

A Study on the Influence of Color Preferences and Color Imagery on Behavior Among Design Students

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ABSTRACT

This study investigates the influence of design students' color imagery cognition and color preferences on their color usage behavior. Structural equation modeling (SEM) was employed to test the proposed research framework, which comprised three latent constructs—color imagery, color preference, and color usage behavior—evaluated through 19 corresponding observed variables. The results indicate that color usage behavior significantly and positively predicts color preference ($\beta = 0.359$, $p < 0.001$). In addition, color imagery exerts a significant positive effect on both color usage behavior ($\beta = 0.165$, $p < 0.05$) and color preference ($\beta = 0.312$, $p < 0.001$). Overall, these findings suggest that design students' color imagery not only directly shapes their preferences but also predicts their actual use of color, while the use of color itself further reinforces those preferences. Pedagogically, integrating color imagery training with psychological associations, along with curricular modules that combine “preference–application behavior,” may enhance students' design.

Keywords: Color preference, Color imagery, Color usage behavior, Design students

1. Introduction

In today's rapidly evolving information society, color is deeply intertwined with daily life and has been widely applied across diverse domains. From product packaging and the film industry to graphic design, color is often the first cue perceived by individuals, directly shaping psychological responses [1]. For design students, color is an indispensable element of creative practice; their preferences and imagery not only guide design choices but also embody cultural symbolism.[2] highlighted that color preference is related to harmony and predictability and is closely tied to semiotics within specific cultural contexts, underscoring the need to investigate this phenomenon in “authentic design settings.” Cross-cultural research has further demonstrated that cultural and product contexts influence color choices. For example,

[3] found notable differences in preferences for colors in technology and fashion design among Chinese, Japanese, Vietnamese, and Dutch students.

Beyond cultural factors, educational background also plays a critical role in shaping students' color tendencies. [4] reported that design students' spatial color choices shift with their educational experiences. Similar patterns have been observed in Taiwan, where black-and-white combinations in sneaker design are perceived as minimalist and formal, whereas red-and-black pairings are regarded as more modern [5]. Further investigations reveal that design students often prefer motifs symbolizing flora, fauna, or traditional culture, reflecting the influence of education and cultural context on the construction of color imagery [5],[6]. Moreover, cultural color education has proven its significance. For instance, [7] incorporated "Taiwan red, Taiwan green, and Taiwan gold" as cultural symbols into curricula, which effectively enhanced students' understanding and identification with local culture.

Taken together, design students' color preferences and imagery are shaped by an interplay of cultural background, educational training, and application context. Prior research has shown that preferences evolve with academic progression and product type, which in turn influence design practice. However, studies examining how students translate personal preferences and color imagery into actual creative behavior remain limited. To address this gap, the present study investigates the influence of design students' color preferences and color imagery cognition on their color usage behavior, employing structural equation modeling to validate the proposed framework. This study aims to bridge theoretical and practical gaps in understanding color usage behavior within design education.

2. Literature Review

2.1 Color Psychology

Color psychology refers to the impact of color on human psychological activity. Individuals' perceptions and emotional responses to color are closely tied to physiological sensory experiences and psychological processes. These responses may stem from personal experiences, life background, and even cultural context. Josef Albers once stated, "If one says 'red'—the 50 people listening will all imagine a different red," illustrating the inherently subjective and diverse nature of color perception on a psychological level.

According to experimental psychologists, the perception and association of color are influenced not only by the thermal properties of color itself but also by its effects on human emotions and psychological states. For example, blue is believed to enhance productivity in workspaces, while red environments may provoke restlessness. Moreover, the symbolic meanings of colors vary significantly across cultures, further underscoring the complexity and depth of color psychology [8].

2.2 Color Imagery

According to the Concise Dictionary of Psychology, imagery refers to a synthesis of concepts, judgments, and attitudinal tendencies toward a wide range of objects or phenomena. Color imagery denotes the mental representations individuals form when exposed to color stimuli, integrating both physiological sensations and psychological interpretations, thereby evoking associations with emotions,

symbols, or fantasies. For example, the color blue is often linked to notions of coolness, technology, expansiveness, and health. The formation of color imagery is strongly shaped by learning, lived experiences, and cultural contexts; thus, the same color may carry divergent symbolic meanings and interpretations across different groups or cultures. Theoretically, color imagery can be understood as an interplay between cognition and emotion, with its essence lying in the associations and meanings elicited by color, rather than in a simple expression of liking or disliking [8].

2.3 Color Preference

Color preference refers to individuals' attitudinal inclination and degree of favoritism toward colors, typically operationalized along three levels: "like," "indifferent," and "dislike." Prior research indicates that the formation of color preferences is shaped by multiple factors, including emotional drives (libido), ego-involvement, and social identification (prestige identification), as well as demographic variables such as age, gender, cultural background, and living environment. Theoretically, color preference is thus regarded as a relatively stable attitudinal disposition, and its outcomes are frequently used to explain consumer behavior, aesthetic choices, and design decisions [9].

2.4 Munsell Color System

The Munsell Color System, developed by American painter Albert H. Munsell and officially established in 1915, was designed to accurately represent the human eye's natural perception of color. This system is built upon three core attributes—Hue, Value (lightness), and Chroma (saturation)—and organizes colors in a circular spatial arrangement. It consists of five principal hues: Red (R), Yellow (Y), Green (G), Blue (B), and Purple (P), along with a series of intermediate hues between them.

In this system, Value increases vertically from the center upward (indicating greater lightness) and decreases downward (indicating darkness), and is divided into 11 steps. Chroma, representing the intensity or saturation of a color, increases radially from the center outward—colors closer to the center appear more muted, while those farther from the center are more vivid. Due to its perceptual accuracy and systematic structure aligned with human vision, the Munsell Color System has been widely adopted in both color science and design fields, and is regarded as an essential tool for conducting color-related research [10].

2.5 Color Usage Behavior

Color usage behavior not only influences the aesthetic quality of a design but also plays a crucial role in shaping the viewer's emotional experience and the reception of intended messages. According to color psychology, color can evoke specific emotional responses and affective reactions from an audience. Therefore, designers are encouraged to consciously reflect on the emotional connotations that colors carry in order to enhance the communicative effectiveness and relevance of their work [8]. In line with the demands of the design field, achieving a balance between visual impact and information delivery is essential. Color application should not only meet aesthetic standards but also serve the overarching goals of the design itself [9].

2.6 Section Summary

Based on the literature review, this study aims to examine the relationship between design students' color preferences and color imagery, and how these factors influence their color usage behavior and underlying design decisions during the creative process. Accordingly, a set of detailed research hypotheses is proposed.

H1: What is the influence of color imagery cognition on color usage behavior among design students?

According to the *Concise Dictionary of Psychology*, imagery encompasses attitudes, judgments, and preferences toward specific objects. Color imagery emphasizes the association between colors and specific emotions or situational meanings. In visual creation, design students often select and apply colors based on the symbolic meanings they associate with certain hues.

H2: What is the relationship between design students' personal color preferences and their perception of color imagery?

According to [9], color preferences are influenced by factors such as age, gender, and cultural background. These personal characteristics also shape individuals' perceptions of color imagery.

H3: How do design students' personal color preferences influence their color usage behavior?

As noted by [8],[11], color can evoke specific psychological responses. Therefore, when students favor certain colors, they are more likely to apply those colors in their creative work to enhance emotional expression and convey their personal design style.

3. Research Design

3.1 The Framework

The theoretical model illustrated in Figure 1 is derived from the literature review and aims to examine the integrative relationship between color usage behavior and color imagery in influencing color preference. Using structural equation modeling (SEM), the study proposes and tests a set of hypotheses to verify these variable relationships. This approach seeks to address the educational gap between theoretical understanding and practical application of color among design students.

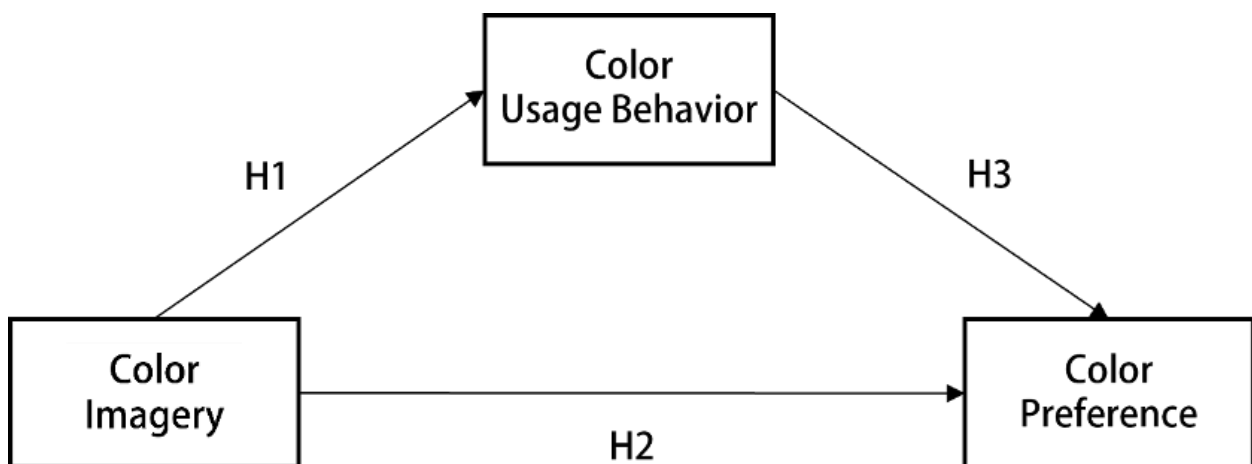


Figure 1. The framework of the study.

3.2 Research Instruments

Based on insights from the literature review, a questionnaire was developed targeting students currently enrolled in universities and colleges in Taiwan. The study employed a questionnaire survey method as the primary research instrument. Guided by findings from [13],[14],[15] regarding measurement reliability and validity, a total of 19 observable items were constructed to assess the proposed variables. The questionnaire was distributed online via Google Forms using a convenience sampling approach to collect responses.

The structure of the questionnaire is as follows: Section I: Psychological Factors of Color Preference. Given the broad scope of color definitions, this section draws upon a literature review to categorize colors based on the Munsell Color System, which identifies ten representative hues. Respondents were asked to select the color they most preferred and respond to items measuring psychological factors associated with their selection, compiled from relevant academic sources. Section II: Color Imagery Building on the preferred color selected in Section I, this section presents items designed to explore participants' color imagery associations, examining the emotional and symbolic meanings they attach to the chosen hue. Section III: Color Usage Behavior This section investigates respondents' actual behavioral tendencies regarding color application, focusing on how they typically use or interact with color in design or daily life contexts. Section IV: Demographic Information final section collects demographic data to understand respondents' backgrounds and determine whether they meet the inclusion criteria for this study.

4. Results and Discussion

Based on the research objectives and hypotheses, this study adopted a convenience sampling approach using a questionnaire survey as the primary method for data collection. An online questionnaire was created using Google Forms and distributed through Facebook groups and with the assistance of university professors. A total of 195 responses were collected. After screening, 32 responses were excluded due to incomplete answers, clearly blank submissions, or the respondents' lack of prior coursework in color theory or related subjects. The final valid sample consisted of 163 completed questionnaires.

4.1 The Characteristics of Participants

According to the demographic statistics of the respondents, there was a notable gender disparity within the sample. Female participants accounted for the majority, with 125 individuals (76.7%), while male participants comprised 38 individuals (23.3%). Statistical analysis indicates that approximately four-fifths of the total sample were female, whereas males represented roughly one-fifth of the population.

In terms of age distribution, the largest group of respondents fell within the 18–24 age range, totaling 138 individuals (84.7%). This was followed by the 25–34 age group, with 18 participants (11%), while respondents aged 35 and above constituted the smallest group, with only 7 individuals (%).

4.2 Reliability Assessment

To ensure the reliability of the measurement scale, a reflective measurement model was analyzed using Partial Least Squares (PLS) to determine whether the research data were appropriate for structural

path modeling [16],[17]. The evaluation was conducted using the following criteria: Cronbach's alpha [18], [19], composite reliability (pc) [20], and average variance extracted (AVE) [21]. The detailed results are presented in Table 1. The questionnaire included a total of 19 items across all measured constructs. The Cronbach's alpha coefficients ranged from 0.722 to 0.901, exceeding the commonly accepted threshold of 0.70 [18], [19]. Composite reliability values ranged from 0.827 to 0.919, all higher than the minimum required value of 0.70 [22],[23]. The AVE values ranged from 0.545 to 0.558, also surpassing the standard of 0.50 [21],[24]. These findings confirm that the measurement instrument used in this study demonstrates good internal consistency and reliability. Specifically, the reliability coefficients (Cronbach's alpha) for the two primary constructs—Color Preference and Color Imagery—as well as for the overall scale, were 0.823, 0.735, and 0.851, respectively. All values exceeded the threshold of 0.70, indicating that the questionnaire used in this study exhibits acceptable and stable reliability for measuring the intended constructs.

4.3 Construct Validity Assessment

To evaluate the construct validity of the research instrument, a reflective measurement model was employed, with assessments conducted through convergent validity and discriminant validity estimation.

4.3.1. Convergent validity

According to the criteria for convergent validity, each item's factor loading should exceed the threshold of 0.70 [25]. The results indicated that the majority of items across all constructs met this requirement. Only three items fell slightly below the threshold: the fourth item under Color Image (factor loading = 0.682), and the first and fourth items under Color Preference (factor loadings = 0.653 and 0.669, respectively). Despite these minor deviations, the remaining items satisfied the standard, indicating that the scale demonstrates adequate convergent validity. The detailed results are presented in Table 1.

Table 1. The performance summary of the formative measurement model (n=163)

Color Usage Behavior	CB01	0.756	0.756	.901	.907	.919	.558
CB	CB02	0.723	0.723				
	CB03	0.707	0.707				
	CB04	0.783	0.783				
	CB05	0.791	0.791	.901	.907	.919	.558

	CB06	0.737	0.737				
	CB07	0.735	0.735				
	CB08	0.73	0.73				
	CB09	0.753	0.753				
Color Imagery	IC01	0.81	0.81	.722	.738	.827	.545
IC	IC02	0.724	0.724				
	IC03	0.732	0.732				
	IC04	0.682	0.682				
Color Preference	PC01	0.653	0.653	.835	.87	.877	.545
PC	PC02	0.738	0.738				
	PC03	0.788	0.788				
	PC04	0.669	0.669				
	PC05	0.853	0.853				
	PC06	0.709	0.709				

Source: By authors.

4.3.2. Discriminant Validity

The discriminant validity of the measurement model in this study was assessed using the Fornell-Larcker criterion. According to [26], discriminant validity is established when the square root of the average variance extracted (AVE) for each latent construct is greater than its correlation with any other construct in the model. The results showed that the square roots of the AVE values for the three constructs were as follows: Color Usage Behavior (CB) = 0.747, Color Imagery (IC) = 0.738, and Color Preference (PC) = 0.738. Each of these values exceeded the corresponding inter-construct correlation coefficients. Therefore, the constructs in this study demonstrate acceptable discriminant validity. Detailed results are presented in Table 2.

Table 2. The performance summary of the Fornell-Larcker Criterion (n=163)

Variables	CB_ Color Usage Behavior	IC_ Color Imagery	PC_ Color Preference
CB_ Color Usage Behavior	0.747		
IC_ Color Imagery	0.165	0.738	
PC_ Color Preference	0.410	0.371	0.738

Source: By authors.

The discriminant validity of the measurement model was further assessed using the HTMT (heterotrait-monotrait ratio of correlations) method, which requires that the correlations between constructs remain below the threshold of 0.90 [27]. The results showed that the HTMT values ranged from 0.738 to 0.747, all of which were below the 0.90 cutoff, thereby supporting the discriminant validity of the instrument. The diagonal values in the matrix represent the square roots of the AVE for each construct, with values greater than 0.70 considered acceptable. The detailed analysis results are presented in Table 3.

Table 3. The performance summary of the HTMT Coefficient (n=163)

Variables	CB_ Color Usage Behavior	IC_ Color Imagery	PC_ Color Preference
CB_ Color Usage Behavior	0.747		
IC_ Color Imagery	0.191	0.738	

PC_ Color Preference	0.457	0.419	0.738
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Source: By authors.

4.3 Structural Equation Modeling

Before estimating the formative measurement model within the overall structural framework, it was essential to examine whether multicollinearity existed among the indicators. This study employed the Variance Inflation Factor (VIF) to assess collinearity issues. According to [28], a VIF value less than 10.0 indicates that multicollinearity does not pose a threat to the accuracy of parameter estimates. The analysis results confirmed that the measurement model was free from multicollinearity concerns. Detailed results are presented in Table 4.

Table 4. The performance summary of Formative Measurement Model (n=163)

Variables	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values	Test Results	Test Results	Test Results
CB-> PC	0.359	0.361	0.361	0.078	4.621	0.000	0.000	Support	Support
IC->CB	0.165	0.186	0.186	0.081	2.044	0.041	0.041	0.041	Support
IC->PC	0.312	0.324	0.324	0.076	4.114	0.000	0.000	0.000	Support

Note: CB=Color Usage Behavior, PC=Color Preference, IC=Color Imagery

Source: By authors.

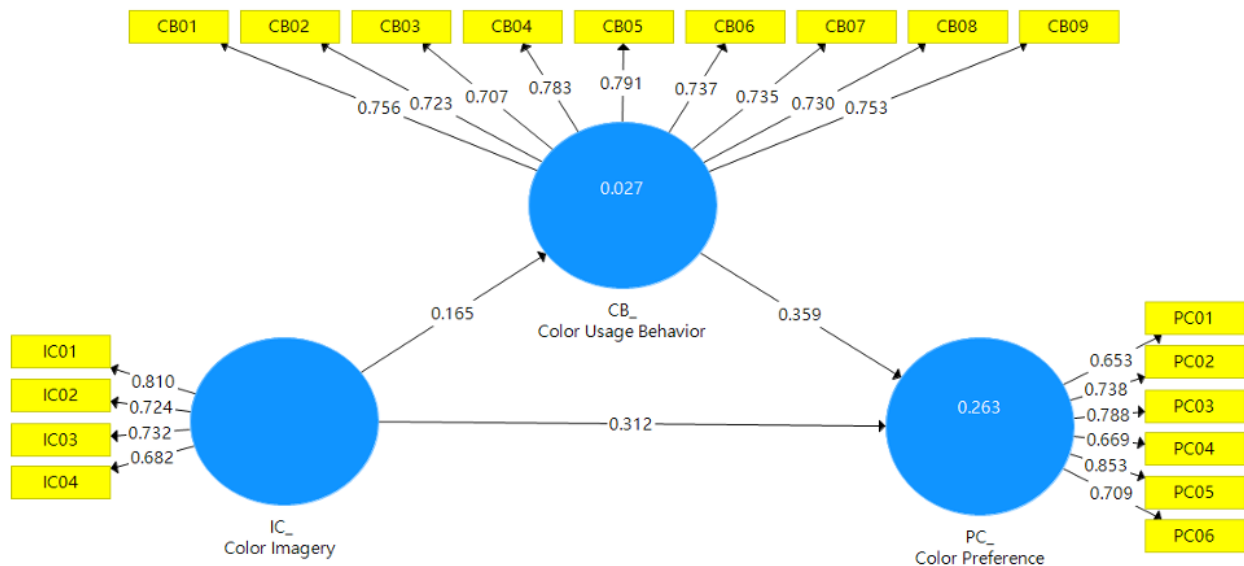


Figure 2. The standardized regression coefficients of the hypothesized model.

The results indicated that Color Usage Behavior (CB) had a significant positive predictive effect on Color Preference (PC) ($\beta = 0.359$, $p < 0.001$). Additionally, Color Imagery (IC) showed a significant positive influence on Color Usage Behavior (CB) ($\beta = 0.165$, $p < 0.05$). Furthermore, Color Imagery (IC) also significantly predicted Color Preference (PC) ($\beta = 0.312$, $p < 0.001$). According to [29], a Standardized Root Mean Square Residual (SRMR) value below 0.05 indicates a good model fit, while values below 0.08 are considered acceptable. However, the SRMR value in this study was 0.108, exceeding the recommended threshold. This suggests that the discrepancy between the observed data and the hypothesized model is relatively high, implying that a larger sample size may be needed to improve estimation accuracy [30],[31]. The results are summarized in Table 4.

5. Conclusions and Suggestions

5.1 Conclusions

In terms of structural model analysis, the results revealed that Color Imagery had a significant positive effect on Color Usage Behavior ($\beta = 0.165$, $p < 0.05$), indicating that the deeper students' understanding of color symbolism and meaning, the more consciously and strategically they applied color in their design work. Additionally, Color Imagery significantly predicted Color Preference ($\beta = 0.312$, $p < 0.001$), suggesting that design students' color preferences are often rooted in internalized symbolic associations and affective perceptions. Moreover, Color Usage Behavior also had a significant effect on Color Preference ($\beta = 0.359$, $p < 0.001$), implying that the colors students frequently use in their creative processes tend to reinforce their preferences over time.

Overall, the proposed path model is largely supported; however, the model's overall fit index (SRMR = 0.108) slightly exceeds the recommended threshold, suggesting that certain latent variables may require refinement. Further analysis revealed that some items (IC4, PC1, PC4) had factor loadings

below the .70 threshold, which may have contributed to elevated model error. Moreover, the predominance of female participants in the sample indicates potential heterogeneity that could affect fit indices. Future research may consider revising or removing low-loading items, conducting multi-group analyses, and testing additional theoretically plausible paths (e.g., PC $\rightarrow$ CB) to improve overall model fit.

Despite the elevated SRMR, if other structural equation modeling fit and predictive indicators remain within acceptable ranges, the model can still be regarded as theoretically meaningful and practically valuable for explaining and applying color-related behaviors in design education.

5.2 Suggestions

The findings indicate that design students' color imagery cognition and color preferences both exert significant effects on their color usage behavior, suggesting that color experience embodies affective and cultural meanings rather than merely formal attributes. Accordingly, we recommend strengthening color-imagery instruction in the curriculum, using cultural semiotics and contextual case analyses to build an explicit "imagery $\rightarrow$ decision $\rightarrow$ output" chain in studio projects. We further encourage self-reflection on color decisions (e.g., design journals, critiques, peer reviews) to align personal preferences with actual usage and to develop a coherent style and strategic deployment of color. In parallel, a dual-track training that integrates cultural color literacy with brand/market strategy (audience segmentation, media constraints for print/digital) can enhance students' cultural expressivity, communicative precision, and workplace readiness.

Several limitations warrant caution. The overall model fit (SRMR = 0.108) exceeds common thresholds, which may inflate measurement error and weaken generalizability while signaling possible sample heterogeneity. The cross-sectional, self-report design raises concerns about common-method bias and precludes causal inference. In addition, the model includes only three core constructs (color imagery, color preference, and color usage behavior) and does not account for contextual factors such as cultural identity, design genre, medium constraints, or brand guidelines.

Future research should incorporate cultural identity and design genre as moderators, employ multi-group analysis with measurement invariance (MICOM), and test theoretically justified reverse/alternative paths while refining low-loading items to improve model fit. We also recommend larger, stratified samples and cross-institutional/cross-cultural replications to strengthen external validity; multimethod triangulation with behavioral and physiological indicators alongside predictive validity checks (e.g., PLSpredict, Q^2_{predict}); and curricular interventions or quasi-experiments to track changes in color decision quality, cultural imagery expression, and early career outcomes, thereby tightening the linkage between design education and professional practice.

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Conflicts of Interest

The author confirms that there are no conflicts of interest.

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