

**The Impact of Color on Learning**

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**P E R K I N S**  
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## **Abstract**

This paper is the result of research conducted in response to a client's question of the importance of color in their new school facility. The resulting information is a compilation of studies conducted by color psychologists, medical and design professionals.

## **Introduction**

From psychological reactions to learned cultural interpretations, human reaction and relationship to color is riddle with complexities. The variety of nuances, however, does not dilute the amazing power of color on humans and its ability to enhance our experience of the learning environment.

To formulate a better understanding of color's impact, one must first form a basic understanding of Carl Jung's theory of the collective unconscious. According to Jung, all of us are born with a basic psyche that can later be differentiated based upon personal experience. This basic psyche reflects the evolutionary traits that have helped humans to survive throughout history. For example, an infant has a pre-disposed affinity for two dark spots next to each other, an image that equals their visual interpretation of a human face. This affinity for the shapes is not learned, but pre-programmed into the collective unconscious of all human children.

Just as we are programmed to identify with the human face, our body has a basic interpretation and reaction to certain colors. As proven in recent medical studies, however, the psychological reaction to color does not preclude the basic biological reaction that stems from human evolution. The human ability to see a wide range of color and our reaction to color is clearly articulated in Frank Mahnke's color pyramid.

The pyramid lists six levels of our color experience in an increasingly personalized interpretation. The clear hierarchy of the graphic, however, belies the immediate impact that mood, age and life experiences play in the moment to moment personal interpretation of color. Balancing the research of color interpretation with these personal interpretations becomes the designer's task as environmental color choices are made.

## **Understanding our Biological Processing**

When discussing color experiences in terms of the physical reactions of blood pressure, eyestrain and brain development, the power and importance of a well-designed environment crosses cultural and personal barriers. It does not cancel the importance of these experiences, but it does provide an objective edge to the argument for careful color application in an often subjective decision-making realm.

Color elicits a total response from human beings because the energy produced by the light that carries color effects our body functions and influences our mind and emotion. In 1976, Rikard Kuller demonstrated how color and visual patterning affects not only the cortex but also the entire central nervous system<sup>1</sup>. Color has been shown to alter the level of alpha brain wave activity, which is used in the medical field to measure human alertness. In addition, it has been found that when color is transmitted through the human eye, the brain releases the hormone, hypothalamus, which affects our moods, mental clarity and energy level.

Experiencing color, however, is not limited to our visual comprehension of hues. In a study conducted by Harry Wohlfarth and Catharine Sam of the University of Alberta, they learned that the change in the color environment of 14 severally handicapped and behaviorly disturbed 8-11



year olds resulted in a drop in blood pressure and reduction in aggressive behavior in both blind and sighted children. This passage of the benefits of varying color's energy is plausible when one considers that color is after all light waves that bounce around and are absorbed by all surfaces.

Further study by Antonio F. Torrice, resulted in his thesis that specific colors impact certain physical systems in the human body.<sup>2</sup> In Torrice's study, he proposes that the following systems are influenced by these particular hues: Motor Skill Activity – Red, Circulatory System – Orange, Cardiopulmonary – Yellow, Speech Skill Activity – Green, Eyes, Ears and Nose – Blue, Nonverbal Activity – Violet.

The analysis of our biological reaction and processing of color is quickly linked to the psychological reactions that often simultaneously manifest themselves. The psychological reactions to color are particularly apparent in the qualitative descriptions (anxiety, aggression, sadness, quiet) offered in color analysis.

### **Introducing Color in Schools**

When discussing color with school districts it is important to approach color choices as functional color rather than from a standpoint of aesthetics. Functional color focuses on using color to achieve an end result such as increased attention span and lower levels of eye fatigue. These color schemes are not measured by criteria of beauty but rather by tangible evidence.<sup>3</sup>

The following are the results of a variety of tests conducted on the impact of color in the environment. Viewed together, the results of these studies demonstrate a basic guideline for designers when evaluating color applications for schools. The tests do not offer a definitive color scheme for each school environment, but provide the functional guidelines and reasons why color is an important element in school interiors.

#### Relieves eye fatigue:

Eye strain is a medical ailment diagnosed by increased blinking, dilation of the pupil when light intensity is static, reduction in the ability to focus on clear objects and an inability to distinguish small differences in brightness. End wall treatments in a classroom can help to reduce instances of eyestrain for students by helping the eye to relax as students look up from a task. Studies suggest that the end wall colors should be a medium hue with the remaining walls a neutral tint such as Oyster white, Sandstone or Beige. The end wall treatment also helps to relieve the visual monotony of a classroom and stimulate a student's brain.

#### Increases productivity and accuracy

As demonstrated by an environmental color coordination study conducted by the US Navy, in the three years following the introduction of color into the environment a drop of accident frequency from 6.4 to 4.6 or 28% was noted.<sup>4</sup> This corroborates an independent study demonstrating white and off-white business environments resulted in a 25% or more drop in human efficiency.<sup>5</sup>

Color's demonstrated effectiveness on improving student's attention span as well as both student and teacher's sense of time, is a further reason as to how color can increase the productivity in a classroom. The mental stimulation passively received by the color in a room, helps the student and teacher stay focused on the task at hand. This idea is further supported by Harry Wohlfarth's 1983 study of four elementary schools that notes that schools that received improved lighting and color showed the largest improvements in academic performance and IQ scores.<sup>6</sup>

The demonstrated negatives of monotone environments also support the positives demonstrated by colorful environments. For example, apes left alone surrounded by blank walls were found to withdraw into themselves in a manner similar to schizophrenics. Humans were also found to turn inward in monotone environments, which may induce feelings of anxiety, fear and distress resulting from understimulation. This lack of stimulation further creates a sense of restlessness, excessive emotional response, difficulty in concentration and irritation.

### Aids in wayfinding

With the growing focusing on smaller learning communities, many schools are organizing their facilities around a school within a school plan. Using color to further articulate these smaller learning communities aids in developing place identity. The color can create a system of order and help to distinguish important and unimportant elements in the environment. The use of color and graphics to aid wayfinding is particularly important for primary school children who starting at the age of three have begun to recognize and match colors and finds design's that emphasize a child as a unique and separate person can be stimulating.

### Supports developmental processes

Being sensitive to each age group's different responses to color is key in creating an environment stimulating to their educational experience. Children's rejection or acceptance of certain colors is a mirror of their development into adulthood.<sup>7</sup> Younger children find high contrast and bright colors stimulating with a growing penchant for colors that create patterns. Once students transition into adolescence, however, the cooler colors and more subdued hues provide enough stimulation to them without proving distracting or stress-inducing.

### **Guidelines for Academic Environments:**

Frank H. Mahnke in his book, Color, Environment and Human Response, offers designers guidelines specifically for integrating color in the educational environment. His guidelines stem from his own research in the fields of color and environmental psychology.

- Preschool and Elementary school prefer a warm, bright color scheme that complements their natural extroverted nature .
- Cool colors are recommended for upper grade and secondary classrooms for their ability to focus concentration.
- Hallways can have more colored range than in the classroom and be used to give the school a distinctive personality.
- Libraries utilize a pale or light green creating an effect that enhances quietness and concentration.

Additional color application guidelines gleaned from the many sources reviewed are:

- Maximum ratio of brightness difference of 3 to 1 between ceiling and furniture finish. (White ceiling at 90% reflectance, desk finish at 30% reflectance)
- Brightness ratio in general field of view is within 5 to 1 promotion smooth unencumbered vision that enables average school tasks to be performed comfortably
- End wall treatments in medium colors (50-60% reflectance) while remaining walls are in a tint such as Oyster White, Sandstone or Beige

Overall, a functional color scheme should strive to successfully meet the following goals:

- Support the function of the building, and the tasks that are carried out in it
- Avoid over stimulation and under-stimulation
- Create positive emotional and physiological effects.

## Summary

All in all, studies conducted demonstrated that people are very aware of color and its impact on how we operate in our environment. Businesses have credited the use of functional color with a decrease in worker absenteeism, an improved quality of work and an increase in productivity. Color psychologists have linked color with brain development and the human transition from child to adult. Given its many impacts and our unknowing response, it is important to take a more studied stance of color in the educational environment. It is not enough to simply provide color, through teacher decoration, school signs, and paint availability.

## Resources

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