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RESEARCH ARTICLE

The Effect of Landscape Colors on University Students' Burnout: A Simulation-Based Perception and Preference Test with AI-Image Generative

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ABSTRACT

Academic burnout occurs when university students experience a loss of motivation and difficulty concentrating as a result of overwork. The increasing awareness of mental health since COVID-19 presents new opportunities for university stakeholders to develop restorative environments that enhance students' psychological well-being, particularly through campus landscape considerations. Numerous studies indicate that the color of landscape elements may influence cognitive ability in individuals. This study examines the impact of color on students' burnout, utilizing a case from IPB University in Indonesia. This study utilizes a qualitative methodology to analyze students' perceptions of color aesthetic quality through Scenic Beauty Estimation (SBE), students' preferences linked to four positive emotions, including calmness, joyfulness, motivation, and enthusiasm, and offers recommendations for effective colors aimed at reducing burnout. Respondents observe 13 landscape image simulations created by artificial intelligence (AI), utilizing diverse colors and compositions by Brewster Color Theory. AI-image generative is regarded as dependable for generating uniform images and facilitating research on perception and preference tests. Research indicates that burnout among university students is prevalent, with female students exhibiting significantly higher levels of burnout, particularly in terms of loss of motivation symptoms. Colors exhibiting high SBE scores are white (199), green (148), and yellow (140). In contrast, compositions with low SBE scores include split complementary (-63), red (-55), and complementary (-45). Yellow and white are significant ($p<0.05$) in mitigating burnout by promoting positive emotions. In contrast, blue and compositions such as split complementary, square, and complementary are associated with a significant increase in burnout ($p<0.05$) by reducing positive emotions. The findings highlight the significance of employing yellow and white as primary colors in landscape designs, especially in healing gardens, to mitigate student burnout. Subsequent studies may employ advanced technologies, including virtual and augmented reality, to enhance the realism and accuracy of preference assessments.

INTRODUCTION

University students represent a vulnerable demographic facing significant stress stemming from academic demands, social pressures, and lifestyle transitions. The prevalence of student stress in Indonesia ranges from 36.70% to 71.60%, which is significantly higher than the global average of 38.91% and the Asian average of 61.30% (Ningsih et al., 2018). Burnout, defined as chronic physical and mental exhaustion, is characterized by concentration difficulties and a loss of motivation, which

adversely affects academic performance. Schaufeli et al. (2002) indicate that student burnout leads to heightened emotional exhaustion and reduced motivation, which impairs academic productivity.

The quality of green open spaces (GOS) on campus may be associated with student burnout. Si et al. (2024) indicate that the quality of campus GOS affects students' mental health and well-being. Kaplan and Kaplan (1989) showed that exposure to natural landscapes, such as parks and green open spaces, provides restorative benefits, decreasing stress and mitigating symptoms of burnout. GOS serve as natural environments that foster calmness and relaxation, facilitating mental recovery and enhancing overall mood (Ulrich, 1984). Aesthetically pleasing plant arrangements utilizing specific color palettes significantly impact landscape beauty (Luo et al., 2023). Kaplan (1995) posits that aesthetically pleasing landscapes provide superior restorative benefits relative to dull or unappealing settings. Consequently, the design of campus GOS is essential.

The visual quality of landscape elements, such as color, texture, and layout, has a significant effect on emotional responses. These elements interact to produce either calming or stimulating landscapes. Additionally, the colors of landscapes affect mental well-being. Studies indicate that color perception in architecture and urban environments has a substantial impact on cognitive, emotional, and behavioral responses (Jaglarz, 2023). Colors in natural landscapes elicit varied emotional responses, potentially alleviating stress or intensifying negative emotions (Küller et al., 2009). Cool colors, such as blue and green, are linked to relaxation, whereas warm colors, including red and orange, can evoke energy and anxiety in specific contexts (Elliot & Maier, 2014). Ulrich et al. (1991) indicate that the presence of GOS is associated with reduced stress levels and enhanced mood, potentially attributable to the restorative effects of nature and the calming attributes of greenery. Nevertheless, limited research directly investigates the impact of landscape color palettes on student stress or burnout, underscoring the necessity for targeted studies.

This research examines the relationship between landscape colors and student burnout. Perception research model is crucial for comprehending how respondents receive, interpret, and perceive the effects of landscape colors in their environment (Smith & Lee, 2021), while preference research identifies landscape colors preferred by respondents in alleviating burnout effects (Takahashi & Nakamura, 2020). This study analyses students' perceptions of color aesthetics and their preferences for characteristics that mitigate burnout and offers recommendations for effective color choices.

Comprehending the impact of stress-reducing colors allows universities to develop restorative environments that enhance students' mental health. A crucial element in stress reduction is the cultivation of emotions linked to the process of mitigating burnout. Burnout is associated with emotional exhaustion, and four positive emotions are significant: calmness activates the parasympathetic nervous system to mitigate chronic stress (Reyes-de-Cózar et al., 2023); joyfulness enhances psychological resilience and fosters optimistic thinking (Fredrickson, 2001); motivation promotes perseverance and instills a sense of purpose and engagement in tasks (Luthans et al., 2007); and enthusiasm provides energy and excitement, facilitating a proactive mindset crucial for resilience against burnout (Maslach & Leiter, 2016). This study's findings can inform campus planning, promoting sustainability and student-friendly environments, which in turn may enhance academic success by improving psychological well-being.

Color simulations of landscape images are crucial to this research. Simulations assess the impact of varying perceptions of landscape colors on burnout mitigation responses. Artificial intelligence (AI) image generation simulates landscape images featuring diverse colors or color compositions, subsequently evaluated by respondents. The capacity to rapidly generate consistent and realistic images minimizes visual bias and subjectivity among respondents (Kim & Hwang, 2020; Bakhshi et al., 2021; Huang & Hung, 2022; Rahmi & Recht, 2017).

METHODOLOGY

This qualitative study was conducted from August to October 2024, involving 80 respondents. The sample size fulfilled the minimum criterion of 30 participants, as indicated by Daniel and Boster (1976). The participants in the study were fifth-semester Landscape Architecture students at IPB

University, comprising 31 males and 49 females. Students were selected based on their completion of the Landscape Design Theory course, which encompasses color theory. As reported by Frontiers in Psychology (2023) and Oxford Academic (2023), an enhanced understanding of color will improve respondent observational skills, facilitating more accurate interpretation and evaluation of colors. Additionally, students handling a substantial academic workload exemplify the general student at IPB University, which commonly encounters rigorous coursework.

The color simulation testing occurred in the Landscape Architecture Computer Laboratory. The focus of the study was the seating area located in the Innovation Park at IPB University's Dramaga Campus, West Java, Indonesia (Figure 1). It was selected based on its recognition within the university's academic community. Gibson (1979) emphasized that a familiar environment enhances the effectiveness of perception studies, as participants generally experience greater comfort in these contexts. The area is frequently utilized by students for sitting, socializing, gathering, discussing, taking graduation photos, or merely passing through.

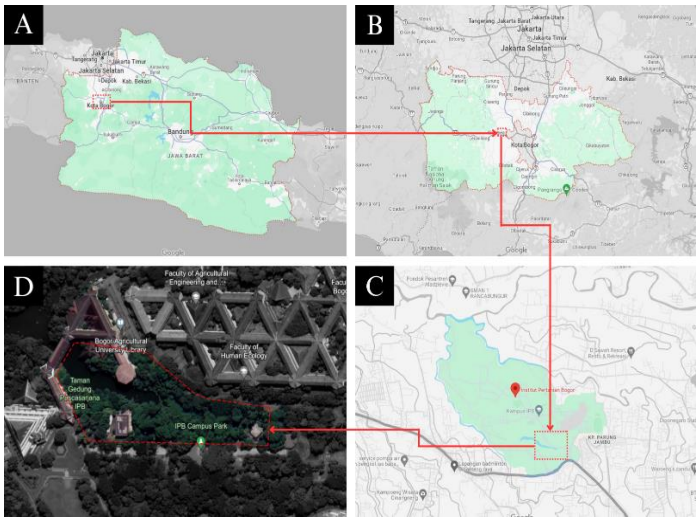


Figure 1: Research location (A) West Java province, (B) Bogor regency, (C) IPB university dramaga Campus, (D) IPB's innovation park

Furthermore, this study consisted of five phases: preparation, modeling, evaluation, analysis, and recommendation (Figure 2).

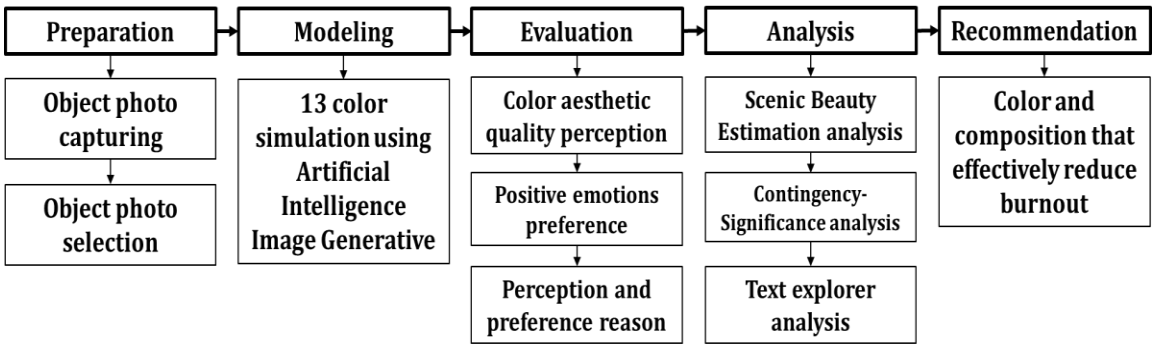


Figure 2: Research phases

Preparation

The seating area of IPB University's Innovation Park was captured using a smartphone. Among the various photos taken, one was chosen to best represent the seating area.

Modeling

The research employed AI-generated image simulations, which were produced by integrating the chosen photograph with landscape components that exhibited particular color variations. The

simulation was created utilizing PromeAI software, with prompts designed to incorporate landscape elements in specific colors. For example, a prompt for a yellow-themed landscape was: *"Add yellow flowers from shrubs, groundcovers, and trees. Input yellow shrubs in the spaces between the benches"*. PromeAI generated simulated images from the provided prompts, adhering to the specified colors and compositions.

This study simulated color schemes according to Brewster's Color Theory (Brewster, 1845), encompassing 13 variations of individual colors and their combinations. Single-color prompts incorporated plants and hardscape elements in primary (yellow, red, blue), secondary (orange, purple, green), and neutral (white). Color compositions encompassed complementary (yellow-purple), analogous (yellow-light orange-dark orange), split complementary (orange-light blue-dark blue), triadic (purple-orange-green), square (purple-orange-blue-yellow), and rectangular (light orange-dark orange-light blue-dark blue) schemes (Figure 3).

The choice of these color components was intended to attain aesthetic or functional results. Nonetheless, variations in combinations did not yield significant differences in perception. Albers (1963) observed that evaluations of color composition are generally consistent, as hues that are adjacent to the color wheel naturally harmonize. For instance, green and orange in complementary schemes produce perceptions akin to those of yellow and purple within the same composition.

Evaluation

The AI-generated montages were administered to participants through Google Forms to evaluate their preferences. Participants were invited to the Landscape Architecture Computer Laboratory, where simulations and questionnaires were presented on 20-inch desktop screens. Slides were presented for 8–10 seconds using a projector, as Daniel and Boster (1979) and Rahmandari et al. (2018) recommended. The utilization of large monitors improved visual clarity and spatial comprehension, thereby decreasing respondent stress during evaluations.

Participants were requested to provide responses regarding their identity, stress symptoms, and preferences for each simulation. Identity inquiries encompassed gender, while stress symptoms were examined using three yes/no questions:

1. "Do you frequently experience concentration difficulties?"
2. "Do you frequently experience a lack of motivation?"
3. "Do these difficulties stem from your academic workload?"

Perception and preferences for each simulation were assessed using two scales:

1. Liking Scale (1–10), to address color aesthetics quality perception: A score of 1 represented the least preferred landscape color, whereas a score of 10 denoted the most preferred.
2. Positive Emotions Scale (1–5 Likert), to address positive emotions preference: Participants evaluated their feelings of calmness, joyfulness, motivation, and enthusiasm toward simulations on a scale where 1 and 2 denoted negative emotions, 3 indicated neutrality, and 4 and 5 represented positive feelings.
3. Open-ended text, to address the rationale behind the perception and preference ratings.

Singular Color

Primary: Yellow

Secondary: Orange

Primary: Red

Secondary: Purple

Primary: Blue

Secondary: Green

Figure 3: The 13 AI landscape simulation

Analysis

The initial analysis employed the Scenic Beauty Estimation (SBE) method to evaluate respondents' perceptions of landscape aesthetics. The SBE scores were computed utilizing the Z-score formula (Eq. 1). The Z-scores for each landscape were averaged to generate an overall SBE value, which was classified as high, moderate, or low. According to Daniel and Boster (1976), scores ranging from -20 to 20 were classified as moderate. This research expanded the classification to five levels: very high (SBE > 60), high (20 < SBE ≤ 60), moderate (-20 < SBE ≤ 20), low (-60 < SBE ≤-20), and very low (SBE ≤ -60) (Kusumoarto et al., 2019; Rahmandari et al., 2018).

$$SBE\ (L_x) = [Z(L_x) - Z(L_s)\ \times 100] \quad (1)$$

where $SBE\ (L_x)$ = SBE value for the x-th landscape, $Z(L_x)$ = average z-score for the x-th landscape, and $Z(L_s)$ = average standard z-score.

Subsequently, contingency analysis was conducted utilizing JMP SAS software to investigate the relationships among categorical variables. This encompassed the correlation between burnout symptoms and respondent identity, along with burnout symptoms and preferences on four emotions (calmness, joyfulness, motivation, and enthusiasm). Two tests were utilized: Likelihood Ratio Test (LRT) (Eq. 2) and Chi-Square Pearson test (Eq. 3). Ivanova and Roy (2013) observed that the integration of these tests facilitates the identification of patterns that may be missed when utilizing a single test alone. Chi-Square Pearson (x^2) analyzes general relationships, whereas LRT (G^2) identifies particular interactions or trends.

$$G^2 = 2\sum O \ln\left(\frac{O}{E}\right) \quad (2)$$

$$x^2 = \sum \frac{(O-E)^2}{E} \quad (3)$$

where O denotes the observed frequency, while E signifies the expected frequency according to the null hypothesis. A p-value of less than 0.05 is deemed significant, suggesting a robust association between the variables (Agresti, 2018).

The analysis of open-ended responses from Google Forms employed text exploration techniques, specifically focusing on word frequency analysis. This process entailed quantifying frequently utilized words and phrases to discern prevailing preferences or sentiments, as suggested by Feldman and Sanger (2007). The results were presented through a word cloud to enhance readability and comprehension.

Recommendation

The findings of the study will inform color recommendations for the design of park elements, specifically for healing gardens intended to alleviate burnout. These recommendations pertain to both softscape and hardscape components. Plants, as components of softscape, provide a variety of colors through their flowers, leaves, stems, and fruits, which vary with seasonal changes and growth stages (Dunnett & Hitchmough, 2004). Hardscape elements, including pathways, walls, lighting, shelters, and benches, obtain their colors from materials such as stone, wood, and concrete, resulting in either contrast or harmony with the natural environment.

RESULTS

Burnout symptom and gender

The research findings indicated that among 80 students, 95% (76 students) faced challenges in concentration and motivation related to the workload coursework. Only four students indicated no difficulties. Analysis by gender revealed that both male and female students experienced these challenges, which suggests a significant degree of burnout among Landscape Architecture students at IPB University. Figure 4 indicates that female students demonstrate greater burnout symptoms, with 42 out of 49 respondents (86%) reporting this issue. Furthermore, contingency analysis indicates that female students exhibit a significantly higher likelihood of losing motivation in comparison to male students ($p<0.05$). Additionally, the majority of respondents choose blue as their favorite color, representing 42% of all participants.

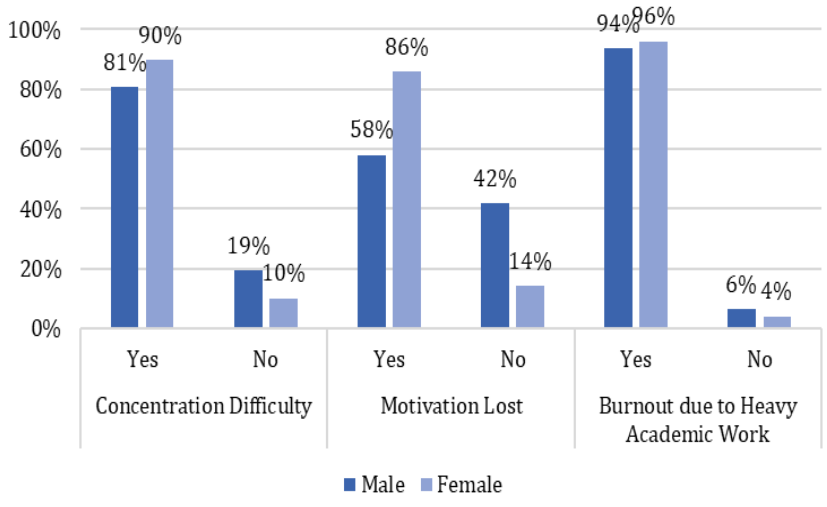


Figure 4: Respondent's burnout symptoms based on gender

Landscape color and aesthetic quality perception

Figure 5 presents the measurement results of SBE values across 13 simulations of landscape color and composition.

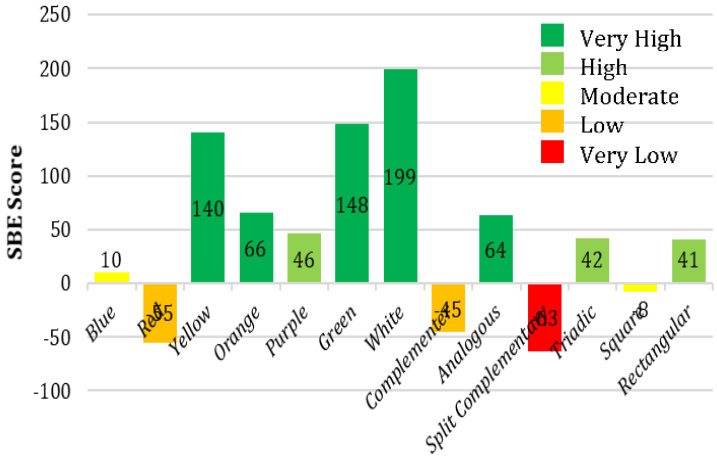


Figure 5: SBE score for 13 landscape simulations

This study demonstrates that colors produced different responses among respondents. Among the seven single colors evaluated, neutral white emerged as the most preferred color (SBE = 199). Similar to white, primary yellow received considerable preference, evidenced by an SBE value of 140, as well as green was among the most favored colors (SBE = 148). Blue was categorized as moderate by a score of 10. On the other hand, red received the lowest preference among respondents and yielded an SBE value of -55, categorized by Daniel and Boster (1976) as low aesthetic value.

On the color composition category, the most highly rated combination consisted of analogous (yellow, light orange, dark orange), achieving an SBE greater than 60 and categorized as really high. Highly rated combinations comprised triadic (purple-orange-green) (SBE = 42) and rectangular (light orange-dark orange-light blue-dark blue) (SBE = 41), exhibiting SBE values greater than 20. The lowest SBE value was recorded in split complementary (orange-light blue-dark blue), with an SBE score of -63 or very low.

Landscape color and positive emotions preference

Landscapes can affect the psychological state of individuals who observe or engage with them. This study analyzed respondents' preferences concerning feelings of calmness, joyfulness, motivation, and enthusiasm following exposure to landscape simulations. The results indicated that landscape simulations incorporating white, yellow, and green elements received the highest preference scores across all four emotions (Figure 6). Table 1 also summarizes the results from the landscape color and composition simulations, emphasizing particular simulations that significantly affected specific positive emotions in respondents.

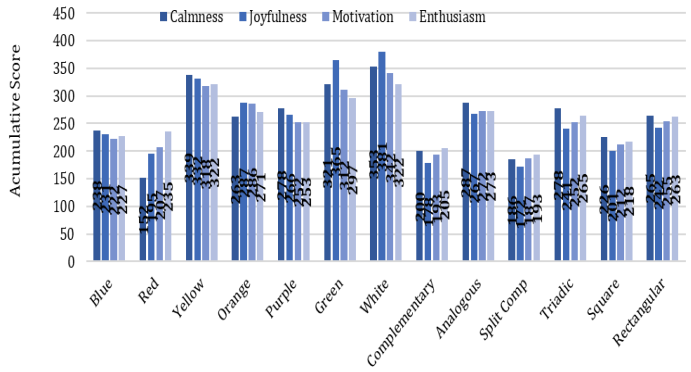


Figure 6: Accumulation score for four positive emotions preference

Table 1: Color simulations with significance effect to four emotions

No	Color/Color Composition	Σ	Z	Significance Test					
				Concentration Difficulty		Motivation Lost		Both due to Heavy Academic Work	
				LRT	P	LRT	P	LRT	P
Calmness (μ = 260.46; σ = 57.11)									
1	Yellow	339	1.38	p<0.05	p<0.05				
Joyfulness (μ = 260.46; σ = 57.11)									
1	Yellow	332	1.13					p<0.05	p<0.05
2	White	381	1.88					p<0.05	p<0.05
3	Complementary	178	-1.23					p<0.05	p<0.05
Motivation (μ = 260.46; σ = 57.11)									
1	Yellow	318	1.32					p<0.05	p<0.05
2	White	342	1.83					p<0.05	p<0.05
3	Blue	222	-0.68	p<0.05					
4	Split Complementary	187	-1.41	p<0.05					
5	Square	212	-0.89					p<0.05	
Enthusiasm (μ = 260.46; σ = 57.11)									
1	White	322	1.64						p<0.05
2	Split Complementary	193	-1.62			p<0.05			
3	Square	218	-0.99					p<0.05	

Notes: Σ (Sigma) = Cumulative score of positive emotion preferences; Z (z-score) = Standardized score; LRT (Likelihood Ratio Test) = Test for likelihood ratios; P (Pearson Chi-Square Test) = Pearson's Chi-Square Test; μ (Mu) = Mean; σ (Sigma) = Standard Deviation; p<0.05 = Significant value.

First, calmness amidst burnout represents a psychological state where individuals feel relieved from exhausting stress or heavy emotional burdens. Based on Table 1, Chi-Square test results indicated positive significant differences in responses to yellow landscape simulations between respondents with burnout (symptoms of difficulty concentrating) and those without burnout (no difficulty concentrating). Respondents with burnout felt calmer after viewing yellow landscape simulations compared to those without burnout (p<0.05).

Second, joyfulness arises when individuals feel satisfied. Contingency analysis revealed that certain colors significantly affect feelings of happiness. Yellow and white were found to positively influence student happiness (p<0.05). Respondents with burnout (symptoms due to heavy academic work) reported feeling happier after viewing yellow and white landscape simulations. However, complementary color compositions (yellow-purple) negatively caused dissatisfaction among respondents. Chi-Square test results showed that respondent scores were cumulatively low, with a score of 178 and a z-score of -1.23. Respondents experiencing burnout (symptoms due to heavy academic work) reported feeling less happy after viewing complementary (yellow-purple) landscapes compared to respondents without burnout.

Third, motivation among students refers to the internal or external drive that encourages them to engage in academic activities and achieve educational goals. Chi-Square analysis revealed that yellow and white landscape simulations positively influence respondents with symptoms due to heavy academic work. Different responses emerged after viewing blue, split-complementary compositions (orange-light blue-dark blue), and square compositions (purple-orange-blue-yellow), which negatively impact respondents with burnout due to difficulty concentrating and those with both symptoms due to heavy academic work.

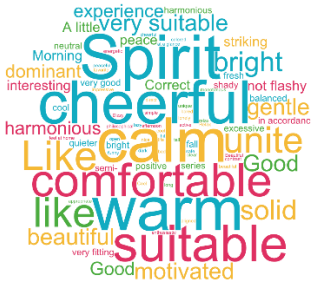
The last emotion, enthusiasm, presents the amount of energy for daily activities, including academic tasks and work. Chi-Square test results indicated that white color significantly influences respondents with symptoms due to heavy academic work in a positive way. Conversely, square

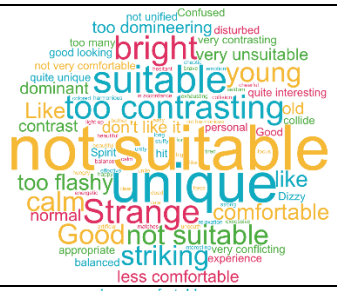
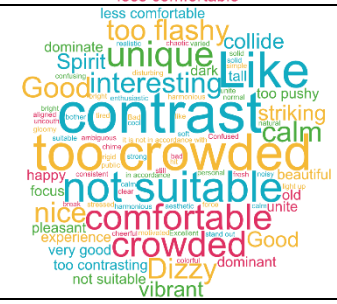
compositions (purple-orange-blue-yellow) and split-complementary compositions (orange-light blue-dark blue) negatively impact those who experience burnout due to difficulty concentrating and lack of motivation.

Landscape color and reason behind the perception and preference

Six colors or color compositions significantly influence the four aforementioned emotions, yielding both positive and negative effects. A text explorer analysis was conducted to investigate the reasons behind the ratings, with the aim of identifying keywords or phrases that characterize the colors or their compositions (Table 2).

Table 2: Text explorer result from color simulations with significant effect

No	Color/Color Composition	Word Cloud	Dominant Words/Phrases
1	Yellow		Calm (30), Warm (14), Spirit (14), Cheerful (13), Suitable (10)
2	White		Calm (46), Like (16), Simple (11), Experience (8), Suitable (8), Peace (8), Beautiful (8), Comfortable (8)
3	Blue		Calm (17), Unique (9), Strange (8), Good (8), Contrast (8), Not suitable (8)
4	Complementary (yellow-purple)		Unique (12), Not suitable (8), Striking (8), Calm (8), Good (7), Too flashy (7)

5	Split Complementary (orange-light blue-dark blue)		Not suitable (13), Unique (10), Suitable (7) Too contrasting (6), Bright (6), Strange (6)
6	Square (purple-orange-blue-yellow)		Too crowded (11), Contrast (8), Like (7), Not suitable (6), Comfortable (5), Crowded (5), Unique (5)

RECOMMENDATION AND DISCUSSION

The findings reveal a relatively high level of burnout among student respondents. Female students demonstrate greater symptoms of burnout compared to male students, especially regarding a more pronounced loss of motivation to engage in academic study. This finding corroborates the work of Fortier et al. (1995), indicating that female students typically exhibit lower confidence or self-efficacy in their abilities, even though they possess a greater intrinsic motivation to learn. Eccles (2005) identified that interpersonal relationships, including connections with peers, teachers, and family, known as extrinsic motivation, can significantly influence female students in educational settings. Their motivation to learn is more likely to diminish in the absence of these support sources. This frequently causes female students to doubt their abilities, potentially diminishing their motivation to pursue further education (Pajares, 2002).

Our analysis, structured in three layers, indicates that yellow and white are effective colors for mitigating burnout. The SBE results indicate that yellow attained a high perceived quality score, with respondents expressing a preference for this color (SBE = 140). Additionally, yellow exhibited a notable positive correlation with three emotions: calmness, joyfulness, and motivation. The text explorer analysis supports this finding, revealing that frequently appearing words included Calm, Warm, Spirit, Cheerful, and Suitable. The findings are consistent with earlier research by Mahnke (1996), which identified yellow as a color that promotes serotonin production in the brain, thus improving mood and inducing a calming effect. This aligns with previous studies (Birren, 2016; Ilhami & Gunawan, 2011), which indicate that yellow, typically categorized as a warm color linked to energy and dynamism, can also evoke feelings of tranquility. In an educational context, Gao et al. (2020) noted that yellow can foster a more energetic learning environment for students. This stands in stark contrast to red, another warm color, which obtained the lowest SBE score (55) among all evaluated single colors.

Alongside yellow, white also exhibited a beneficial impact on reducing burnout. In the evaluation of aesthetic quality, participants assigned white the highest preference, achieving an SBE score of 199. White markedly decreased burnout by improving levels of happiness, motivation, and enthusiasm. Despite Calm being the most frequently mentioned term, white did not significantly influence calmness as is typically observed with cool colors (Birren, 2016). Other commonly associated terms, Simple, Suitable, Peace, Beautiful, and Comfortable, reinforce earlier research indicating that white promotes a sense of cleanliness and order, potentially enhancing concentration and productivity (Saha, 2014).

These findings suggest the incorporation of yellow and white into landscape elements. Healing-themed gardens should incorporate colors that represent calmness, warmth, simplicity, peace,

neutrality, cheerfulness, and enthusiasm. These colors have been demonstrated to effectively reduce burnout by promoting tranquility, joy, motivation, and energy. White and yellow can be incorporated by selecting tropical vegetation (refer to Table 3) and can also be implemented using LED, filament, or halogen lighting. Furthermore, yellow and white are applicable in wood paint, metal paint, wall coatings, pavement markings, stone cladding, and various landscape elements. The use of yellow and white as primary colors in the design of healing landscapes is highly recommended across various landscape features (Figure 7).

Table 3: Vegetation recommendations with yellow and white color

No	Vegetation Strata	Yellow	White
1	Tree	• *Handroanthus chrysotrichus* • *Cassia fistula* • *Michelia champaca* • *Soga tinge*	• *Terminalia mantally var. white* • *Cerbera manghas* • *Michelia alba* • *Plumeria alba*
2	Shrub	• *Allamanda cathartica* • *Hibiscus rosa-sinensis var. yellow* • *Turnera ulmifolia* • *Codiaeum Variegatum*	• *Jasminum sambac* • *Gardenia jasminoides* • *Aglaonema Variegata*
3	Ground Cover	• *Wedelia biflora* • *Sphagneticola trilobate* • *Arachis pinto* • *Lantana camara var. yellow* • *Portulaca Grandiflora*	• *Portulaca var. white* • *Tabernaemontana corymbose* • *Zephyranthes robusta* • *Chlorophytum comosum*

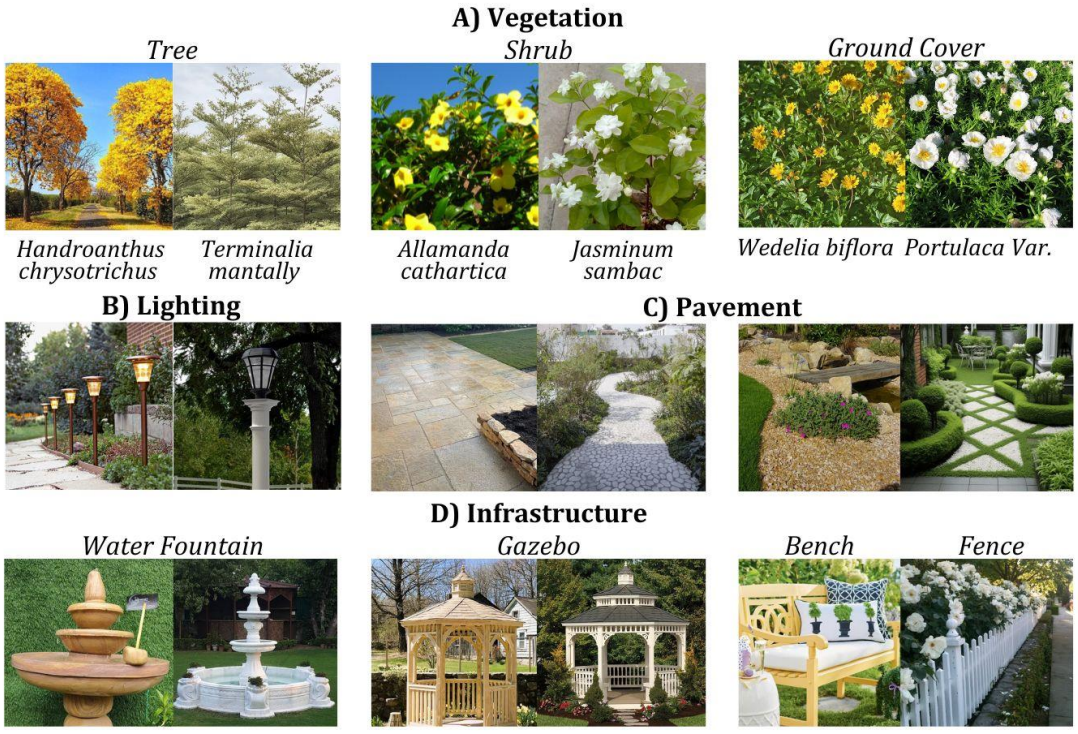


Figure 7: Moodboard recommendation for landscape elements with yellow and white color

Conversely, specific colors and compositions, such as blue, complementary (yellow-purple), split complementary (orange-light blue-dark blue), and square (purple-orange-blue-yellow) color schemes, are discouraged due to their potential to exacerbate feelings of burnout. Among the individual colors, blue was identified as having a significantly negative effect. This finding contradicts multiple studies indicating that blue positively impacts stress reduction, including Birren (2016), who characterized it as a cool color linked to calmness. Text-explorer results further indicate that

"Calm" was the most frequently mentioned term. The aesthetic quality score for blue was classified as moderate (SBE = 10). In the significance analysis, blue was identified as having a negative effect on motivation. This is consistent with earlier research, such as that by Kwallek et al. (1996), which indicated that soft or neutral colors, particularly blue, tend to foster a calm and stable environment. In work or study environments that demand energy, these colors are less effective in enhancing the observer's motivation. Schauss (1979) found that excessive exposure to blue in landscapes may diminish drive and motivation to participate in activities.

The split complementary (orange-light blue-dark blue), complementary (yellow-purple), and square (purple-orange-blue-yellow) composition schemes exhibit a shared characteristic of uniqueness, as evidenced by text-explorer results. Nonetheless, this perception was coupled with unfavorable assessments, as respondents characterized these compositions as excessively contrasting, inappropriate, or overly congested, especially regarding square (purple-orange-blue-yellow) schemes that incorporate four distinct colors. The SBE perception scores for these combinations fell below the good category: square (purple-orange-blue-yellow) was categorized as moderate (SBE = -8), complementary (yellow-purple) as low (SBE = -45), and split complementary (orange-light blue-dark blue) as very low (SBE = -63). The findings corroborate earlier research, including Mahnke (1996), which indicated that excessive use of bright complementary color combinations in landscapes may induce visual fatigue, diminish emotional comfort, and result in feelings of dissatisfaction. Birren (1978) posited that high-contrast, unbalanced color schemes could induce feelings of restlessness or discomfort stemming from the intense emotional reactions they provoke in observers. Consequently, these color compositions adversely affect burnout by diminishing feelings of joy, motivation, and enthusiasm.

Subjectivity in color evaluation was evident in certain instances. Kaya and Epps (2004) indicate that individuals' evaluations of visual compositions frequently diverge from anticipated results. An intriguing case was blue, which, despite being the preferred color for 42% of respondents experiencing burnout, nonetheless negatively impacted motivation. A significant number of respondents indicated a decrease in motivation following exposure to the color blue. The text analysis indicates that this phenomenon may stem from the overwhelming presence of blue, overshadowing the natural green of the landscape. This dominance does not promote tranquility; instead, it creates a learning and working environment that is deficient in energy and stimulation.

Poor aesthetic evaluations of color combinations may arise from subjective assessments of tone, shade, contrast, or the arrangement of individual elements. Respondents' comments frequently highlighted these aspects. Consequently, various strategies may be utilized to improve the aesthetic quality of color combinations, including:

1. Utilizing natural color palettes (Kaplan & Kaplan, 1989)
2. Avoiding excessively sharp contrasts between colors (Tveit et al., 2007);
3. Effectively balancing complementary colors (Hussain et al., 2019)
4. Incorporating soft tones or pastel shades (Kaplan, 1995; Hartig et al., 1991)
5. Selectively choosing accent colors (Velarde et al., 2007).

CONCLUSION

The colors present in landscapes play a crucial role in shaping the perception of aesthetic quality and influencing the emotions of observers. Simulations of single-colored landscapes achieved the highest aesthetic quality scores, with white (199), green (148), and yellow (140) receiving the top ratings. The lowest scores were associated with split complementary compositions (-63), red (-55), and complementary compositions (-45). Respondents' preferences for four positive emotional indicators, including calmness, joyfulness, motivation, and enthusiasm, indicate that landscapes characterized by white and yellow significantly mitigate student burnout. In contrast, blue, complementary, split complementary, and square compositions markedly heightened feelings of burnout. Consequently, the use of white and yellow is advised for both softscape elements (vegetation) and hardscape

elements (materials, pavements, structures), particularly in landscapes designed with a healing garden concept, to effectively mitigate burnout.

Future research should utilize a more extensive methodology by incorporating a greater number of participants. Advancements in technology enable the use of 3D animation simulations via virtual reality and augmented reality platforms. Providing a dynamic 3D or 4-dimensional world-reality experience allows respondents to engage in more realistic interactions, facilitating more accurate preference evaluations.

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