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Color Preference Based on Children's Choices for the Interior Spaces of Kindergartens

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Abstract— *Most of children experience kindergartens as first social and educational places so that children's behavior could be affected by these places. Therefore, an excellent design of kindergarten could flourish children's ingenuity, creativity, communicative abilities, and so forth. Colors are a key factor in design of kindergartens; hence, they should be utilized effectively in order to have an attractive environment for children. The aim of this study is to find children's favorable colors for painting classrooms, playgrounds, dining rooms and furniture. Moreover, associations between primary colors and shapes are investigated in order to have a better understanding of children's viewpoint on primary colors and shapes. Two hundred children between 4 and 6 years of age participated in this investigation including one hundred boys and one hundred girls. They were randomly selected from eight coeducational kindergartens located in the Isfahan city of Iran. Results delineate that pink is the most favorable color for painting classrooms of kindergartens. It worth noting that pink could be used in the synthesis of other popular color like red and blue among children. In addition, it is better not to use black and brown in kindergartens. On the other hand, the results pertinent to color-shape associations reveal color-shape combinations of yellow-triangle, red-square, and blue-circle. This conclusion shows that color-shape combinations based on children's viewpoint are analogous to Kandinsky's theory.*

Keywords— *Color preference: Colors for interior design: Color-shape associations: Interior design of kindergartens.*

I. INTRODUCTION

Most children experience kindergartens as their first social and educational places. Therefore, an excellent design of kindergarten could flourish children's ingenuity, communicative abilities, and so on. In other words, being colorful should be considered in design as well as safety, comfort and attraction. Using color in learning places increases creativity and improves visual processing, problem solving and brain development. Thus, the colors utilized in kindergartens could play a prominent role in blooming children's ingenuity and abilities.

Several research efforts have been done to investigate the effects of educational building design, colors and so forth on learning process. For instance, Niero and Premier [1] recognized the different types of usage of colors in different educational buildings. The researchers chose 15 kindergartens among 54 cases of architectural building. According to their findings, white is the main used color that makes the environment brighter and lighter, especially in learning spaces. Finally, they concluded that colors that can create excitement like red should be used in amusement spaces. Barrett et al. [2] experimentally investigated the impacts of school building design on the learning achievement of elementary school students. They utilized multi-level modelling by a range of environmental design parameters to explicit impacts on learning progression. Finally, they reported that color has 18% proportion of increase in students' learning progression. In addition, they expressed that warm color for the wall and floor area might complete the young students' extroverted nature. They also reported that the room color (wall and floor) has a significant role in learning progression. Salleh et al. [3] carried out a research in Malaysian's kindergartens to evaluate indoor environmental quality (IEQ) in refurbished kindergarten buildings. The concentration was to recognize occupier's euphoria over the different IEQ factors. In the sequel, they named color and attractiveness as the most significant IEQ factors based on the occupier's opinion. Yoon and Jeong [4] investigated the toilets of elementary school, and analyzed juvenile pictures. The purpose of the study was to propose a toilet color design direction preferred by children as users. Therefore, they proposed to improve the toilet to a more familiar environment with high accessibility considering the development of the child when using color in design space through color preference.

Furthermore, there are remarkable number of articles in the literature about the effects of colors on children's understanding and behavior. As a good illustration, Kowalski and Zimiles [5] showed that color terminology and the ability to conceptually represent color in children are in direct relationship. The results of their experiments delineated that children were divided into three groups according to their comprehension of color. They detected children who have knowledge of color terms are successful in conceptual tasks that require the understanding of color. Perez-Carpinell et al. [6] studied two groups of 50 children between 9-11 and young adults between 20-27 years old. Five comparison samples of color chips to remember were chosen in delay times of 0, 5s, 15min, and 24h. As a result, they found children matched reference test worse than young adults for, bluish green, yellow green and orange while men remember violet reference test worse than women. Helvacıoğlu and Olguntürk [7] experimentally studied the effects of color on children's wayfinding ability in school environment. As a result, they determined the use of color in their remembrance and route learning process. Their results showed the important role of color in children's wayfinding. Gyu "Phillip" Park [8] investigated gender difference effect on color preference. It showed that cool colors are more pleasant for male whereas warm colors are more pleasant for female. The most preferred colors are red, yellow, green, blue, and purple that were chosen by children between 7-11 years old. Gyu "Phillip"

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Park [8] examined the role of color attributes (lightness and saturation) on children's color preferences for interior room colors. In addition, he employed scale-models to investigate children's most preferred colors among each of the five major hue families in the Munsell color system. He emphasized that a simulation method allowed for investigating the value of color in real contexts and controlling confounding variables. It demonstrated that saturation was positively correlated with children's preferences in the red, green, blue, and purple hue families. In the yellow hue family, interestingly, lightness has a positive correlation with preferences. Children's gender differences were found in that girls prefer red and purple more than boys. Weisgram et al. [9] examined the characteristics of toys and their effect on boys' and girls' interests, stereotypes, and judgments of the toys. They indicated that although girls dare play with a masculine toy through the color pink, boys' choices did not change much by masculine color in feminine toys. Gnambs et al. [10] studied on 190 secondary school students in context of learning. Students memorized short text that was designed with color red and gray. After administrated knowledge test and measure cognitive load, they showed that for boys, repeated color exposure affected test performance more strongly than color presentation during a single phase, whereas for girls, a single-color manipulation impaired knowledge retrieval, while repeated exposure to red had no influence. Brooker and Franklin [11] conducted some experiments to detect color influence on cognitive performance in 8-9 years old children. They compared the difference performance of colored and gray screens when children do a battery of tasks. As a conclusion, they offered that color can influence children's cognitive performance. In addition, the results of that work emphasized the significant impact of red on cognitive performance.

On the other hand, there are several articles in the literature allocated to associations between primary colors and shapes. It seems that Kandinsky was the first one who suggested a correspondence theory proposing a relationship between primary colors and shapes. Based on this theory, a triangle is matched with the color yellow, a square is matched with the color red, and a circle is matched with the color blue. He asserted that the correspondence between shapes and colors was due to an inherent relationship between the colors and angles of the shapes [12,13]. However, the correspondence theory was challenged by other researchers. In fact, several research efforts have failed to replicate Kandinsky's correspondence theory [14-19]. As a good case in point, Jacobsen [14,15], utilized an amended Kandinsky questionnaire and found color-shape combinations of triangle-red, circle-yellow, and square-blue in German samples, proposing that color-shape associations were according to everyday experience and knowledge. Albertazzi et al. [16] utilized a matching task to evaluate color-shape associations in Italian participants. They found that both square and circle were matched with red, whereas a triangle was matched with yellow. In the end, they concluded that semantic information such as the "lightness" and "warmth" might determine the color-shape associations. Furthermore, Chen et al. [17] investigated color-shape associations in Japanese participants; their studies indicate similar color-shape associations to those of Italian participants (Japanese color-shape association: triangle-yellow, circle-red, and square-blue). Therefore, they suggested that color-shape associations might arise from shared semantic information between shapes and colors as Albertazzi et al. [16] mentioned. These research efforts delineate that there are non-random associations between shapes and colors; thus, these color-shape associations might be affected by the semantic information associated with people's learning experience and visual features.

Places designed for children, specially learning environments should affect children's mind and sense efficiently to promote learning process and create a happy and energetic environment. On the other hand, there are lots of articles in the literature allocated for improving design of buildings and engineering systems [20-30]. Therefore, it is essential to have a proper recognition of children's sense to consider their favorable colors in kindergarten design. The aim of this research is to find children's favorable colors to improve decoration and painting of various parts of kindergartens [31]. To this end, some questionnaires and answer sheets were provided to children's viewpoints on painting classrooms, playgrounds, dining rooms, furniture and associations between primary colors and shapes.

II. Methodology

A. Participants

Two hundred children between 4-6 years old participated in this investigation including one hundred boys and one hundred girls. They were randomly selected from 8 coeducational kindergartens located in the Isfahan city of Iran. It should be mentioned that the children's physical and mental health conditions were almost the same, because those children were in the same category based intelligent tests which were help by Iran's Ministry of Education. In addition, their ethnic and religious conditions were analogous to each other since those kindergartens were located in the same area of Isfahan city.

B. Design and Procedure

In this research, data were collected by the help of questionnaire. The questions were divided to three categories which were personal, specific and practical questions. Personal questions such as "what is your name?", "how old are you?" and so forth were asked in order to have a better communication with children. In other words, by using these questions, children feel more comfortable and also their nervousness could be decreased. It seems this procedure could help children not to answer to specific questions hastily, so their responses would be more reliable.

In order to ascertain children's honesty and color detection, some trivial questions such as "What is the color of your classroom walls?" were inserted in the specific questionnaire. If a child cannot answer to the questions correctly, the results of the questionnaire are not valid, so they should be neglected. In continuation, several questions were provided for detecting children's favorite colors of classrooms, playground, dining rooms and furnishings of

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kindergartens. Therefore, we asked children to select the most favorable color for painting of classroom walls. The options were white, blue, red, yellow, black, purple, orange, pink, green and brown. In some cases, children selected several colors for classroom; therefore, we added an option to the questionnaire, which is called colorfulness option. Similarly, we asked children to express their favorite color for painting of playground, dining rooms and furnishings. The aim of these questions was to find the best color for painting all mentioned places and components since kindergartens should be designed in such a way that they could be close to children's wishes about an ideal kindergarten.

In the section of practical questions, an answer sheet and color pencils were given to children to paint geometric shapes. It should be noted that the geometric shapes were circle, square and triangle; and the colors were red, yellow and blue. It is noteworthy to mention that Color system we have employed is based on Munsell color system [32], the hues are such as red (R), yellow (Y) and blue (B) and so forth. Moreover, the value (V) is 5 for each color which is the middle of the value from 0-10. Fig. 1 depicts a sample of pained answer sheets. The aim of this section was to evaluate associations between primary colors and shapes from children's viewpoints. The purpose of color design in architecture is not only related to decoration, but also shape of the structure. Architects always concern about the design of kindergartens in order to achieve more comfortable and enjoyable places for children. This section could evaluate the relationship between shape and color from children's viewpoint in order to gain better information for design of class shapes and decorating them. In more details, it is only a stereotype to design all classrooms as cubes, while classrooms can be designed as circles, triangles and so on. Hence, by knowing the best relationship between colors and shapes from children's viewpoint, architects can design more interesting kindergartens for them.

Fig. 1. Sample of painted answer sheets.

Finally, chocolates with primary colors (blue, red and yellow) were used to detect the children's favorite primary color. It is noteworthy to mention that the shape, size and taste of all chocolates were the same as shown in Fig. 2. It seems that each child unintentionally selects chocolates which have his or her favorite color. This procedure seems more efficient in compared to asking them what their favorite primary color is, because they might answer another color in order to make a difference. In addition, children might think that chocolates are their gratuity, so they might answer to the questions carefully to get a chocolate at the end of interview.

Children who are in the age of 4 to 6 are not able to read so questions were affectionately asked by researchers since children may answer the questions nervously if instructors ask them. Furthermore, children might affect each other, so they tend to reply similar responses. Hence, as shown in Fig. 3, a distinct place was provided to ask children individually.

Fig. 2. Colored chocolates.

Fig. 3. Distinct place to interview with children.

III. Data Analysis and Results

In this section all data are classified on the basis of questions and then results are presented in bar charts to discuss in details. Firstly, the results of color preference for interior design are discussed in subsection A and then, the results pertinent to the associations between primary colors and shapes from the children's viewpoint will be drawn in the subsection B.

A. Color Preference for Interior Design

In this subsection, the data obtained from questionnaires about the color preference of classrooms, playgrounds, dining rooms and furniture are shown in bar charts and their results are discussed in details. In addition, as mentioned above, one of the questions was about children's favorite color among three primary colors (blue, red and yellow); therefore, to find the children's favorite primary color, they had an option among chocolates with three primary colors.

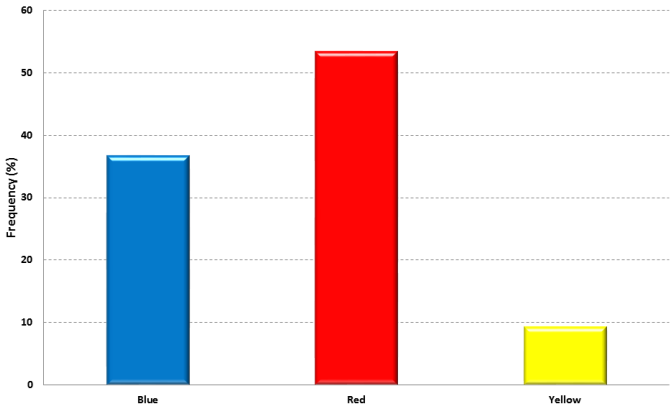

Fig. 4. Percentage of children's favorite colors among primary color.

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Selection percent of each color is delineated in Fig. 4. As illustrated in this figure, red is the first selection by the percentage of about 53%. Furthermore, blue and yellow are placed on second and third places, respectively by the percentages of 37% and 9.5%. It is worth mentioning that red, blue and yellow are respectively 5R, 5B and 5Y based on Munsell Hue [21].

It is obvious that classrooms are one of the most important places in each kindergarten since children spend the majority of their time with instructor in them. Hence, it is essential to select an appropriate color for painting classes in order to have a favorable and convenient place for children. To do so, Fig. 5 is provided based on children's answers to the question of "what is your favorite color for classrooms?". Based on Fig. 5, pink is an option by the percentage of 23%. In addition, both red and blue are located on the second place by the percentage of about 17%. In contrast, the colors of black, brown and purple are not favorable at all. Therefore, it seems that pink, blue and red are the best selections to paint classrooms.

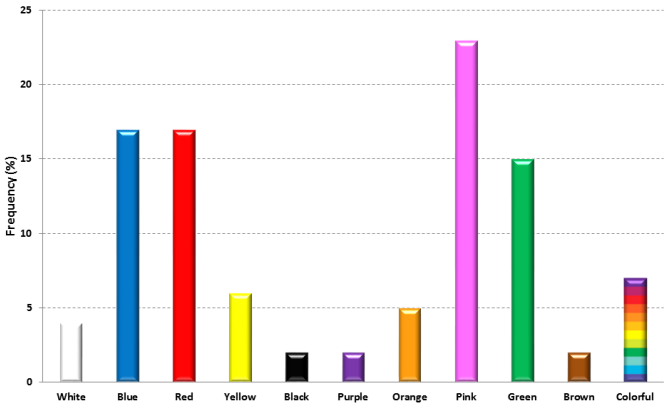

Fig. 5. Percentage of children's favorite colors for classrooms.

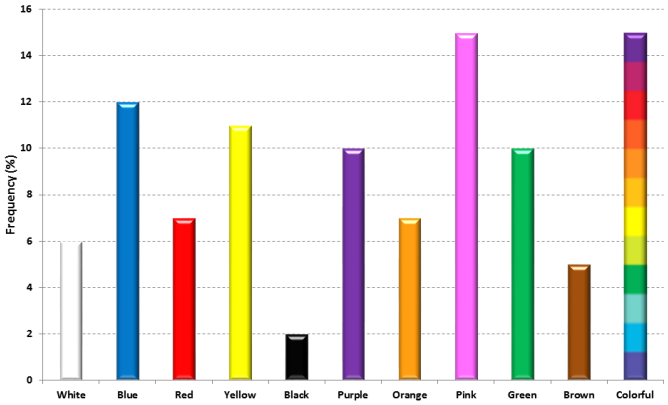

Fig. 6. Percentage of children's favorite colors for playgrounds.

In continuation, we asked children about their favorite place for playing and entertainment. Interestingly, all of children in the study proposed an open field (without ceiling such as yard) for playing. Then, they selected their favorite color for playgrounds which is illustrated in Fig. 6 based on percent. According to this figure, colorfulness, pink and blue options are three most favorable colors by the percentage of about 15%, 15% and 12%. On the other hand, black and brown are located on two last places by the percentage of 2% and 5%. Hence, it seems that colorfulness option, pink and blue are the best selections to paint playgrounds. As a recommendation, it is better that playgrounds be painted in various colors except black and brown to satisfy the majority of children.

Fig. 7 presents the selection percent of each color for dining rooms in the kindergartens. As shown in this bar chart, the colors of red, yellow, pink and green are the most favorable colors for dining rooms. For further details, these colors were selected by the percentage of about 15%, 14%, 14% and 12%, respectively. It should be noted that, black has the last place by the percentage of 2%. Thus, it is suggested that the colors of red, yellow, pink and green be used to paint dining rooms in kindergartens.

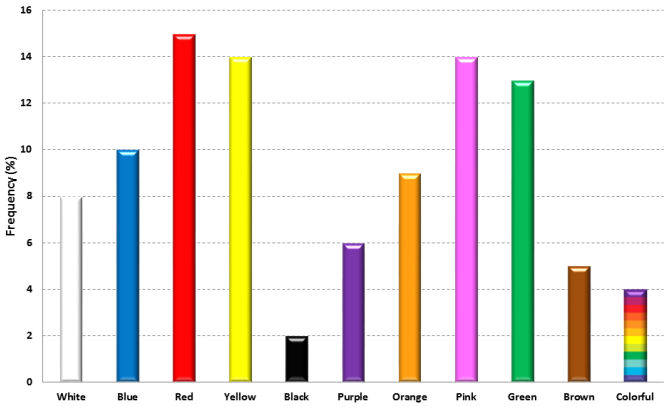

Fig. 7. Percentage of children's favorite colors for dining rooms.

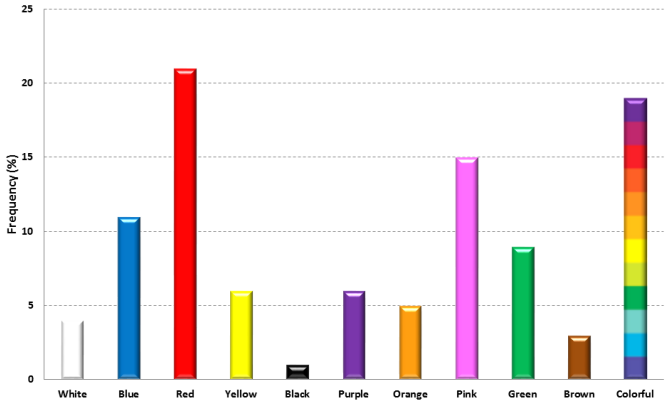

Fig. 8. Percentage of children's favorite colors for furniture.

With regard to the fact that kindergarten environments should be attractive, furniture could play a prominent role to create an interesting and relaxing environment for children. Therefore, another parameter that we studied is children's favorite colors for furniture in kindergartens. The results of this study are presented in Fig. 8. It can be perceived from this figure that children's first priority for the color of furniture is red by about 21%. In addition, colorfulness option and pink are placed on second and third places by 19% and 15%, respectively. According to Fig. 8, children do not like to see common colors of furniture such as black, brown and white;

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thus, it is reasonable to use warm colors such as red and pink for furniture of kindergartens in order to have an attractive environment for children.

B. Associations between primary colors and shapes

In this subsection, the results pertinent to associations between primary colors and shapes from the children's viewpoint are presented. Figs. 9-11 depict percentage of children's favorite colors for triangle, square and circle, respectively. According to Fig. 9, about 47% of children selected yellow for triangle; in addition, blue and red have second and third places by 33% and 20%. Similarly, it is perceived from Figs. 10 and 11 that around 50% and 44% of children chose red and blue for square and circle, respectively. It seems that the results of this study have a good agreement with the color-shape associations presented by Kandinsky [12] [13]. This agreement can be ascribed to children's unbiased viewpoints.

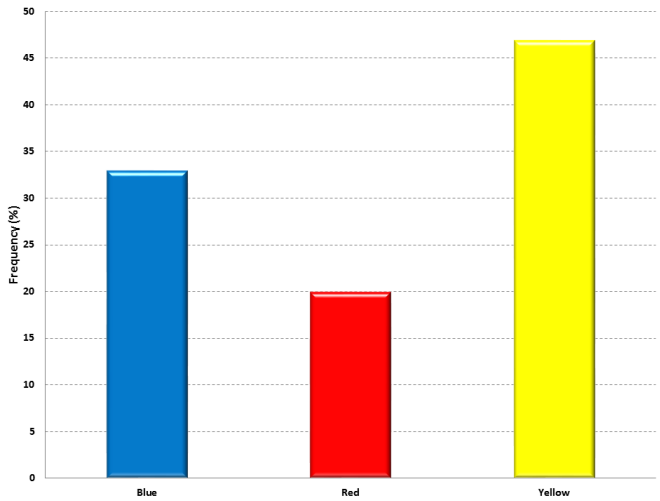

Fig. 9. Percentage of children's favorite colors for triangle.

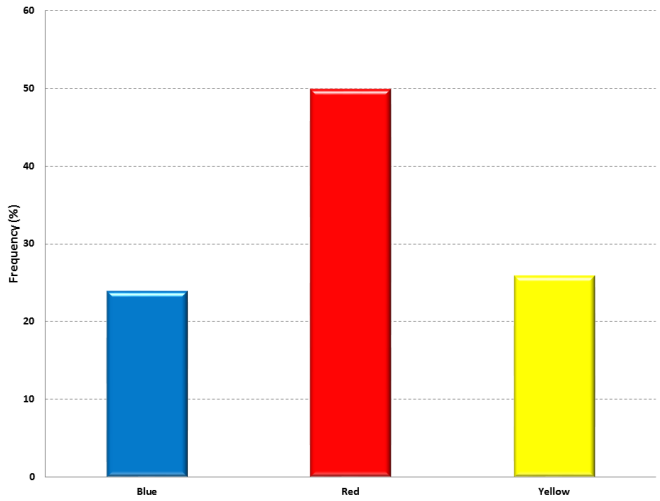

Fig. 10. Percentage of children's favorite colors for square.

In more details, adults might have a preconception about associations between primary colors and shapes due to noticing traffic signs during driving car, riding bicycle and so on. For example, in most of countries, the majority of traffic signs are triangle, square and circle, which are pained by red, blue, and red, respectively. Hence, adult might unintentionally select red for circle and triangle, and blue for square owing to their viewpoints on traffic signs.

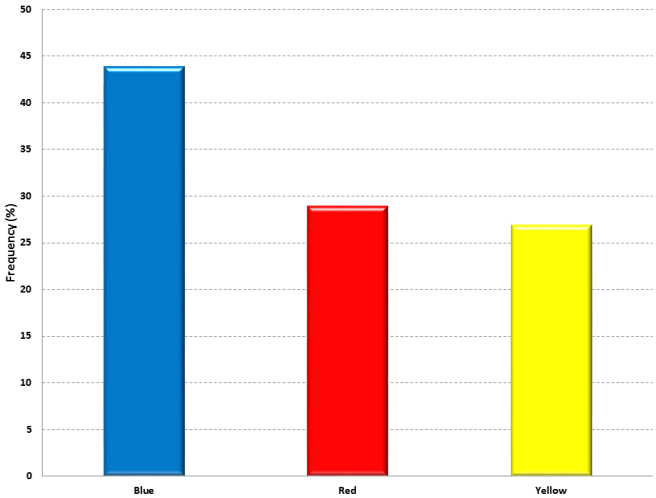

Fig. 11. Percentage of children's favorite colors for circle.

IV. CONCLUSION

In this work, two main goals were sought in order to acquire an adequate understanding of children's taste in painting kindergartens and geometric shapes. In more details, the first aim was to find children's favorable colors for painting classrooms, playgrounds, dining rooms and furniture; in addition, the second purpose was to investigate associations between primary colors and shapes from children's perspective. To do so, two hundred children between 4 and 6 years of age participated in this investigation including one hundred boys and one hundred girls. They randomly selected from eight coeducational kindergartens located in the Isfahan city of Iran. The results of the present study could be helpful to design an attractive kindergarten for children. The ensuing conclusions may be made from the results:

- Among primary colors of red, yellow and blue, red is more favorable for children so that its selection percentage is about 53%. Furthermore, blue and yellow are placed on second and third places, respectively by the percentages of 37% and 9.5%.
- Pink is the most favorable color by the percentage of 23% for painting classrooms of kindergartens. In addition, both red and blue are located on the second place by the percentage of about 17%.
- Colorfulness, pink and blue are three most favorable options by the percentage of about 15%, 15% and 12% for painting playgrounds kindergartens.
- The colors of red, yellow, pink and green are the most favorable colors for dining rooms. The corresponding selection percentage of each of mentioned colors is about 15%, 14%, 14% and 12%, respectively.
- Red, colorfulness and pink might be children's first priorities for the color of furniture by selection percentages of about 21%, 19% and 15%, respectively.

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- It seems that children do not like to see common colors of furniture such as black, brown and white in kindergartens.
- It is better not to use black and brown in kindergartens since generally, the lowest percentage of each part allocated to these two colors.
- The results related to color-shape associations revealed color-shape combinations of yellow-triangle, red-square, and blue-circle. This conclusion shows that color-shape combinations based on children's viewpoint are similar to Kandinsky's theory.

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