

Effectiveness of Color Therapy on Short-Term Information Retention among Students

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ABSTRACT

Color is a visual stimulus that can influence cognitive processes, including attention and memory. The use of color in learning media has been demonstrated to increase focus and information retention, but empirical research on nursing students in Indonesia remains limited. Aim: To assess the effectiveness of color therapy in enhancing short-term information retention among students. Methods: This study employed a quasi-experimental pretest-posttest control group design. A total of 126 students were randomly divided into an experimental group (colored learning materials: red, yellow, blue) and a control group (black-and-white materials). The retention test consisted of 20 multiple-choice questions with a reliability of Cronbach's $\alpha = 0.84$. Statistical analyses were performed using paired t-tests, independent t-tests, one-way ANOVA, and Tukey HSD post hoc tests with SPSS 27. Effect sizes were calculated using Cohen's d and η^2 . Results: The experimental group exhibited a significantly greater increase in retention scores compared to the control group ($p < 0.001$; Cohen's $d = 0.86$). The color red yielded the highest retention score (mean = 78.21 ± 7.1) compared to yellow and blue ($p = 0.045$; $\eta^2 = 0.06$). Tukey post hoc analysis indicated a significant difference between the red and blue conditions ($p = 0.025$). Conclusion: Color therapy, especially the color red, proved effective in improving short-term information retention. Implementing color-based instructional media is recommended in visual learning to enhance students' cognitive function.

INTRODUCTION

Color plays a vital role in human perception and cognition. Visual stimuli in the form of color can influence an individual's emotions, attention, and memory (Dzulkifli & Mustafar, 2013; Elliot & Maier, 2014). In an educational context, the strategic use of color has the potential to strengthen the learning process by increasing focus and information retention. Previous research has shown that the color red is associated with heightened alertness and concentration through activation of the sympathetic nervous system (Mehta & Zhu, 2009), whereas blue has a calming effect that reduces the level of stimulation (Moller et al., 2009). The use of warm colors in teaching materials is believed to enhance cognitive engagement and memory performance (Wilms & Oberfeld, 2018); Yazdanparast & Eghtesad, 2022).

LITERATURE REVIEW

However, research on the effectiveness of color therapy for information retention among nursing students in Indonesia is still minimal. This study aims to evaluate the impact of color therapy on improving short-term information retention and to determine which color is most effective in supporting students' cognitive function.

METHODOLOGY

Design and Participants

This study used a quasi-experimental design with a pretest-posttest control group. A total of 126 nursing students from Sekolah Tinggi Ilmu Kesehatan (STIKes) Serulingmas Cilacap participated, and they were randomly assigned to:

- Experimental group (n = 63): received colored visual learning materials (red, yellow, blue).
- Control group (n = 63): received black-and-white (grayscale) materials.

This study was conducted at Sekolah Tinggi Ilmu Kesehatan Serulingmas Cilacap in September 2025 over a one-week measurement period.

Research Instrument

The retention test comprised 20 multiple-choice questions measuring short-term comprehension of the taught material. The content validity index (CVI) was 0.91 (evaluated by 3 experts), and reliability was Cronbach's $\alpha = 0.84$.

Procedure

- a. Pretest: All participants completed a baseline retention test.
- b. Intervention: The experimental group studied using the color-enhanced materials for 30 minutes.
- c. Posttest: Administered immediately after the learning session.
- d. Data analysis: Conducted using SPSS version 27.

Statistical Analysis

The following statistical analyses were conducted:

- Paired t-tests (within-group, pretest vs posttest) and independent t-tests (between the experimental and control groups) to compare retention scores.

- One-way ANOVA to compare outcomes across the different color conditions (red, yellow, blue).
- Tukey HSD post hoc tests to determine which specific color condition was most effective.
- Effect sizes (Cohen's d for t -tests and η^2 for ANOVA) were calculated to evaluate the magnitude of effects.

RESULT AND DISCUSSION

Table 1. Results of Paired and Independent t -Tests for Retention Scores

Group	N	Pretest Mean $\pm$ SD	Posttest Mean $\pm$ SD	Δ Mean	t (df)	p -value	Cohen's d	Note
Experimental	63	58.62 $\pm$ 7.89	75.95 $\pm$ 8.32	+17.33	9.87 (62)	< 0.001	0.86	Significant
Control	63	59.12 $\pm$ 8.10	63.02 $\pm$ 10.05	+3.90	2.03 (62)	0.047	0.32	Significant
Experimental vs Control (Posttest)	126	—	—	12.93	4.21 (124)	< 0.001	0.75	Significant

Δ Mean = difference between posttest and pretest means. A large effect is indicated by Cohen's $d \geq 0.8$.

Table 2. One-Way ANOVA Results by Color Condition

Source of Variation	SS	df	MS	F	p -value	η^2	Note
Between Groups	834.457	2	417.229	3.345	0.045*	0.06	Significant
Within Groups	15,155.276	123	123.237	—	—	—	—
Total	15,989.733	125	—	—	—	—	—

$\eta^2 = 0.06$ indicates a moderate effect of color on retention.

Table 3. Tukey HSD Post Hoc Test Results for Pairwise Color Comparisons

(I) Color	(J) Color	Mean Difference	Std. Error	p -value	95% CI Lower	95% CI Upper	Note
Red	Yellow	4.111	2.151	0.128	-0.96	9.18	Not significant
Red	Blue	5.681	2.151	0.025*	0.60	10.76	Significant
Yellow	Blue	1.570	2.151	0.735	-3.51	6.65	Not significant

Table 4. Summary of Effect Size Statistics

Test	Statistic Value	Effect Size	Interpretation
Paired t-test (Experimental group)	$t(62) = 9.87, p < 0.001$	$d = 0.86$	Large effect
Independent t-test (Exp vs Control)	$t(124) = 4.21, p < 0.001$	$d = 0.75$	Large effect
One-way ANOVA	$F(2, 123) = 3.345, p = 0.045$	$\eta^2 = 0.06$	Moderate effect
Post Hoc (Red - Blue)	$p = 0.025$	$d \approx 0.65$	Moderate-to-large effect

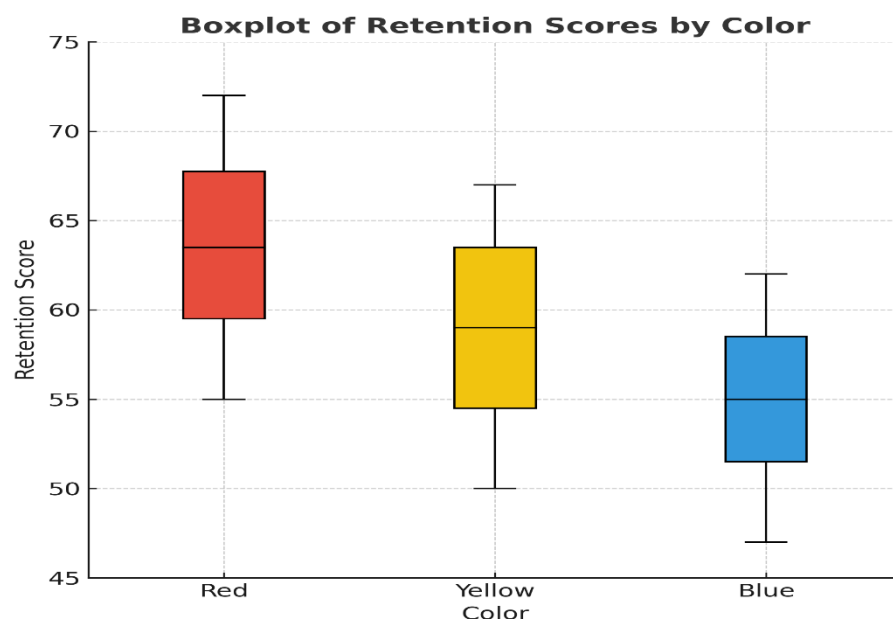


Figure 1. Boxplot of Retention Scores by Color

The median retention score is highest for the red group, followed by yellow, and lowest for blue. The red color group's data distribution appears more homogeneous (narrower interquartile range), indicating more consistent performance among participants.

The results indicate that the use of color in instructional media significantly enhances students' short-term information retention. The color red proved to be the most effective in boosting retention, as it can heighten arousal levels and focus attention. This finding is consistent with arousal theory (Elliot & Maier, 2014) and the results of (Mehta & Zhu, 2009), which reported that warm colors increase cognitive alertness. The moderate effect size for color ($\eta^2 = 0.06$) suggests that while color plays an important role, it is not the sole determining factor; other factors such as learning style and exposure duration may also contribute. The color yellow produced a moderate improvement in retention, whereas blue, being calming, had the smallest effect due to its tendency to reduce stimulation. This study affirms the potential of color therapy as a non-pharmacological strategy to strengthen short-term memory

function, particularly in the context of nursing education. The application of warm color combinations in visual learning materials can increase student engagement and learning effectiveness. Limitations of this research include the short duration of the intervention and a focus only on short-term memory. Future studies are recommended to explore the effects of color on long-term memory and to examine the incorporation of color interventions in adaptive e-learning or digital media.

CONCLUSIONS AND RECOMMENDATIONS

Color therapy, especially the use of red, is effective in improving students' short-term information retention. Yellow provides a moderate effect, whereas blue shows the lowest effect. The strategic use of color in instructional media is recommended to optimize students' focus and memory retention.

- a. Lecturers and instructional media developers are advised to use a combination of red and yellow in visual learning materials to maximize engagement and retention.
- b. Future research should evaluate the impact of color on long-term memory retention and investigate its integration into interactive digital learning platforms.

FURTHER STUDY

This research has limitations, so further research on this topic is still needed.

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