Vol. 3 No.3 2025

RECOGNIZED IN "Y" CATEGORY BY

Research Consortium Archive
P(ISSN) : 3007-0031
E(ISSN) : 3007-004X
https://rc-archive.com/index.php/Journal/about

Impact of Colors in Classroom: A Visual Study on Educational Attention and Psychological Comfort

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Publisher : EDUCATION GENIUS SOLUTIONS
Review Type: Double Blind Peer Review

ABSTRACT

This study investigates the impact of classroom color schemes on students' educational attention and psychological comfort, recognizing the physical learning environment as a key contributor to academic performance and emotional well-being. Employing a mixed-methods research design, the study collected both quantitative and qualitative data to explore how warm (red, orange, yellow), cool (blue, green, violet), and neutral (white, beige, grey) color themes influence learners in real classroom settings. The quantitative phase involved a sample of 240 secondary school students, equally divided into three groups based on the color schemes of their classrooms. Data on focus were collected using a standardized Attention Assessment Scale (AAS) and analyzed using one-way ANOVA and Tukey HSD post-hoc tests. The results revealed a statistically significant difference ($p < 0.001$) in attention scores, with students in cool-colored classrooms scoring the highest ($M = 81.15$) and those in warm-colored classrooms scoring the lowest ($M = 72.40$). The qualitative phase included semi-structured interviews and focus group discussions with 30 students (10 from each color group). Thematic analysis revealed three major themes: (1) emotional calmness and focus in cool environments, (2) overstimulation in warm settings, and (3) boredom and detachment in neutral rooms. These themes complemented the quantitative findings, demonstrating that color schemes significantly influence both cognitive engagement and emotional comfort. The study concludes that cool color schemes are most effective in enhancing attention and providing psychological ease, whereas warm colors may hinder focus and induce stress. Neutral schemes offer visual simplicity but lack emotional engagement. The findings contribute to educational psychology and environmental design literature and suggest actionable strategies for optimizing classroom environments through intentional use of color.

Keywords: classroom design, color psychology, student attention, psychological comfort, environmental psychology, mixed-methods research

1. Introduction

The physical setup of a classroom plays a significant role in how students feel and perform during the learning process. While much focus is often placed on curriculum, teaching strategies, or technology integration, the environment in which students learning including classroom colors is often overlooked. Research from fields like psychology and design shows that colors can strongly influence our mood, emotions, and ability to focus (Engelbrecht, 2003). Soft blues and greens tend to have a calming effect, which might help students concentrate, while bright colors like red or yellow can stimulate excitement or even anxiety depending on their intensity (Naz & Epps, 2004). In recent years, some educators and architects have started paying more attention to color when designing classrooms. Still, there is a lack of in-depth research focusing specifically on how these color choices affect both students' attention levels and their sense of psychological comfort. Most existing studies have either focused only on emotional responses or on performance outcomes, not both. Therefore, there is a need for a more comprehensive look at how classroom color environments

might influence learning in both cognitive and emotional ways. This research aims to explore this topic through a visual study of classrooms with different color themes. By observing students' attention levels and collecting feedback about their comfort, the study hopes to provide useful insights into how thoughtful use of color can make classrooms better spaces for learning. These findings can help teachers, school leaders, and classroom designers make informed decisions that benefit students both academically and emotionally.

1.1 Research Objectives

1. To examine the relationship between classroom color schemes and students' attention levels during instructional time.
2. To evaluate the extent to which different colors used in classroom environments contribute to students' psychological comfort.

1.2 Research Questions

1. How do various classroom color schemes affect students' ability to maintain attention during lessons?
2. What is the perceived level of psychological comfort among students in classrooms with different color themes?

1.3 Problem of the Statement

Researcher is growing awareness about the importance of classroom design through this research because; very little specific researchs has been done on the role of color in learning spaces, especially in terms of both attention and emotional comfort. Most studies that exist tend to look at either the emotional impact of color (such as stress or mood) or academic performance (like test scores or focus), but rarely combine the two. This creates a research gap, as learning is both a cognitive and emotional process. If students feel uncomfortable or distracted because of their environment, their learning may be affected even if teaching methods are strong. Therefore, this study seeks to fill that gap by examining how different color settings in classrooms influence students' attention spans and their psychological comfort at the same time.

1.4 Significance of the Study

This research holds great significance for a range of stakeholders in education—from teachers and school principals to architects and interior designers. It offers new insight into how seemingly minor details, like wall paint or furniture color, can influence students' focus and emotional well-being. With mental health becoming a growing concern among school-aged children, designing classrooms

that are both visually appealing and emotionally supportive is more important than ever. If certain colors are shown to improve concentration or reduce anxiety, they can be used intentionally to create better learning conditions. Thus, the study's outcomes could contribute to healthier, more engaging, and more inclusive learning environments.

2. Literature Review

Over the past two decades, the impact of the physical environment on educational performance has received increasing attention, with studies spanning across architecture, psychology, and education. Among these environmental variables, color has emerged as a critical, though under-researched, factor influencing students' cognitive performance and emotional well-being. Classrooms are not just functional spaces; they also serve as psychological and sensory environments that can either support or hinder learning. Color, as a visual and emotional stimulus, holds the potential to shape students' attention, memory retention, motivation, and emotional comfort (Barrett et al., 2015). The literature in environmental psychology and educational design acknowledges that visual aesthetics especially color can alter mood states and influence learning behavior (Küller et al., 2009). However, the academic focus has often remained fragmented, with studies examining either psychological comfort or cognitive outcomes in isolation. There remains a notable absence of integrated research that evaluates how classroom color schemes affect both students' attention levels and their perceived psychological comfort simultaneously. This critical review aims to present what is known about this intersection, identify existing gaps, and situate the current study within the broader academic landscape.

2.1 Classroom Environment and Learning Outcomes

The learning environment is known to significantly influence student achievement, engagement, and well-being. According to the Holistic Design Framework (Barrett et al., 2015), elements like lighting, temperature, air quality, and visual aesthetics including color collectively impact students' learning experiences. Studies such as that by Tanner (2009) have shown that spatial and environmental factors can explain variations in student performance, yet color often receives less focus compared to light or layout. In the school design literature, color is typically considered a secondary aesthetic feature rather than a primary educational tool. However, Engelbrecht (2003) argued that color is not merely decorative but instrumental in shaping psychological responses such as calmness, excitement, or anxiety, which in turn influence attention spans and emotional stability in learners. This research provides an important foundation but stops short of empirically testing color's direct impact on students' classroom behaviors.

2.2 Psychological Effects of Color

Psychological perspective, color perception is tied to emotional and physiological responses. Research by Kaya and Epps (2004) found consistent associations between specific colors and emotional reactions for instance, blue and green were linked to calmness and focus, while red and yellow often evoked excitement or tension. These emotional reactions can have both positive and negative effects on learning, depending on the context. Color theory, as used in design and marketing, classifies colors into warm (e.g., red, orange, yellow) and cool (e.g., blue, green, violet) tones, with each category producing different psychological effects (Stone, 2003). While warmer colors may increase alertness, they may also lead to overstimulation if overused. Cool colors, on the other hand, are more conducive to sustained attention and reduced stress levels (Küller et al., 2009). Despite this knowledge, there is still little research exploring how these color-emotion relationships translate into real classroom dynamics.

2.3 Cognitive Outcomes: Attention and Color

Cognitive psychology offers additional insights into how color affects attention and memory. According to the Attention Restoration Theory (Kaplan, 1995), natural elements and calm-inducing visuals like the colors of nature can help restore attention and improve cognitive functioning. Although initially applied to environmental exposure outside the classroom, this theory suggests that similar restorative effects could be achieved through interior color schemes mimicking nature. Dzulkifli and Mustafar (2013) highlighted that color can enhance memory and attention when used in educational materials, but this research largely focuses on textbooks and visual aids rather than environmental color. There is a growing consensus that visual stimuli such as classroom wall colors, desk colors, and surrounding décor may directly impact learners' ability to maintain attention during lessons, yet empirical classroom-based studies remain sparse.

2.4 Cultural and Developmental Perspectives

It is essential to consider cultural and developmental differences in color perception and emotional response. Color meanings vary significantly across cultures; white may represent peace in some contexts and mourning in others (Saito, 1996). Similarly, children may respond differently to color stimuli compared to adolescents or adults, making age a critical variable in classroom color studies. However, most existing literature uses homogeneous samples or fails to control for these factors, limiting the applicability of findings to diverse educational settings. In environmental design for learning, the literature reveals several gaps.Lack of holistic studies that

consider both psychological comfort and attention in the same classroom context. Much of the existing work comes from laboratory settings or is focused on printed materials. Insufficient cultural and developmental consideration, making generalizations problematic Few empirical studies on how color in actual classrooms (e.g., walls, furniture) influences students in real-time instructional settings. This study contributes to the academic discourse by bridging cognitive and emotional dimensions of the learning experience through a visual analysis of classroom color schemes. It aims to offer empirical data collected directly from real classrooms and student participants, focusing on how color affects both attention and psychological comfort. The study addresses the need for context-sensitive, interdisciplinary research that integrates insights from education, psychology, and design.

2.5 Theoretical Framework

This research is guided by two primary theoretical lenses: Color Theory in Environmental Psychology and Attention Restoration Theory (ART). Color Theory explains how different hues elicit varied psychological and emotional responses. In environmental psychology, this theory is applied to explore how built environments impact human behavior (Mahnke, 1996). Within the classroom context, color is not just a passive background but an active component influencing learners' mental states. Using this framework, the study categorizes colors into warm and cool tones to examine their associations with comfort and attention. ART suggests that environments with calming, non-threatening stimuli allow the brain to recover from cognitive fatigue. While ART was originally applied to natural outdoor settings, its principles are increasingly relevant in indoor spaces like classrooms. This study assumes that classrooms painted in calming colors (e.g., blue, green) may restore students' focus better than more stimulating color schemes (e.g., red, orange), thus positively affecting both attention and comfort. These theories offer a balanced understanding of both emotional and cognitive impacts of color. Alternative approaches such as Behaviorism or Constructivism in educational psychology may explain learning processes but do not adequately account for environmental stimuli. Therefore, Color Theory and ART provide the most suitable conceptual grounding for this research, allowing for a nuanced exploration of how classroom colors influence the dual dimensions of educational attention and psychological comfort.

3. Research Methodology

3.1 Research Design

This study employed a mixed-methods research design, integrating both quantitative and qualitative approaches to comprehensively examine how classroom colors influence students' educational

attention and psychological comfort. The rationale behind choosing a mixed-methods design was to capitalize on the strengths of both methodologies. The quantitative component focused on objectively measuring attention levels using a standardized scale, while the qualitative component allowed the researcher to gain deeper insights into students' emotional and psychological responses through interviews and focus group discussions. This approach enabled triangulation of data, ensuring reliability and a more nuanced interpretation of findings. It also addressed both measurable outcomes and subjective perceptions, which were critical in understanding the dual cognitive and emotional impacts of classroom color schemes (Creswell & Creswell, 2018).

3.2 Population and Sampling

The study targeted students from secondary school levels (grades 7 to 10), as students in this age range are cognitively mature enough to articulate their psychological experiences and demonstrate measurable attention in structured learning environments. The research was conducted in public and private schools in Lahore, Pakistan, chosen for their diversity in classroom infrastructure and design. A purposive sampling technique was used to select schools where classroom walls were painted in distinctly different color themes categorized into warm, cool, and neutral color palettes. A total of 240 students were selected and grouped into three categories based on the dominant classroom color:

1. Group A: 80 students from classrooms with warm colors such as red, orange, and yellow.
2. Group B: 80 students from classrooms with cool colors like blue, green, and violet.
3. Group C: 80 students from classrooms with neutral colors such as white, beige, and grey.

This stratified grouping ensured comparative analysis across color environments while maintaining balance in gender representation and academic ability.

3.3 Data Collection Methods

Data were collected over a span of six weeks, using both quantitative instruments and qualitative protocols. For the quantitative data, the researcher used the Attention Assessment Scale (AAS), a validated and reliable instrument designed to evaluate attention span, distractibility, and engagement levels in classroom settings. This scale was administered during actual class periods in core subjects like Mathematics and Science, with each session lasting 45 minutes. The assessment was repeated three times to ensure reliability and reduce the influence of day-to-day variations. For the qualitative

data, the researcher conducted semi-structured interviews and focus group discussions (FGDs) with a subsample of 30 students (10 from each group). These discussions focused on students' emotional reactions to their classroom environments, including how the wall colors made them feel during lessons, their levels of comfort, and whether the colors influenced their motivation or stress levels. Interviews were recorded, transcribed, and later analyzed using thematic analysis techniques to identify recurring emotional and psychological themes.

3.4 Research Instruments

Several tools were used to collect data in this study. The primary instrument for the quantitative phase was the Attention Assessment Scale (AAS), a structured tool that measured various components of student attention, including sustained focus, behavioral engagement, and response inhibition. It was administered in a controlled environment and interpreted according to standardized scoring procedures. For the qualitative phase, a semi-structured interview guide was prepared with open-ended questions that explored emotional responses, comfort levels, and aesthetic satisfaction. A Classroom Color Audit Checklist was also developed to classify and confirm the dominant colors in each classroom. This checklist ensured consistency in categorizing classrooms into warm, cool, or neutral color schemes.

3.5 Procedure

The research procedure began with obtaining ethical approval and informed consent from school administrators, students, and their parents. After identifying schools that met the classroom color criteria, the researcher conducted an environmental audit to classify the classrooms based on wall colors. Students were then assessed in their natural learning environments during regular class sessions. Quantitative assessments using the AAS were conducted during three separate lessons, ensuring consistency and reliability. Once the quantitative phase was completed, qualitative data were collected through interviews and focus groups with selected students. These sessions were audio-recorded, transcribed verbatim, and analyzed using Braun and Clarke's (2006) six-phase thematic analysis approach.

3.6 Data Analysis

Quantitative data were processed using SPSS software. Descriptive statistics were used to summarize attention scores, followed by Analysis of Variance (ANOVA) to compare differences between the three color groups. This allowed the researcher to determine whether the type of classroom color significantly affected students'

attention levels. For qualitative data, a thematic analysis approach was employed. Transcripts from interviews and FGDs were coded line by line, and themes were developed related to students' psychological comfort, including categories like emotional safety, stress levels, aesthetic preference, and motivation. These themes were then compared across groups to determine patterns linked to specific color environments.

3.7 Ethical Considerations

Ethical approval was obtained from the university's institutional review board. Participation was voluntary, and all participants were informed of their rights, including the right to withdraw at any stage. The researcher ensured anonymity and confidentiality of student data, and the findings were used exclusively for academic purposes. Parental consent was secured for all participants below the age of 18.

The chosen mixed-methods approach successfully aligned with the research objectives and provided both empirical and experiential data on the impact of classroom colors. Through structured assessments and student voice, the methodology helped reveal how visual elements in classroom environments could significantly influence educational outcomes and emotional well-being. This robust design laid a strong foundation for future research and practical interventions in classroom design and educational psychology.

4.Data Analysis and Findings

The data for this research were collected using a mixed-methods design to address both cognitive and emotional responses to classroom color schemes. A total of 240 secondary school students were divided into three equal groups based on the color schemes of their classrooms: warm colors (e.g., red, orange, yellow), cool colors (e.g., blue, green, violet), and neutral colors (e.g., white, beige, grey). Quantitative data were gathered using the Attention Assessment Scale (AAS), while qualitative data were collected through semi-structured interviews and focus group discussions. This section presents the findings for both research questions, supported by statistical analysis, participant quotations, and thematic interpretations.

4.1 Research Question 1: *How do classroom color schemes affect students' ability to maintain attention during lessons?*

4.1.1Quantitative Data Analysis

The AAS was scored on a scale of 0 to 100, with higher scores indicating greater levels of sustained attention and reduced

distractibility. The analysis involved descriptive statistics, one-way ANOVA, and post-hoc comparisons.

Table 1: Descriptive Statistics of Attention Scores

Color Group	Sample (n)	Mean Score	Standard Deviation	Confidence Interval
Warm Colors	80	72.40	6.85	71.00 – 73.80
Cool Colors	80	81.15	5.34	80.02 – 82.28
Neutral Colors	80	76.10	6.52	74.80 – 77.40
Total	240	76.55	7.04	

The mean attention score was highest for students in classrooms with cool color schemes (81.15), indicating better attentional control. Students in warm-colored classrooms had

the lowest mean score (72.40), suggesting higher distractibility.

4.1.2 Inferential Statistics: ANOVA

A one-way ANOVA was conducted to determine whether the differences in attention scores across the three color groups were statistically significant.

Source	Sum of Squares (SS)	df	Mean Square (MS)	F-value	Significance (p)
Between Groups	2,140.67	2	1,070.34	28.94	0.000**
Within Groups	8,733.60	237	36.84		
Total	10,874.27	239			

Note: *$p < 0.01$ indicates statistical significance.*

The ANOVA test showed that the effect of classroom color on attention was statistically significant ($F = 28.94$, $p < 0.001$), meaning students' attention levels varied notably depending on the classroom color scheme. Post-Hoc Comparison (Tukey HSD Test). To identify where the significant differences occurred, a Tukey post-hoc test was run:

- Cool vs. Warm = 8.75, $p < 0.001$
- Cool vs. Neutral = 5.05, $p = 0.002$
- Neutral vs. Warm = 3.70, $p = 0.018$

This confirms that students in cool-colored classrooms had significantly higher attention than those in both warm and neutral settings.

4.2 Research Question 2: What is the perceived level of psychological comfort among students in classrooms with different color themes?

4.2.1 Qualitative Data Analysis

Thematic analysis of 30 student interviews (10 from each color group) revealed three main themes that explained the relationship between color schemes and psychological comfort.

Theme 1: Emotional Calmness and Focus

Sub-theme 1: Dominant in Cool-Colored Classrooms

Students in classrooms with shades of blue, green, or violet often expressed feelings of relaxation, reduced anxiety, and focused energy.

Quotation (Student B7): "When I come into our classroom, the blue walls help me feel at ease. I don't feel anxious, and it's easier to listen to the teacher."

Quotation (Student B3): "Green makes the room feel peaceful. It's quiet, and my mind doesn't get distracted."

Theme 2: Overstimulation and Restlessness

Sub-theme 2: Dominant in Warm-Colored Classrooms

Students surrounded by red, orange, and yellow tones frequently reported feelings of tension, distraction, and visual fatigue.

Quotation (Student A4): "The red color is too strong. I feel like my eyes keep moving around. It's hard to stay focused on the board."

Quotation (Student A9): "Sometimes the colors make me feel like I'm rushing, even when the teacher is speaking slowly."

While students did not report discomfort in neutral settings, many mentioned that the lack of color made the classroom feel lifeless or uninspiring.

Quotation (Student C9): "Our classroom is all white. It's clean, but it feels empty. I don't feel excited to learn here."

Quotation (Student C2): "It's not bad, but it's boring. A little color would make a difference."

The quantitative findings showed that students in cool-colored classrooms scored significantly higher on attention assessments than those in warm or neutral rooms. The qualitative data supported these results, with students in cool environments reporting greater comfort, reduced distraction, and enhanced focus. In contrast, warm-colored classrooms produced both lower attention scores and more frequent complaints about distraction and overstimulation. Although neutral rooms offered a distraction-free zone, they failed to emotionally engage students. These results validate existing psychological theories suggesting that cool hues (blue/green) have calming effects and promote sustained cognitive engagement, while warm colors (red/orange) increase arousal levels, often impairing concentration (Küller et al., 2009; Engelbrecht, 2003). The collected and analyzed data provided strong evidence that classroom color schemes have a significant impact on students' attention and psychological comfort:

a) Cool colors support mental calmness and attentiveness.
b) Warm colors reduce attention and may increase anxiety or visual stress.
c) Neutral colors offer a baseline level of comfort but may hinder motivation due to dullness.

Educational planners, school designers, and policymakers should consider revising classroom color strategies to promote environments that foster focus, comfort, and emotional well-being. These findings offer practical guidance for evidence-based classroom design and have the potential to improve both student behavior and academic performance.

5.Discussion

This research aimed to explore the influence of classroom color schemes on students' cognitive attention and psychological comfort. The study addressed two primary research questions:

1. *How do various classroom color schemes affect students' ability to maintain attention during lessons?*
2. *What is the perceived level of psychological comfort among students in classrooms with different color themes?*

A mixed-methods approach was employed, integrating standardized quantitative data (Attention Assessment Scale) with qualitative insights (interviews and focus group discussions). The sample consisted of 240 secondary school students grouped into warm-colored, cool-colored, and neutral-colored classroom settings. Data

collection and analysis were aligned with Environmental Psychology theories and cognitive-emotional learning models, offering a dual lens of both behavioral and perceptual impact.

5.1 Interpretation of Findings on Attention (Cognitive Impact)

The quantitative results clearly demonstrated that students in cool-colored classrooms significantly outperformed their counterparts in terms of attentional engagement. With a mean score of 81.15 on the Attention Assessment Scale (AAS), cool-color classrooms such as those painted in shades of blue, green, and violet appeared to foster a conducive cognitive environment. In contrast, warm-colored rooms, dominated by reds, oranges, and yellows, resulted in significantly lower attention scores (M = 72.40). Neutral-colored environments (white, beige, gray) fell mid-range (M = 76.10), statistically different from both warm and cool categories. These findings respond directly to Research Question 1, confirming that color does, in fact, impact student attention. The results support Research Objective 1: *To examine the relationship between classroom color schemes and students' attention levels during instructional time.*

The observed data validate existing theories in Environmental Psychology, particularly those advanced by Küller et al. (2009), who argued that certain color environments alter neurological arousal levels, which in turn influence alertness and cognitive clarity. Blue and green tones are thought to promote lower arousal but increased concentration, while red is linked with overstimulation, which can impair executive functions, including attention, memory retention, and impulse control. These results reinforce stimulus-response theory, which posits that external environmental stimuli (e.g., color, light) can condition behavior and cognitive responses. In this case, cooler color tones appear to trigger a calmer physiological state, enabling students to better process instructional content without emotional or sensory distraction.

5.2 Interpretation of Findings on Psychological Comfort (Affective Impact)

The qualitative component of this research deepened the understanding of how students experience color emotionally. Three dominant themes emerged from the analysis:

1. Emotional Calmness and Focus – Prominent in cool-colored environments
2. Visual Overstimulation and Restlessness: Dominant in warm-colored environments
3. Neutrality and Lack of Engagement: Common in neutral-colored environments

Students in cool-colored classrooms described the learning spaces as “calm, peaceful, and relaxing,” frequently linking these feelings to their ability to concentrate and reduce stress. These findings fulfill Research Objective 2: *To evaluate the extent to which different colors used in classroom environments contribute to students' psychological comfort*, and answer Research Question 2 positively color clearly shapes students' perceived emotional safety and comfort.

In contrast, warm-colored classrooms were associated with heightened sensory alertness, often resulting in mental fatigue, eye strain, or even physical symptoms such as headaches. Students expressed that such environments made them feel rushed, pressured, or even agitated during lessons. Neutral-colored classrooms yielded mixed feedback. While no students reported discomfort or tension, many described the space as "lifeless" or "uninspiring." Some reported mental disengagement, noting that while they did not feel stressed, the room lacked stimulation, which affected their motivation and emotional investment in classroom activities. These findings align with Engelbrecht (2003), who emphasized the role of color in mood regulation, motivation, and classroom atmosphere. They also draw on principles from the Cognitive-Affective Learning Model, where emotional states act as mediators for learning outcomes. Here, psychological comfort served as a gateway to attention, with higher emotional satisfaction leading to improved academic focus. The integration of attention scores and emotional responses provides a compelling narrative:

a) Cool-colored classrooms are optimal for both attention and emotional stability.
b) Warm-colored classrooms risk causing sensory overload and psychological discomfort, both of which undermine learning.
c) Neutral-colored classrooms may offer visual calm but lack the positive emotional triggers needed for deeper engagement.

This dual impact illustrates the reciprocal relationship between cognition and emotion, a central tenet of Social Cognitive Theory (Bandura) and Neuroscientific Education Models, which emphasize the brain’s reliance on environmental cues to regulate behavior and performance. The findings also support the Theory of Optimal Arousal, which suggests that performance is best when physiological arousal is at a moderate level. Cool colors help achieve that balance, whereas warm colors may push students into a state of over-arousal, limiting their working memory and focus.

This study contributes to a growing body of literature advocating for evidence-based classroom design. Previous research (Küller et al., 2009; Mahnke, 1996) emphasized that educational architecture should include careful attention to environmental

psychology. However, few studies have integrated both attention data and emotional perceptions across varied color schemes, especially within South Asian classroom contexts. his research goes beyond existing literature by providing converging evidence from both quantitative and qualitative streams, showing that the same color schemes that enhance attention also enhance emotional comfort. This positions color as a dual-function pedagogical tool, influencing both the cognitive and affective domains of learning.

The findings present a compelling case for rethinking classroom aesthetics as a strategic educational decision, not just a matter of decoration. Specifically: Schools should consider incorporating cool color tones (sky blue, sage green, light violet) into classroom walls and decor, especially in exam rooms, science labs, or subjects requiring high concentration. Warm colors may be better suited for short-duration, creative tasks or break areas, but should be minimized in core learning spaces. Neutral tones may serve as a foundation but require accent colors to avoid emotional disengagement. Given the cost-effectiveness and simplicity of color interventions, these findings provide school leaders, architects, and curriculum developers with actionable strategies to improve educational outcomes and learner well-being. This study achieved its intended objectives and answered its guiding questions with clarity. It confirmed that classroom color schemes significantly influence both students' attention and psychological comfort. The integration of objective measurement and lived student experiences produced a rich and valid understanding of how classroom design can be optimized to support learners. These findings open the door to future investigations into gender-based color preferences, teacher perceptions, and cross-cultural validations, which could refine and contextualize the results further.

5.3 Conclusion

This research investigated the influence of classroom color schemes on students' academic attention and psychological comfort by employing a mixed-methods approach. With a carefully selected sample of 240 secondary school students, the study explored the effects of warm, cool, and neutral color themes in real classroom settings. The primary aim was to examine whether the visual environment, specifically the dominant colors in learning spaces, significantly influenced students' ability to concentrate and their overall emotional well-being during lessons. The quantitative analysis revealed statistically significant differences in students' attention levels across the three color groups. Students exposed to cool-colored classrooms (blue, green, violet) demonstrated markedly higher scores on the Attention Assessment Scale compared to those in warm-colored environments (red, orange, yellow). These findings affirm that cooler hues promote a cognitive state that is conducive

to sustained focus and mental clarity. In contrast, students in warm-colored classrooms exhibited the lowest attention scores, suggesting that brighter, more stimulating colors may over-activate sensory pathways, leading to distraction or fatigue. Neutral-colored classrooms (white, beige, grey), while not detrimental, were found to offer only a moderate level of cognitive support, falling between the cool and warm conditions.

The qualitative component further enriched these findings by offering insight into students' lived experiences. Students in cool-colored settings reported feelings of calmness, safety, and increased focus. These affective responses were directly linked to their ability to stay attentive and emotionally grounded throughout the school day. On the other hand, students in warm-colored rooms expressed discomfort, overstimulation, and difficulty concentrating, often describing the environment as stressful or mentally exhausting. Meanwhile, those in neutral environments neither expressed discomfort nor enthusiasm many described the space as dull or uninspiring, which in turn seemed to limit emotional engagement with the learning process.

Together, these findings confirm that classroom color is more than a design element it serves as a psychological and pedagogical tool that can significantly influence student performance and emotional regulation. This conclusion aligns with principles from Environmental Psychology and Cognitive-Affective Learning Theories, which posit that learners' behavior and cognitive efficiency are deeply shaped by the physical surroundings, including color, light, and spatial arrangements. The study’s results are also consistent with stimulus-response theories and neuroscience-informed education models, which emphasize that certain colors can either stimulate or inhibit neurological activity associated with attention, memory, and mood regulation. In addressing the original research objectives, the study successfully demonstrated that classroom color schemes are directly linked to both students’ ability to maintain attention and their perceived psychological comfort. These outcomes validate the hypothesis that cooler color schemes provide an optimal learning environment, while warm and neutral tones, when not carefully balanced, may hinder cognitive engagement or reduce emotional connectedness.

From a practical standpoint, this research highlights the importance of incorporating educational design strategies into school infrastructure development. It underscores the potential of low-cost, evidence-based environmental modifications, such as repainting classrooms with appropriate colors, to significantly enhance learning outcomes and student well-being. Educational policymakers, architects, and school administrators should consider replacing overly warm or starkly neutral color schemes with cooler,

psychologically supportive palettes to create learning environments that are cognitively stimulating yet emotionally comforting. The impact of color in classrooms extends beyond aesthetics it touches the very core of how students feel, behave, and perform in academic contexts. As education systems increasingly emphasize learner-centered environments, attention to such sensory factors becomes not just desirable, but essential. By aligning physical classroom settings with psychological research, schools can cultivate spaces that promote focus, reduce anxiety, and ultimately foster more effective teaching and learning.

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