

Comparing the Effect of Used Colors in Girl Primary Schools' architecture on Pupils' attitude (Case Study: Isfahan Schools)

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Abstract—Academic spaces should be considered as one of the most crucial urban spaces, because for a child, school is the first environment in which laws and regulations are applied. According to psychologists, the environment of academic settings should be in such a way that learning occurs either easy or pleasant. Despite the remarkable figures of children statistics in our country and severe necessity for their training and education, the issues regarding academic spaces are considered less significant. Using colors in a correct way, causes students' positive mental picture reinforcement of school and eventually it is effective in their educational developments.

Unfortunately, most of the country's educational and academic spaces lack necessary adjustment with children and teenager's psychological characteristics and therefore, their effects on pupils' attitude and insight due to education and learning would be degraded. The purpose of the present study is to obtain suitable color combination for academic spaces according to students' viewpoints. The research methodology is post-facto (cause-comparison) through field study notions by using questionnaire and analyzing the results by SPSS. In this research, different students' perspectives in schools due to color application in architecture and schools have been evaluated.

Keywords— *Academic environment, color, students' attitude, classrooms*

I. INTRODUCTION

What forms human characteristic, undoubtedly, is affected by the environment in which they grow up. Therefore, paying more attention to a place where one spends most of his/her time and having most of his interaction with society is very critical. So preparing a quiet, lovely and enjoyable environment causes attracting students' attention and tendency for attending at school and enhances their psychological health. One of the effective elements in school architecture is the accurate use of color. It has been achieved through experience and practice that color is a lustrous material giving the space a spiritual concept and impresses human's behavior and temperament

even has an effect on his face. Then, based on individuals mentality and its recognition, active and bearable spaces can be created by appropriate coloring [10].

Winning (2006) asked two different high school students to describe their own desirable colors in academic settings. The results revealed that interest in colors is different according to culture and age limitations. In another study, Denis more, continuing color patterns, is opposite in schools based on traditional definitions and expresses a need for using gay and happy colors. Color as an architecture in separable element has a plenty of effects on users' mentality and behavior in these buildings and spaces, and impresses their emotional and psychological mood. Thus, paying more attention to these items such as "to what extent have schools, as the most essential academic places, considered the effect of colors on education?" and "what are the basic colors used in schools?" are the fundamental issues to be investigated in this study. The following hypotheses are dealt with in this paper:

- Through investigating students' mentality and scientific analysis, color usage principles can be obtained.
- By examining students' different viewpoints, a suitable school color spectrum can be achieved for various age and sex groups.

School designers should be aware of designing influences on individuals and its dominant psychological issues, instead of imposing their own taste. Therefore, the main goal of the present study is investigating color combinations used in schools and introducing suitable color combinations based on pupils' perspectives.

In order to review and examine the data, questionnaire style was applied, containing 22 questions, to obtain students' attitude and insight on 7 available colors in Itten color cycle (white, red, orange, yellow, green, blue and purple) and the suggested concepts are proposed in the questionnaire. In front of every student, there are colorful cards in grey background and he/she was asked to express his/her idea about that color according to the proposed concepts. The examined concepts in this test were multiple choice and the students answered to the

questionnaire based on an instruction. Statistical computation has been performed by SPSS software to analyze raw statistical data.

For investigating data in this software, every one of 22 questions and each of the five choices were scored, so descriptive (qualitative) variables turned into quantitative and measureable variables. After examining questionnaire data, the cronbachs' alpha coefficient obtained was higher 0/7 ($\alpha = 0/88$) considered favorable.

Statistical population in this study include all girl schools in Isfahan. In order to implement the research design, first, 4 regions out of 5 educational region were randomly selected, then in every school among the third, fourth and fifth classes, 3 classes were randomly chosen and eventually 10 students in every class responded to the questionnaire.

II. THEORETICAL BASE

The present study investigated 6 colors (red, orange, yellow, green, blue and purple), and the mentioned colors are related to Itten color cycle. In Table 1, the most important psychological effects of these 7 colors on human and their application in educational settings are mentioned.

TABLE I. COLOR PSYCHOLOGY EFFECTS

Color effects	Color
Inspire cleanliness and purity. Remain an unlimited, infinite and senseless effect. It is placed in cold color group.	White
It is a warm, alive, energetic, cheerful color. This exciting color is very motivate in the setting and causes an increase in creativity, energy and freshness in life. Red is not applied a lot in classroom architecture, because red walls makes kids bad tempered and disturbed and for its emotional and exciting spirit and mode, this color causes kids to get out of calm mood and starts being restless and agile, so prevent their concentration. It is better not to use this color in classroom setting; however, it can be used in play game and sport environment [1, 12].	Red
It is a mixture of red and yellow. It is the symbol of energy and it is a color of joy, dance, anti-fatigue, learning and testing. This color is very effective for being comfortable. Because orange is a stimulating color, it is very ideal for academic settings of primary school, on the one hand, it makes students to be energetic, warm and lively, on the other hand, it stops child's sleepiness and indifference in the early hours of the morning.	Orange
This color is the symbol of awareness and trans quality. It causes to produce a bright and happy space; however too much application of this color may provide people and environment isolation [11]. It creates near distance feeling in the space and it is stimulating [5]. Yellow reinforces individuals' intelligence and curiosity, and increases concentration [1]. It has a kind of mental and intellectual stimulation which extremely boosts human's thinking. Authorities on	Yellow

color psychology believe that yellow color mixed with a small amount of blue (refer to green) stimulates that part of brain which has mutation and increases presence of mind. For this reason, using this color with mentioned combination in training and educational centers is very crucial.	Green
Green is the most comforting color creating a complete balance in our psychological structure. Green is ideal for interior designing of study rooms, educational spaces and places in which people more focus. If green is mixed with various types of creamy and white for painting academic rooms and spaces, there would be a comfortable and relaxing place. And if it is mixed with red, it helps creative people development and will produce a strong mixture [13]. Blue and green combination produce a pleasant and coordinate mixture. These two colors give a balance and calm space to classrooms and increase individuals' concentration which is ideal for study rooms. Generally, this combination is comforting and concentrating [1].	
Blue indicates complete comfort and it inspire imagination. It is better to combine this color with other colors in classrooms and educational spaces. Because it has a cold and formal nature and it is far from being warm and friendly[1, 5, 13].	Blue
Purple is considered as one of the most spiritual or immaterial colors and it displays a coordination between sense and mind. A purple space is a mysterious, strong and unique place which one expect something will happen but he/she feels comfortable. When this color is inclined to red, the space will be warmer and to blue, will make it colder. Being in a purple space for a long time causes depression, for its energy is so strong that mind cannot bear its extra load and reacts to it. Then, it is better to mingle purple with white, green, light purple in educational space designing [1, 4].	Purple

III. STUDIES AND INVESTIGATIONS

In According to the mentioned explanations for answering questionnaire in previous sections, four schools "Birjandi, Abbaspoor, Hossayn Amin, and Haghpanah" were selected among various districts of education and training organization in Isfahan. Through dividing these school spaces into three groups "a-classrooms b-corridors and internal spaces (such as stairs), and c-exterior spaces including (Yard and Play grounds), the used colors in every space were investigated and the highest or lowest colors were identified. The obtained results from questionnaire data were analyzed by SPSS software. A lot of results about questionnaire concepts for every school were brought in Table 3,4,5 and 6.

Moreover, the data related to the most frequency about questionnaire concepts for the seventh colors, according to general school

investigation, were collected in the form of a Table. The results are given in Table 2.

TABLE II. THE OBTAINED COLOR CONCEPTS FOR THE SEVENTH COLORS

The obtained color concept	Color
comfort, satisfaction, construction, soothing, faith	White
being happy, liveliness and gay, strength, stimulating, force and energy seriousness, pleasure, determinant, energetic and anti-fatigue	Red
thoughtful, Reflection	Yellow
knowledge, success, liveliness, existence and life, victory	Green
thought reinforcement, knowledge	Blue
Kindness	Purple

Based on the obtained data from Table 2 and depend on the subjects related to Table 1, the applied color combinations in schools were investigated. The analysis of every school is explained separately.

1. Birjandi School :

According to the mentioned descriptions, Birjandi School space analysis will be done in the mold of 3 categories: classrooms, corridors and internal spaces (such as stairs) and external spaces including (Yard and Play ground and game spaces).



External spaces Corridors classroom

Figure 1: Spaces of Birjandi School

A. Classroom

In Birjandi School, walls are white and curtains, benches are yellow. The most significant used color in classrooms is yellow. In an interview with students in this school according to Table 3, yellow has happy concept for them. In addition to the mentioned. Psychological concepts in Table 1, yellow color makes the space or room bright and gay, similarly it is matched with students feelings. However, too much application of this color cause isolation from people and environment [11]. Also this color contain a kind of mental and intelligence stimulating mood which extremely cause human thought reinforcement. Authorities in color psychology believe that if yellow is mixed with a little blue (inclined to green), stimulate that part of brain containing thought mutation and brings about an increase in the amount of mind

presence in individuals. Therefore, using this color with the said combination is very essential in education and training centers. So, it is worth saying that instead of merely using purely yellow color, mix it with a little blue. According to Table 3, also, this color among the questionnaire concept, inspire a thoughtful reflection concept for students, for this reason, it can be used in classroom spaces. As a conclusion, these two colors combination will be appropriate for classrooms. In an interview done previously, red inspires seriousness concept for this school students and therefore, it can be used in classrooms to create this feeling. But regarding the said points in Table 1, because the color remove calmness and comfort of children and prevent their concentration, it is better not to use red on the walls totally, and it should be used in combination with other colors such as white, because combination of these colors in space reduces brightness or space shining. It is suggested that this color be used in decorating school classrooms to excite shy, introvert and secluded children. Most of its usage will be in short term periods such as test or sport races periods. Orange is a suitable color for classrooms, for as it was mentioned, it is the color of learning and testing. It is a stimulating color for academic spaces, appropriate for primary level. Because, on the one hand, it makes students lively, warm and energetic, on the other hand orange prevent child sleepiness and unconcern in the morning early hours.

In addition, orange inspire the concept of power for students and can strengthen or give power to them for study hours. However, purple containing the concept of kindness for school students is better to be used in spaces or rooms needing more friendliness among kids. For class atmosphere has a more serious mood. According to the points in Table 1, being in a purple room for a long time can cause depression, because its energy is so high that mind can't bear its extra load and reacts to it. Then it is proper to mix purple with white, green or light purple in designing educational spaces.

Table 3, demonstrates the obtain results of questionnaire data investigation, in Birjandi School.

TABLE III. THE SELECTED CONCEPT FROM QUESTIONNAIRE RELATED TO SEVENTH COLOR, BY BIRJANDI SCHOOL PUPILS.

Birjandi School	Color	Frequency (person)	Selected concept
	White	12	Comfort
	Red	15	Seriousness
	Orange	8	Power
	Yellow	7	Happy
	Green	12-12	Existence-Life-Victory
	Blue	10	Relief- Peaceful
	Purple	15	Kindness

B. Corridors

Anti-spaces, corridors and stairs, especially in the early years of education and learning are constantly encountered with students' excitement, emotion and gay. Generally, at the break time or when the school is closed, students leave classrooms with a lot of excitement. Also, after the break during that period, they return from gay, joyful school yard to class. Stairs and corridors are between the yard and class. Therefore, by using appropriate colors, students' spiritual excitement control can be very effective, and in addition to creating peace, and relief in the environment, probable clash among pupils can be reduced. In Birjandi School, generally, all corridor walls are white. But among the next sixth colors, yellow has mainly been used on corridor spaces which according to Table 4, in the performed interview, this color has the meaning and concept of being glad for students in this school. However, considering eliciting characteristic of yellow color, it is proper to use this color less or it can be used in combination with other colors in corridors. The most frequent color after yellow is orange. It has neither the warmth of red nor the coldness of blue; however, it lives energy to the child, and it can be efficient in controlling his/her excitement and emotion. But green having the least frequency in this school corridor spaces is suitable for both corridor spaces and classrooms. It is the most comforting color. It is neither similar to red with stimulating and exciting effect nor like blue with inactive and peaceful influence. It has a mild and pleasant effect. And continual exposure to it doesn't make any problem. According to Table 2, green embraces concepts including knowledge, success, existence, life, victory as well; therefore, in addition to providing class atmosphere and creating thinking sense, it is suitable for corridors and helps liveliness and freshness.

C. External Spaces (Yard and Play Grounds)

School exterior spaces such as yard and play grounds are places that children enjoy playing

there. Children after passing their home word and study hours, go to the open space of yard to refresh themselves. These places using gay and pleasant colors aid kids to refresh and regain energy for next periods. Among seventh colors, red is a powerful and warm color increasing creativity making mind and energy free and makes children happy and fresh. According to Table 3, this color involves freshness, joy, rejoice, power and energy, forceful and anti-fatigue which is suitable for school yard. Moreover, based on the questionnaires, purple is the color of kindness and it can be used for creating more friendliness in yard or open spaces.

2. Abbaspoor School :

Abbaspoor School space analysis is obtained and demonstrated on Table 4.



External spaces

Corridors

Figure 2: Spaces of Abbaspoor School

A. Classroom

Abbaspoor School classes are all white and as a matter of fact there is no color for their painting.

TABLE IV. THE SELECTED CONCEPTS FOR THE SEVENTH COLORS BY ABBASPOOR SCHOOL PUPILS

Abbaspoor School	Color	Frequency (person)	Selected concept
	White	11	Soothing and Relieving
	Red	12-12	Strength-Seriousness
	Orange	6	Determinant
	Yellow	10	Knowledge-Success
	Green	11	Existence and Life
	Blue	7-7	Gladness, Thought reinforcement
	Purple	11	Kindness

B. Corridors

In this school all corridors are totally white.

C. External Spaces (Yard and Play Grounds)

In Abbaspoor school yard the most used color is yellow. Red white are next. Based on the previous issues, considering corridor atmosphere, yellow and red are appropriate colors for yard because of their stimulating

property. Applying white color, has soothing and relieving concept for pupils according to their questionnaires. Of course, because of the coldness character of white, it is better to use white in combination with other colors on the school walls.

3. Hossayn Amin School :



External spaces Corridors Classroom
 Figure 3: Spaces of Hossayn Amin School

A. Classroom

In Hossayn Amin School classes, yellow, green and white are the most frequent used colors on walls respectively. These colors have stimulating, existence and relief concepts among students' opinions, respectively. According to the mentioned explanations in previous sections, yellow is a proper color for class walls. Yellow stimulating concept coordinates with the same concept for pupils. Green with its existence and life concept can create a special liveliness. rejoice and gladness for students in classrooms. Meanwhile, using blue with pleasure concept is also appropriate, based on the students' questionnaire. However using white with soothing and relieving concept is not suitable. Either its inspiring concept among students or its coldness property doesn't provide a proper place for classrooms. The obtained results of questionnaire data investigation reveal the following information for Hossayn Amin School shown in Table 5.

TABLE V. THE SELECTED CONCEPTS FOR THE SEVENTH COLORS BY STUDENTS

Hossayn Amin School	Color	Frequency (person)	Selected concept
	White	16	Soothing and Relieving
	Red	14-14	Gladness- Power and energy
	Orange	7-7	Knowledge and Success- Construction
	Yellow	8	Simulating- Motivating
	Green	14	Existence and Life
	Blue	10	Pleasure
	Purple	10	Kindness

B. Corridors

In Hossayn Amin School corridors, there are various colors such as red, yellow, orange, green, blue and light purple with different percentage on the space. The most used colors are yellow, orange and white. According to the said point, it is better to use less yellow color on corridor walls, and use more orange which is appropriate. Also, red is used restrictedly on window frames attracting students' attention to prevent any crash or accident, therefore their usage is suitable.

C. External Spaces (Yard and Play Grounds)

Red is the most frequently used color in the yard space. In their questionnaires, students stated that it is a joyful cheerful energetic color giving power and according to the red concepts, it is the best choice for using in this school yard. Because based on Table 3, this color inspires gladness, freshness, rejoice, power, energy, and pleasure concepts, and it is anti-fatigue and forceful. Yellow is the most frequently used color after red. Having stimulating and motivating concepts in the questionnaire, yellow is an appropriate color for this space. Moreover, based on the opinions on the questionnaire purple is the color of kindness, which can be used on the yard spaces for creating more friendliness. Any way according to the said concepts, it is more advisable to use purple accompanied with white, green, and light purple at the same time in designing educational settings. Blue got the third place according to its usage rate.

It is better to apply blue with warm colors and because of its coldness property and providing a very comfortable and cold feeling use it less in these spaces.

4. Haghpanah School :

Haghpanah School analysis is performed as the following:



External spaces Corridors
 Figure 4: Spaces of Haghpanah School

A. Classroom

Class spaces in Haghpanah School are painted with white, benches and curtains are yellow and orange. Yellow is the color of satisfaction based on the students questionnaires which can be used as a positive color on class walls. Blue is a peaceful color and white clarifies

liveliness, existence and life. Red, according to color psychology and the school students' concept (motivation and stimulating), would be better not to be applied in class walls- orange containing gladness freshness and rejoice is a appropriate color for class spaces. Because referring to the mentioned issues, orange is a stimulating color for academics setting sand spaces ideal for primary levels. Table 6, reveals the obtained results of the questionnaire data investigation in Haghpanah School.

TABLE VI. THE SELECTED CONCEPTS FOR THE SEVENTH COLORS BY HAGHPANAH SCHOOL STUDENTS

	Color	Frequency (person)	Selected concept
Hossayn Amin School	White	10-10	Liveliness-Existence-Life
	Red	18	Stimulating-Motivating
	Orange	7-7	Gladness-Freshness and Rejoice
	Yellow	7-7	Satisfaction-Pleasure
	Green	13	Existence-Life
	Blue	14	Comfort-Relaxation
	Purple	13	Kindness

B. Corridors

In Haghpanah school, corridors and internal spaces are painted green, yellow, orange, red and blue, of course with different usage amount. The most used color is first yellow and then orange. According to the mentioned points in previous parts, orange application which is either anti-fatigue, gay color or comfortable can be a suitable color. Also, students expressed that it is the color of fun, rejoice and freshness. Red has the concept of stimulation for students in the school and it has excitement concept in psychology, applied on the corridor walls. It is not an appropriate color, because school corridor spaces in which children encounter after passing class hours, should be in such a way that on the one hand it should create a refresh spaces and on the after hand control and decrease kids excitement and emotions. Because of motivating property of yellow, it is better to use it less in corridors.

However, green is the least used color on corridor walls. It is one the most comfortable colors; it is neither stimulating and exciting like red, nor inactive and soothing like blue. It has a mild pleasant effect and continual impact with it doesn't make any problem, because of its property balance from different sides, it cause neither continual nervous reactions which leads to imbalance and excitement nor its relieving effects are too much reducing refresh ness and human activity [9]. It has life and existence concept among students and it has comfort

refreshment and rejoice in corridors, therefore it can be used more in corridor spaces.

C. External Spaces (Yard and Play Grounds)

In Haghpanah School yard and play grounds, white, red, orange, yellow and green are used. The most applied color in these places is yellow. Red and white are the next most used colors. Both red and yellow have stimulating mode and are full of energy, warmth and heat, suitable for playgrounds and children after emotional evacuation can return to classes with more comfort and ease. However, using too much white is not recommended in school settings. White as a cold color remain an unspecific, unlimited and infinite energy [14]. According to the performed poll related to purple, with kindness concept, it can be used in yard spaces for creating more friendliness, and based on previous issues, it is better to combine it with white, green and light purple.

IV. RESEARCH FINDING:

After investigating the accuracy of the used color and analyzing their usage in school and the obtained results from 1 and 2 tables, appropriate colors for classroom should contain comfort and a kind of mental and intellectual stimulation as well as provide a background for thinking and imagination. Therefore, in this research, yellow for having these properties has the concept of thinking and meditation with the majority frequency on students' questionnaire is the most appropriate color for classroom spaces. Moreover, blue creates active imagination feeling accompanied with comfort, orange as stimulating color for excitement and sleepiness prevention, green by creating a comfortable and thoughtful space and inspiring success, knowledge and thinking reinforcement concepts are among the proper colors for classrooms according to the questionnaires.

School corridor spaces and educational settings are as a retaining between classes and school yard. Students expect to know about some news when they are in corridors which lead to class space and/or school yard. Corridors should not only create comfort and control students' excitement, but also maintain the feeling of liveliness, rejoice, being fun and gay. According to the obtained concepts from questionnaires for green, it can be said that liveliness, existence and life are associated with it, which is suitable for corridor spaces and provide rejoice, refresh-ness and liveliness there. Purple includes some characteristics;

establishing coordination between feeling and wisdom. It can reduce child's excitement after departing school yard and through creating balance, harmony and spiritual firmness, prepare him/ her to enter class setting. The obtained concept from questionnaire for purple is kindness which can be used for creating friendliness. Moreover, orange, green and purple are intergrade colors not having the coldness and the warmth of the main colors before and after them. Therefore, they can make a calm environment as well as inspire liveliness and a gay or refresh sense.

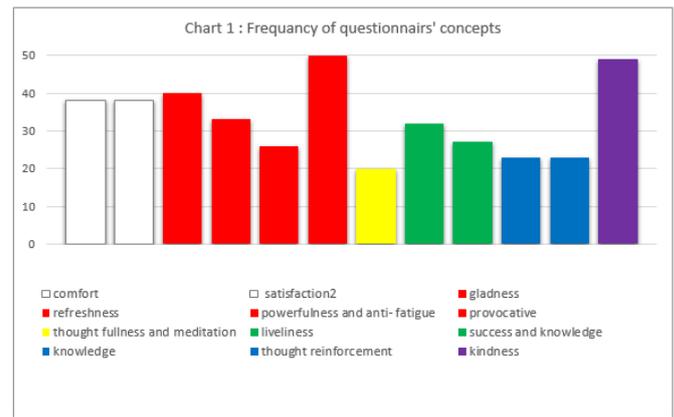
School yards are spaces that students encounter after leaving calm school environment and don't need any concentration.

In such a situation, children need to be agile to give out their energy and their internal excitement. Red, and orange are warm and energetic colors and according to the questionnaire results, red is a powerful and anti-fatigue color associating with gay, rejoice, freshness and pleasure concepts. Thus, these two colors are appropriate for school yard. Furthermore, it can be concluded from Table 1 results that being in a sheer purple environment causes depression, whereas this color has the concept of kindness and friendliness amount the students questionnaire, it can be used in the yard space but it is better to use it along with white, green and light purple.

V. RESULTS

The following results were obtained from analyzing the questionnaires according to the academic space colors and students' attitude toward these space color concepts[chart 1]:

- White frequency for satisfaction and comfort concepts is 38.
- Red frequency for gladness concept is 40, provocative and refreshness is 33, for stimulation is 50, powerfulness and anti- fatigue is 26.
- Yellow frequency for thought fullness and meditation concepts is 20.
- Green Frequency for success and knowledge concepts is 27 and for liveliness is 32.
- Blue frequency for knowledge and thought reinforcement is 23
- purple frequency for kindness concept is 49.



According to the previous analysis due to school color and obtained results, color concept frequency is categorized in to three group for school space which generally the mentioned colors in Table 7 are the most appropriate colors:

TABLE VII. THE SUGGESTED COLORS FOR SCHOOL SPACES

Space	Classrooms	Internal Spaces and Corridors	Yard and Play Ground
Suggested color	yellow (inclined to green)- green- blue- orange- white with a controlled amount	orange- green- purple- red to a controlled amount and as a warning color	red- purple (in combination with white, light purple and green) orange

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