



The Effect of Classroom Red Walls on the Students' Aggression

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Abstract

Background: Color is one of the most important physical features of the environment that affects the architectural quality of space, behavior, and human feelings.

Objectives: This study was conducted to investigate the effect of classroom red walls on the aggression of female high school students.

Methods: The sample size in this study included 70 female high school students studying in Shiraz, Iran, during the academic year of 2017 to 2018. The research sample was obtained using cluster random sampling. In this way, one area was selected randomly from four educational districts of Shiraz. Then, one school was selected randomly from all female high schools in a selected district. Classes were randomly divided to two groups of 35 students, control and intervention group, among all the school classrooms. At first, a pre-test including Buss and Perry aggression questionnaire was performed. Then, the classroom walls of the intervention group were painted red. While the classroom walls of the control group were white. After 12 weeks, aggression tests were performed for each group. The means and standard deviations were used at descriptive level and analysis of covariance (ANCOVA) was used at inferential level.

Results: Pre-test and post-test score of aggression in the intervention group was 76.89 ± 25.494 and 101.00 ± 25.121 . In the control group, the mean of pre-test and post-test were 79.54 ± 19.655 and 76.60 ± 19.820 . The results of ANCOVA analysis showed that the classroom with red walls could significantly increase the level of aggression in general ($P < 0.001$) and its subscales, including verbal aggression ($P < 0.001$), physical aggression ($P < 0.001$), anger ($P < 0.001$), and hostility ($P < 0.001$).

Conclusions: According to the results, red color of the classroom walls increased the aggression and its dimensions, including verbal aggression, physical aggression, anger, and hostility among female high school students.

Keywords: Aggression, Color, Red, Classroom, Wall, Student, Mental Health, Physical Classroom Environment

1. Background

Aggression is one of the most important behavioral problems of students during adolescence and youth. Sadeghi and coworkers (1) reported that rampancy of aggression and violence among youth and adolescence in Iran was 30% to 65%. High prevalence of aggression is a worrying sign and should be considered by the educational system. Students with mental health and away from negative emotions, such as aggression, stress, and anxiety have a better concentration, attention, learning, and motivation (2). Also, the physical environment of the classroom could provide opportunities and barriers to education.

Different dimensions, such as family, cultural, social, and environmental factors, may cause aggression amongst students. Among environmental factors, architecture also affects human mental health. Built environment with different characteristics could affect human behavior. Mean-

while, different factors, such as color, visual comfort, thermal comfort, green plants, and light influence mental health (3-5). Therefore, interior design of the space affects the user's behaviors and emotions (6).

Color is one of the most important components of the physical environment and greatly affects the quality perceived by humans. Studies have shown that color surround people in the environment has profound effects on their mood and behavior (6). Also, scholars have investigated the effect of color on academic outcome and performance among the students (7).

In order to better understand the psychological effects of color on humans, it is necessary to explain the theory of color and color processing by eyes. Color analysis occurs in the retina by conical cells. Light has various wavelengths. When light hits an object, it absorbs some of the light and reflects the rest of it. The wavelengths that are

absorbed or reflected depend on the object properties and the wavelength of reflected light determines, which color a person sees. The light waves reflect off the object's surface and hit the light sensitive retina at the back of the eyes, where cones come in. The tiny cells in the retina that respond to light are cones, which have the same function as a photo-recorder. When light from an object hits the cone, it stimulates them to varying degrees. The resulting signal is zapped along the optic nerve to the visual cortex of the brain, which processes the information and returns with color (8, 9).

Responses to color are both scientific and emotional. Changes in blood pressure and eye strain are physiological effects of color. For example, red color causes the heart to beat faster, heightens the sense of smell, and increases blood pressure. However, blue color causes lower temperature of the body and slower pulse rate (8, 10).

Red color is the longest wavelength. Red is a basic color, strong, and powerful, which has the property to grab humans attention (11). Aggression, visual impact, and strain are negative reported impacts of red color (6). Fielding's (12) research showed that red color incited aggression yet green color helped with calming and yellow color induced simplistic.

Psychological responses to color include changes in mood. As color is transmitted through the eyes, the brain releases hormones, which affect the person's mood (10).

Kuller (13) reported that color not only affects human mood yet also affects the central nervous system. According to his study, rooms with walls painted in blue, green, and purple tones tend to create a more peaceful climate and rooms painted in red, orange, and yellow tend to create a more high-energy climate.

Yildirim and coworkers (14) investigated the effect of different colors, including pink, blue, and cream on the performance of students in the classroom. As the results indicate, students in classrooms with blue walls were more positive compared to classrooms with two other colors.

Kurt and Osueke (6) investigated the effect of different colors on college student's mood. The color preferences of the students were as follows: Blue (28%), green (19%), yellow (17%), purple (13%), red (8%), black (3%), white (3%), orange (3%), gray (2%), pink (2%), brown (1%) and other colors (1%).

Cetin and coworkers (15) examined the quality of nursing work space and its effect on psychological responses. Based on the results, the color of nurse stations affected their aggression, stress, alertness, and concentration during working hours. Iranian researchers have highlighted the effects of youth and adolescent's aggression in Iran, from 1970s. Although aggression is not a new issue in Iranian researches, adolescent's aggression side effects on mental health is a major public health problem and has attracted the attention of researchers (1). According to the

importance of the subject and the prevalence of aggression among students, color should be examined in real environments to make the results realistic. Color is an important environmental parameter in the design of schools that requires further investigations.

2. Objectives

Despite the importance of student's mental health and prevalence of aggression among them, a few studies have investigated environmental factors affecting aggression, especially physical features of school buildings. This study attempted to investigate the effect of red-walls in classrooms (as an environmental factor) on female high school student's aggression.

3. Methods

A quasi-experimental single blind design, with pre-test and post-test measurements and two groups (intervention and control) was employed. The dependent variable was "aggression" as measured by Buss and Perry aggression questionnaire and the independent variable of the study was "color of the classroom walls".

The participants of the study consisted of all female high school students studying in Shiraz, Iran, during the academic year of 2017 to 2018. In order to calculate sample size, the G power-software was used (statistical power of 0.80, with a large effect size, $f^2 = 0.80$, a moderate correlation $R = 0.50$, and an overall level of significance of 0.05).

The research sample size ($N = 70$) was obtained using random cluster sampling. In this way, one area was selected randomly from four educational districts of Shiraz. Then, one school was selected randomly from all female high schools in the selected district. Two classes were randomly divided to two groups of 35 students, control and intervention group, among all the school classrooms.

Both groups were pre-tested by Buss and Perry aggression questionnaire, which consists of 29 items. This questionnaire quantifies aggression in four subscales including: Physical aggression (nine items), verbal aggression (five items), anger (seven items) and hostility (eight items).

The students answered the 5-point Likert scale based on how true they thought the phrase was (extremely characteristic of me = 5, extremely uncharacteristic of me = 1). Range of general aggression score and four subscales were: General aggression 29 to 145 (min 29 and max 145), physical aggression 9 to 45, verbal aggression 5 to 25, anger 7 to 35, hostility 8 to 40 (16).

Several studies have confirmed Buss and Perry questionnaire validity (17). Samani (18) studied the validity and reliability of the Buss and Perry aggression questionnaire in Iran. According to his study, this questionnaire had an

appropriate validity and reliability for use in Iran (reliability coefficient = 0.78).

In the next step, the walls of intervention group classes were painted red, while the walls of the control group classes remained white. Students spent 12 weeks in these classes during their normal course of study and after 12 weeks, aggression was examined using the Buss and Perry questionnaire for both intervention and control group students.

The data were analyzed by SPSS software (version 21.0); the mean, standard deviation and analysis of covariance (ANCOVA) were used to investigate the research hypothesis. Parents of the students signed the written consent for the presence of their child in the study.

This study was approved by the Ethics Committee of Shiraz University of Medical Sciences.

4. Results

Seventy students, who did not have a mental health problem in their school health records, participated in the study, voluntarily. Students were categorized to intervention (N = 35) and control groups (N = 35). Both groups were homogenous in gender, educational grade, age, economic status, level of parental education, and level of aggression before the intervention (Buss and Perry aggression scores). The mean age of participants was 16.15 ± 0.95 and 16.35 ± 0.78 in the intervention and control groups. In both groups, the mean family monthly income was two million Tomans. Also, the average level of parental education was Bachelor's degree in both groups.

Table 1 summarizes mean and standard deviations at each time pointed (pre and post-test) for both groups (control and intervention), derived from using the Buss-Perry aggression questionnaire. Pretest and post-test score of aggression (according to the Buss and Perry aggression test) in the intervention group was 76.89 ± 25.494 and 101.00 ± 25.121 . Also, the mean of pre-test and post-test in the control group was 79.54 ± 19.655 and 76.60 ± 19.820 .

According to the results, the mean of Aggression in general and its subscales, including physical aggression, verbal aggression, anger and hostility, increased in post-test compared to pre-test in the intervention group. However, these changes were not seen in the control group.

In order to determine the effects of red color on the aggression of female high school students, analysis of covariance (ANCOVA) was used. The ANCOVA analysis showed significant differences in the score of both the intervention and control groups ($P < 0.001$). According to the results, the classroom with red walls could significantly increase the level of aggression in general ($P < 0.001$) and its subscales, including verbal aggression ($P < 0.001$), physical ag-

gression ($P < 0.001$), anger ($P < 0.001$), and hostility ($P < 0.001$).

5. Discussion

This study supports the effect of red color on the aggression and its subscales, including verbal aggression, physical aggression, anger, and hostility among female high school students.

Krenn (19) focused on color and aggressiveness in his study and reported viewing red on self or others increases appraisals of aggression and dominance. Results of Krenn's (19) study were consistent with the results of the present study.

Although several studies support the negative effects of red color on psychological reactions and academic performances, Smajic and coworkers (20) reported no significant moderation effects on psychological reactions, such as anxiety. Also, they expressed that color influenced 2% to 4% of variance in the test performance. Even with minimal negative effects, this may be very destructive over the time.

Also, Genschow and coworkers (21) investigated the effect of Baker-Miller pink on the aggression of prisons. The results did not support the relationship between color and aggression and were consistent with the results of the present study.

The present study had some limitations. One of the limitations of the research was that the school's principal did not allow the researchers to paint the walls of different classes in different colors. Therefore, it was not possible to study the effect of different colors on aggression in this study. It is thus suggested to compare the effects of other colors on student's aggression in future researches. Given the reported evidence of certain gender differences in aggression (1, 22, 23), future studies could investigate the effect of color on the aggression among male students and compare the result with the present study. It is also recommended to review this issue among students of other educational levels, such as primary and secondary schools.

5.1. Conclusions

In this study, the effect of the red color of the classroom walls on the aggression of female high school students was investigated. According to the results of the research, student's aggression increased in general, and in its subscales, including verbal aggression, physical aggression, anger, and hostility in a classroom with red walls compared to a classroom with white walls, which showed that red color had an effect on increasing student's aggression. The need to know the effects of colors on student behavior and mood is essential for architects, managers, and teachers. Careful planning and attention to the interior design during construction of educational buildings can play a

Table 1. Mean and Standard Deviation for Scales of Buss-Perry Aggression Questionnaire by Group^a

| Buss-Perry Aggression Questionnaire | Intervention Group (N = 35) | | | Control Group (N = 35) | | |
|-------------------------------------|-----------------------------|-----------------|---------|------------------------|----------------|---------|
| | Pre-Test | Post-Test | P Value | Pre-Test | Post-Test | P Value |
| Verbal aggression | 13.17 ± 5.711 | 17.17 ± 5.415 | < 0.001 | 13.63 ± 5.202 | 12.51 ± 5.527 | < 0.001 |
| Physical aggression | 26.11 ± 11.822 | 31.14 ± 10.539 | < 0.001 | 26.91 ± 11.268 | 26.40 ± 12.341 | < 0.001 |
| Anger | 19.54 ± 8.413 | 24.71 ± 8.270 | < 0.001 | 18.34 ± 6.0752 | 17.51 ± 6.40 | < 0.001 |
| Hostility | 18.06 ± 7.989 | 27.97 ± 12.263 | < 0.001 | 20.66 ± 6.752 | 20.17 ± 7.501 | < 0.001 |
| Aggression | 76.89 ± 25.494 | 101.00 ± 25.121 | < 0.001 | 79.54 ± 19.655 | 76.60 ± 19.820 | < 0.001 |

^a Values are expressed as mean ± SD.

major role in student's behavior. The use of appropriate colors would reduce negative reaction behaviors, such as aggression. Given that the present study was not blind and the students were aware of the research process, the same result could be achieved for other colors. What can definitely be deduced is that the color of the classroom walls can affect the level of aggression.

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Footnotes

Conflict of Interests: The authors declare no conflict of interest.

Ethical Considerations: This study was approved by the Ethics Committee of the Shiraz University of Medical Sciences and written informed consent was obtained from student's parent.

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