, Harold. (1999). Color in Architecture. New York: McGraw-Hill.

Lloyd, Richard Earl. (1987). Color Sensation and the Realizations of Color on Exterior Architecture: an Archival and Experimental Study of Color Perception. Michigan: UMI Dissertation Services.

Mahnke, Frank H. (1996). <u>Color, Environment and Human Response.</u> New York: Van Nostrand Reinhold Company Inc.

---, Rudolf H. Mahnke. (1987). <u>Color and Light in Manmade Environments.</u> New York: Van Nostrand Reinhold.

Mehrabian, Albert. (1976). <u>Public Places and Private Spaces.</u> New York: Basic Books Inc., Publishers.

Munsell Book of Color: Glossy Finish Collection. (1991). Baltimore, Maryland: Macbeth Division of Kollmorgen Instruments Corporation.

Neal, Victoria, Nichole L. Torres. (2000). "Off color." <u>Entrepreneur.</u> June v28 i6: 24-26.

Pile, John. (1997). <u>Color in Interior Design.</u> New York: McGraw Hill Pub.

Porter, Tom, Byron Mikellides. (1976). <u>Colour for Architecture.</u> London: Cassel and Collier Macmillan Publishers Ltd.

Sanoff, Henry. (1994). <u>School Design.</u> New York: Van Nostrand Reinhold Company Inc.

Sturck, Lawrance Estes. (1992). <u>The Design of the Learning Environments.</u>
Michigan: UMI Dissertation Services.

Swirnoff, Lois. (1988). <u>Dimensional Color.</u> Boston: Birkhauser Boston Inc.

Trent, Linda. (1995). "The ABC's of color." <u>American School and University.</u>
July v67 n11: 34-7

Zelanski, Paul, Mary Pat Fisher. (1989). <u>Colour.</u> London: The Herbert Press.

APPENDIX A

The effects and the meanings of the major hues of the color wheel are as follows,

Red: Red is the color that has the longest wavelength and the lowest energy. It is the hottest of the warm colors. Red is an arousing, exciting and stimulating color. It is the most dominant and dynamic of all colors. "It grabs the attention and overrules all the other hues." (Mahnke, 1996). It has the greatest emotional impact on humans since it quickens the heart flow and causes adrenaline flow. It is also an advancing color different than blue, which appears to be retreating. Red represents life and living in relation to the color of the blood. It also represents love and passion.

Blue: Blue is placed on the cool end of the visible spectrum. It is a calming and tranquil color. In extreme cases it can be depressing. It is found rare in nature, except for the sea and the sky its presence in the nature is quite few. The color blue is generally associated with spirituality and wisdom. It represents dignity, poise and reserve. Blue is the anti thesis of red. It is transparent and wet whereas red is opaque and dry. It reduces the blood pressure and heart rate in contrast to red.

Yellow: Yellow is the happiest color of all the hues. It is reflective and luminous. It radiates warmth, cheerfulness and inspiration. It is the most reflective color of the true colors. Symbolically yellow signifies mental and spiritual enlightenment, expansion, sunlight, and communication.

Green: Green is the most relaxing and restful color. It is the most easily seen and restful color for the eye since its wavelengths focus exactly on the retina. It is a mixture of the gaiety of yellow and dignity of blue. The associations done with green are nature and vigorous growth. "In this case green is quintessential color of life." (Mahnke 1996) It represents withdrawal from stimulus from psychological standpoint. It also represents poison, sickness, and decay for humans.

Black: Black is a color that carries negative connotations in general. It identifies the power of the mighty to induce fear. It is ominous, the fear of the unknown, the dark of the night, grief and death. Black heightens colors and makes them appear more luminous.

White: White represents light, the celestial, spiritual, hope, holiness, and innocence. It is goodness in contrast to black, which is evil. It is generally the least preferred color; it is hardly ever preferred over a color. When looked from the psychological point of view, white has no psychotherapeutic effect, it makes the people think of unemotional clinical practice rather then involved human caring. Therefore, it is not preferred over

other colors but interestingly it is used in a lot of interior spaces. (Mahnke and Mahnke, 1987; Mahnke, 1996; Lloyd, 1989)

APPENDIX B

Age: _____

Sex: Boy_____   Girl_____

Phase 1

1. Choose your favorite color from the given chart and write its code in the space

    provided. _____

Phase 2

1. Which one these pictures would you prefer your classroom to be? _____

2. Which one these pictures would you prefer your corridor to be? _____

3. Which one these pictures would you prefer your cafeteria to be? _____

4. Do you like the colors used in your school environments? _____

Yaş:

Cinsiyet: Erkek_____   Kız_____

Aşama 1

1. En sevdiğiniz rengi verilen tablodan seçip kodunu yazınız. _____

Aşama 2

1. Gösterilen resimlerden hangisinin sizin sınıfınız olmasını tercih ederdiniz? Kodunu

   yazınız. _____

2. Gösterilen resimlerden hangisinin sizin koridorunuz olmasını tercih ederdiniz?

   Kodunu yazınız. _____

3. Gösterilen resimlerden hangisinin sizin kafeteryanız olmasını tercih ederdiniz?

   Kodunu yazınız. _____

4. Okul çevrenizde kullanılan renkleri seviyor musunuz, sevmiyor musunuz? _____

APPENDIX D

Name of the school:

The major/significant color of the building:

Color of the exterior of the building:

	Classroom	Corridor	Cafeteria	Auditorium	Library
Illumination					
Walls					
Floor					
Ceiling					
Chairs/seats					
Desks/tables					
Curtain/shade					
Shelves					
Lockers					
Details					
Railings					
Doors					
Windows					
Boards					
Others					

APPENDIX E

Color Chart according to R:G:B Color System

1	46:46:0	**17**	255:87:87	**33**	0:87:0
2	87:87:0	**18**	255:171:171	**34**	0:171:0
3	171:171:0	**19**	255:212:212	**35**	0:255:0
4	255:255:0	**20**	25:4:57	**36**	87:255:87
5	255:255:87	**21**	38:7:81	**37**	171:255:171
6	255:255:171	**22**	61:15:124	**38**	212:255:212
7	255:255:212	**23**	106:79:154	**39**	0:0:0
8	112:45:7	**24**	150:129:183	**40**	38:38:38
9	155:65:14	**25**	0:0:46	**41**	89:89:89
10	231:101:26	**26**	0:0:87	**42**	128:128:128
11	240:148:80	**27**	0:0:171	**43**	166:166:166
12	246:181:128	**28**	0:0:255	**44**	204:204:204
13	46:0:0	**29**	87:87:255	**45**	255:255:255
14	87:0:0	**30**	171:171:255		
15	171:0:0	**31**	212:212:255		
16	255:0:0	**32**	0:46:0		