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Exploring Color – Elicited Emotions among STEM and HUMSS SHS Learners

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ABSTRACT

This study explores the significant differences in emotional responses to colors among learners in Science, Technology, Engineering, and Mathematics (STEM) and Humanities and Social Sciences (HUMSS) strands. It explores color preferences and how exposure to different colors influences emotional states. The research employed a descriptive-comparative method with 80 participants from Mindoro State University Main Campus Laboratory High School. Data was gathered through a self-made survey based on the RYB color model and Plutchik's Wheel of Emotions. Results showed that black, blue, and white were the most preferred colors, while yellow emerged as the most joyful color. Red was linked to anger, while black was associated with sadness. The study found significant differences in emotional responses to white and red after exposure. No significant differences in emotional responses were observed for the remaining colors. This research contributes to the field of color psychology by examining emotional responses among STEM and HUMSS learners. It provides valuable insights for educators and parents on the potential impact of color on emotions in learning environments.

Keywords: Emotions, Colors, HUMSS and STEM SHS Learners

1. INTRODUCTION

Color psychology, a field exploring the impact of colors on human emotions, moods, and behaviors, has a significant and globally recognized influence on human lives (Cherry, 2024). Its origin can be traced back thousands of years to the Ancient Egyptians, Greece and India, who used colors for medicinal purposes (Schwertly, n.d.). This historical practice served as a cornerstone for subsequent chromotherapy theories. Nevertheless, chromotherapy (color therapy) has been met with scientific skepticism due to the absence of supporting evidence. Within the medical field, it is widely perceived as fraudulent and devoid of any demonstrable therapeutic merit (Cianci, 2023).

Despite the skepticism surrounding chromotherapy, the study of color persists. Aristotle's view, suggesting that colors came from blending white and black (Nassau, 2023), prevailed until Isaac Newton identified the color

spectrum and how light wavelengths determined colors. Isaac Newton organized colors into a wheel after his prism experiments revealed that white light split into seven colors: red, orange, yellow, green, blue, indigo, and violet when refracted onto a wall (Kendall, 2023). This paved the path for the widely accepted concept of red, yellow, and blue as primary colors ("The Origins of Color", n.d.). Consequently, color is defined and adopted in this study, as the visible range of light detectable by human eyes. White encompasses all the wavelengths of light reflected by an object, while black, conversely, appears to human eyes when very little light is reflected from a given space (Hogeback, 2016). This shift in understanding, from Aristotle's blending theory to Newton's spectrum revelation, fundamentally transformed the perception of color and its underlying principles.

However, in his 1810 work "Theory of Colours," German author Johann Wolfgang von Goethe challenged Newton's color-spectrum theory, suggesting that color arises from the interplay between light and darkness. He emphasized the active role of darkness with his statement, "Color in itself is a degree of darkness" ("Goethe's Fascinating Color Theory," n.d.). Despite Goethe's theory not gaining acceptance in modern physics, his work remains a notable study on color's impact on mood and emotion (Kendall, 2023). He proposed that colors have the capacity to evoke specific emotions, such as characterizing yellow as "cheerful" and "calm," while associating blue with feelings of melancholy.

Moreover, Kurt Goldstein, an early psychologist in color psychology, expanded on Goethe's work. In 1942, he conducted experiments on five patients with central nervous system disorders to explore the impact of colors on motor function. Goldstein found that red exacerbated the patients' symptoms, while green alleviated them, leading him to hypothesize that red was stimulating and green calming. Despite the hypothesis not being validated by other researchers, Goldstein's work greatly influenced modern color psychology by popularizing the idea that colors can evoke physiological responses, an area of ongoing research today.

The belief in color's influence on human behavior and emotions has persisted for centuries, but formal color psychology is relatively recent, emerging in the 20th century with systematic studies by psychologists ("Guide to Color Psychology", n.d.). Swiss psychiatrist Carl Jung, an early 20th-century pioneer, believed colors held symbolic meaning and could offer insights into the unconscious mind. He developed art therapy, including sandplay therapy, where patients create images with colored sand and objects to explore their inner thoughts and emotions. He firmly believed that "colors are the mother tongue of the subconscious". His work in color psychology has influenced psychology and therapy, though some criticize it for lacking scientific evidence. Nonetheless, it has heightened awareness of color's psychological impact and spurred further research ("Psychology of Color Explained: What Is Color Psychology?" 2021).

Notwithstanding, color's enduring fascination throughout history, its profound connection to human emotions remains largely uncharted. Although colors, both natural and artificial, surround human daily, the field of color psychology remains relatively underdeveloped (Elliot, 2015). Hence, the primary objective of this study is to delve into the correlation between colors and emotions, thereby contributing to the academic advancement of this field. Additionally, the researcher chose this topic to better understand learners in terms of color and its impact on their emotions, and how educators and parents should be mindful of color use. Subsequently, this study will

endeavor to provide comprehensive answers to the following research questions:

1. What are the color preferences of STEM and HUMSS SHS learners?
2. What emotions are experienced by STEM and HUMSS SHS learners when exposed to different colors?
3. How do different colors impact the emotions of STEM and HUMSS SHS learners? Is there a significant difference in their emotional state before and after exposure to these colors?

Primarily, this study examines the correlation between colors and emotions. It focuses on both primary and secondary colors according to the traditional RYB color model, which designates red, yellow, and blue as primary colors. Combinations of two primary colors generate secondary colors such as green (yellow and blue), orange (yellow and red), and violet (blue and red) (Nassau, 2023). The study will also incorporate the use of black and white.

Regarding emotions, this research will align with psychologist Plutchik's Wheel of Emotions. Plutchik's Wheel of Emotions is a comprehensive psychological model designed to categorize and understand human emotions. This model delineates eight fundamental or primary emotions: joy, sadness, anger, fear, surprise, disgust, anticipation, and trust (Karimova, 2017). While other references for choosing emotions for this study offer different sets of emotions, the researcher chose the Wheel of Emotions due to its direct approach to categorizing them into eight primary categories.

2. METHODOLOGY

The study utilized a descriptive-comparative research method involving 80 STEM and HUMSS SHS learners from Mindoro State University Main Campus Laboratory High School during the first semester of the academic year 2023-2024. Given the relatively small population size of both the HUMSS and STEM strands, total enumeration was employed to achieve comprehensive data collection. A self-made questionnaire, based on the RYB color model and Plutchik's Wheel of Emotions, was validated by the expertise of a psychometrician, a social science Instructor, and an English major teacher. The instrument demonstrated reliability through paired t-test, as assessed from the responses of the 10 non-respondents from TVL learners. The questionnaire featured sections on participant information, color preference, emotion assessment, color exposure, and emotions elicited by colors. In the data collection phase, formal approval was obtained from the principal through a letter of request. Close coordination was established with the advisers and class presidents to ensure a smooth research process. The study adhered strictly to the provisions of Republic Act 10173 - Data Privacy Act of 2012, ensuring participant data and privacy were safeguarded. Data on the emotion assessment and color exposure were measured using a seven-point likert scale. On the other hand, emotions elicited by colors were aligned on Plutchik's Wheel of Emotions. To compare emotional states of STEM and HUMSS learners before and after color exposure, the researcher employed the Wilcoxon Signed-Rank Test.

3. RESULTS AND DISCUSSIONS

Table 1 shows the color preferences of 80 SHS learners, categorized by gender. It shows the number and percentage of SHS learners who preferred each of ten colors: black, blue, brown, gray, green, orange, pink, purple, red, and white.

Table 1. The Color Preferences of STEM and HUMSS SHS Learners

Color Preference	Male		Female		All Respondents	
Black	8	31%	9	17%	17	21%
Blue	7	27%	9	17%	16	20%
Brown	2	8%	2	4%	4	5%
Gray	0	0%	1	2%	1	1%
Green	2	8%	5	9%	7	9%
Orange	1	4%	3	6%	4	5%
Pink	0	0%	6	11%	6	8%
Purple	1	4%	5	9%	6	8%
Red	1	4%	4	7%	5	6%
White	4	15%	8	15%	12	15%
Yellow	0	0%	2	4%	2	3%
TOTAL	**26**	**100%**	**54**	**100%**	**80**	**100%**

Table 2. STEM and HUMSS SHS Learners' Emotions with Different Colors

	White		Black		Red		Blue		Yellow		Green		Violet		Orange	
Joy	27	34%	9	11%	14	18%	19	24%	47	59%	21	26%	27	34%	29	36%
Sadness	3	4%	37	46%	0	0%	16	20%	1	1%	1	1%	4	5%	2	3%
Anger	0	0%	2	3%	44	55%	0	0%	0	0%	0	0%	2	3%	1	1%
Fear	3	4%	19	24%	6	8%	7	9%	5	6%	4	5%	8	10%	5	6%
Surprise	2	3%	3	4%	6	8%	16	20%	14	18%	11	14%	7	9%	17	21%
Disgust	1	1%	1	1%	7	9%	2	3%	7	9%	15	19%	11	14%	12	15%
Anticipation	5	6%	6	8%	1	1%	7	9%	2	3%	11	14%	14	18%	8	10%
Trust	39	49%	3	4%	2	3%	13	16%	4	5%	17	21%	7	9%	6	8%
TOTAL	**80**	**100%**	**80**	**100%**	**80**	**100%**	**80**	**100%**	**80**	**100%**	**80**	**100%**	**80**	**100%**	**80**	**100%**

With the question "Which color do you personally prefer the most?" presented, SHS learners responded different color preferences. Black was the most popular choice overall, with 17 (21%) of SHS learners picking it as their favorite. Blue followed closely, garnering the preference of 16 (20%) SHS learners. White was a preferred color by 12 (15%) SHS learners. Green was the color picked by 7 (9%) SHS learners, while pink and purple were each chosen by 6 (8%) learners. Red was chosen by 5 (6%) SHS learners, followed by brown and orange which have both 4 (5%) SHS learners. Yellow with 2 (3%) SHS Learners and gray with 1 learner (1%) were the least preferred colors among the SHS learners.

Overall, the table shows the different color preferences of SHS learners. Black, blue and white were the most preferred colors while gray and yellow being the least preferred colors.

Table 2 presents the frequency and percentage of different emotional states experienced after viewing different colors. Each row corresponds to a specific emotional state (e.g., joy, sadness, anger), while each column corresponds to a different color (e.g., White, Black, Red).

Yellow emerged as the most joyful color, with 47 (59%) respondents feeling happy when seeing it. Red triggered anger in 44 (55%) respondents, suggesting a strong association between the color and this emotion. White was the color most associated with trust, with 39 (49%) respondents mentioning this feeling. Similarly, black emerged as the top color linked to sadness, with 37

Table 3. Comparative Analysis of Emotional States in STEM and HUMSS SHS Learners before and after Exposure to Different Colors

Treatment 1	Treatment 2: Emotional Response to Colors	W-value	N	P-value	Interpretation
Pre-Color Emotional State	White	303.5	51	0.00076	Significant
Pre-Color Emotional State	Black	595	53	0.28462	Not Significant
Pre-Color Emotional State	Red	373.5	48	0.0278	Significant
Pre-Color Emotional State	Blue	472	48	0.23404	Not Significant
Pre-Color Emotional State	Yellow	958.5	63	0.72786	Not Significant
Pre-Color Emotional State	Green	627	58	0.07672	Not Significant
Pre-Color Emotional State	Violet	698	54	0.70394	Not Significant
Pre-Color Emotional State	Orange	544	55	0.05876	Not Significant

Level of Significance: 0.05

respondents making this connection. Interestingly, none of the respondents associated white, blue, yellow, or green with anger.

Overall, the table illustrates varying emotional responses to different colors, with joy being the most frequently reported emotion across several color categories while anger was primarily linked to red.

Table 3 presents the comparison between the pre-color emotional state and the emotional response to different colors among 80 respondents. Upon exposure to colors, statistically significant differences were observed in the emotional response to White and Red as indicated by the corresponding p-values of 0.00076 and 0.0278, respectively. Moreover, no significant differences were found for Black, Blue, Yellow, Green, Violet, and Orange with their 0.28462, 0.23404, 0.72786, 0.07672, 0.70394, 0.05876, respectively, as their p-values exceeded the alpha level of 0.05.

4. CONCLUSION

This study explored color preferences and associated emotions in Senior High School learners. Black, blue, and white were the most preferred colors, while gray and yellow were least preferred. Yellow was strongly linked to joy, red to anger, white to trust, and black to sadness. Statistically, exposure to white and red significantly altered pre-existing emotional states, unlike black, blue, yellow, green, violet, and orange. These findings highlight the varying emotional impact of colors, with white and red demonstrating a more immediate influence on emotions.

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6. CONFLICT OF INTEREST

The authors have declared that there is no conflict of interest.

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