Color emotion as a feasible tool in a participatory project for a Primary School

Cristina Boeri[1]

[1] *Color Lab, Department of Design, Politecnico di Milano, cristina.boeri@polimi.it*

Corresponding author: Cristina Boeri (cristina.boeri@polimi.it)

ABSTRACT

The experimentation conducted during a participatory pilot research project in a Primary School in Milan, explored the use of emotional associations of color through the identification of evocative terms, or "emotion words", together with color combinations and images of projects in specific contexts, as a basis for comparison, discussion and verification, and, to conclude, for development of project hypotheses. Even if we cannot, on a numerical level, consider significant the reference sample used within the participatory process, both in the preliminary and in the verification phase of the methodological assumptions, the results of the experimentation led us to assume that the design methodology we identified and adopted proved to be functional in order to facilitate comparison and verification within the participatory process and subsequently develop design hypotheses based on the same comparison and verification.

KEYWORDS color emotion, color design, color preference, color in educational environments

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1. Introduction

The evaluation of the emotional response to color, or "color emotion", has been the focus of a great number of researches, and can be divided into two broad categories, as noted by Gao and Xin (2006): one related to the aesthetic experimentation of color, or color preference, which addresses the color evaluative dimensions, and the other related to the color descriptive dimensions, linked to connotations like warm or cool, light or dark, heavy or light, etc.

A few of these studies evaluated emotional color preferences and associations in children (Boyatzis and Varghese 1994; Burkitt et al. 2003; Pope et al. 2012). These studies suggested that the positive or negative emotions associated to color depended on the individual child's personal experience (Boyatzis and Varghese 1994). Children tended to associate their favorite colors with the positive characters of a drawing and the least preferred to the negative characters of a drawing (Burkitt et al. 2003) and also to associate their preferred colors with positive feelings (Pope et al. 2012).

In particular, the study of Boyatzis and Varghese (1994) investigated the color preferences in children aged 4-5 and 6-7 years, compared to nine different colors and the emotional reactions they had to each of these colors, expressed verbally. The study showed that the emotional associations elicited in the children by the selected colors were mostly positive. The percentage of positive emotional responses was higher for the bright colors (pink, red, yellow, green, purple, and blue) than for the dark colors (black, brown, and gray). The positive emotions mentioned by the children were codified as happiness, strength, and excitement and the negative ones as sadness, anger, and boredom (Boyatzis and Varghese 1994, p. 80).

Some of these studies focused on children preferences in pre-school indoor environments using, for this purpose, the image of a digitally manipulated school space to create different color alternatives (Read and Upington 2009; Dalirnaghadeh 2016).

In the study by Read and Upington (2009) the colors of the photographic image of an interior corner of a child development center were modified using the following colors: purple, blue, green, yellow, orange, red, and gray, of which, however, the various manipulation results were not provided, nor a more precise coding on the adopted lightness and saturation levels. The study showed that the red image was the most selected as a first choice, followed by the purple one, which was the favorite of the girls. The gray image was mostly selected as the last choice.

In the study by Dalirnaghadeh (2016), only the walls of the photographic image of the environment were modified using a high and low saturated red, a high and low saturated blue, and a high and low saturated gray (but since they were achromatic grays it would be more correct to say a light and a dark gray), and a white. The study showed that the high saturated blue was the most preferred and was associated with the positive emotion of happyness and the high saturated red the least preferred and associated with the negative emotions of anger (Dalirnaghadeh 2016, p. 80). As for the achromatic schemes, the results suggested that the most preferred classroom was the one with the white, which was associated with happiness, while the one with the high saturated gray was the least preferred, and associated with anger (Dalirnaghadeh 2016, p. 82).

Among the aims of these studies, we may also see the opportunity for discussion, with respect to the value of the context in which the preferences of color are expressed, and hence on the possible design implications related to this research area.

In the study by Park (2014), the correlations between color attributes and color preferences in children were analyzed using scale models of rooms. As stated by the same Park, compared to the numerous studies on color preferences that made use of small color samples, his study focused on the environmental effects of color through physical simulation models in order to investigate the color preferences in a real context.

As noted by Küller (1981), with regard to the studies conducted on color preferences, one of the most critical issues is linked to the fact that most of these studies are without contextualization, and the other to the fact that most of these studies focus on preference or meaning of single colors rather than color combinations.

This is the background to the experimentation we conducted during a participatory pilot project in a primary school in Milan, which explored the possibility of using emotional color associations, through the identification of connotative terms or "emotion words" to be associated with color schemes, and images of projects in specific contexts, as a basis for comparison, discussion and verification, and, as a final point, to develop of design hypotheses.

2. The pilot project "Let's design the school together"

The pilot project "Let's design the school together", concerning the participatory planning of the school environments of a primary school belonging to the

"Istituto Comprensivo Luigi Cadorna" in Milan, had as a main goal the identification of innovative criteria for the design and redevelopment of schools. The two-year long project was completed in 2018. The salient points of the design method adopted focused on a participatory planning with children, teachers and parents and a design by a multidisciplinary team of architects, designers and engineers [1].

The participatory project was carried out through design workshops with children and questionnaires addressed to children and adults [2]. The analysis of the state of the art and the results of the participatory methods produced a number of "design responses", regarding both the architectural works and the space refitting, and the qualitative interventions related to furnishing solutions, materials, light and color. The latter were developed for each individual area of expertise, and in working groups interspersed with moments of comparison and sharing [3]. Each work group was provided with a summary of the outcomes of the design workshops made with children and the project questionnaires, as a basis to create the design concepts that would later be submitted to the school community and, following discussion and verification, become project proposals.

Briefly, the school was built in 1932, and houses today a primary school and a preschool, which are part of the "Istituto Comprensivo Luigi Cadorna", plus a municipal micro-nursery. About 500 pupils attend the school, including primary and preschool. The building consists of three floors above ground and a basement. The access is from a raised ground floor where the office block and the meeting rooms, the kindergarten, the micro-nursery and one of the two gyms are located. On the first floor there are the classrooms of the primary school, the second gym, the laboratories and the library. On the second floor are the remaining classrooms of the primary, other laboratories, the literacy classrooms, a large multi-purpose hall and the school of Italian for mothers. In the basement there are the refectory and the technical and storage rooms, a small gym and a multifunctional space used for exhibitions, workshops, meetings, gatherings, parties, etc. The school is also equipped with outdoor spaces.

3. The color project and the design methodology adopted in the participatory process

The operative methodology explored within the participatory pilot project for the Cadorna primary school was based on the need, on the one hand, to translate the desires expressed or that could possibly be expressed during the participatory process and, on the other, to build a basis for comparison, discussion and verification on which to develop the design hypotheses.

Within the various questionnaires given to each work group in the form of a summary of the results, specific questions on color were provided. In particular, in the questionnaire relating to "My class" the children in a third grade class of an average age of 8 years, were asked to answer the question "Do you like colors?" and all the fourteen answers were positive. Another of the questions asked the children "What color would you like in your class?" and of the fourteen answers given, most expressed a preference for two colors (10), followed by a preference for single colors (3) and then for four colors (1). The overall results showed how the most mentioned color was light blue (Table 1).

6	5	5	4	3	2	1	1
LIGHT BLUE	YELLOW	WHITE	RED	GREEN	BLUE	PURPLE	BLACK

Table 1 – The color named by the children sample in answer to the question "What color would you like in your class?". (Multiple color choices are reported).

Other specific questions about color were addressed to the children of the same class, within the section of the questionnaire "How is your school when you enter the building?" One of the questions asked, "What color would you like to have in the corridors and throughout your school?" From the fifteen answers given, we observed that most children responded with a polychromatic meaning by repeatedly using the term "rainbow" (6) in addition to one answer that read "all" (1). The overall results showed that most children responded "rainbow" (6), followed by red (2 red, 1 dark red, 1 fiery red), sea green (1), blue and purple (1) (Table 2).

6	4	1	1	1	1	2
RAINBOW	RED	PURPLE	BLUE	SEA GREEN	ALL COLORS	OTHER

Table 2 – The color named by the children sample in answer to the question "What color would you like to have in the corridors and throughout your school?". (Multiple color choices are reported).

Within the section "What would I like to do at school?" there were other specific questions about color directed to the association between colors and particular activities such as studying, resting and playing (Table 3).

Therefore, the analysis of the questionnaire summaries offered us the possibility of assessing the children's

responses not only in terms of preferences accorded to a single color, but also in presence of recurring multiple choices of colors as well as of choices of multiple color combinations.

TO STUDY	(16 responses)			
8	7	3	2	3
RAINBOW | ALL COLORS | MULTICOLOR	RED	LIGHT BLUE	GREEN	OTHER
TO RELAX	(17 responses)			
8	4	3	2	2
LIGHT BLUE	GREEN	BLUE	YELLOW	OTHER
TO PLAY	(17 responses)			
6	6	4	3	2
GREEN	RED	BLUE	LIGHT BLUE	OTHER

Table 3 – The color named by the children sample in answer to the questions "What color would you like to have in your school to study?", "The color to relax?", "The color to play?". (Multiple color choices are reported).

This datum, together with the partiality of the rather small sample offered by the results of the questionnaires, inspired us to identify and explore a methodology that would allow us to base the design hypotheses not so much on the individual and specific color preferences detected and detectable but on the possibility of translating and summarizing the desires and suggestions expressed, specifically by children, through keywords associated to multiple color combinations.

3.1. *Method and materials*

The method we identified, consists (a) in the possibility to analyze and synthesize the recurring descriptions and suggestions given by the children in the questionnaires to express how they would like their school spaces to be in evocative terms or "emotion words"; (b) to associate the identified "emotion words" with 4-colors palette examples, suggesting possible application scenarios through the use of illustrative and contextualised images; and, finally, (c) to subject them to verification and discussion.

The analyses of the descriptions and suggestions most used by children in the questionnaires to express how they would like their school spaces were summarized in the "emotion words" soft, natural, warm and rainbow (Fig. 1). The first two referred to "The school I want" and hence they summarized the wishes expressed by the children about how they would like the spaces of their school to be. Instead, the word "Warm" referred to "The school as it is" and thus summarized a positive connotation used to describe how the school was perceived. Finally the term "Rainbow", in the double meaning of polychromatic and transformable, referred directly to the color preferences expressed by the children and to a recurring description they used to describe how they would like their school spaces to be.

Each of these "emotion words" was associated with an exemplifying 4-colors palette, and a specification of the hue, lightness and saturation attributes that eventually characterized the palette, using the visual representation of the NCS, Natural Colour System, color circle and color triangle. The palette was developed using as a reference source the literature and experimental research that addresses the synesthetic and emotional associations of color (Kobayashi 1991; Mahnke 1996; Tornquist 1999; Riccò 2005, 2008; da Pos 2007; Boeri 2019).

For each "emotion word", we suggested some possible combinations with materials, shapes and finishes (Fig. 2) and, in a additional table, we associated illustrative images, related to school environments, and selected for their affinities with the color palettes and the sensory characteristics described (Fig. 3).

Figure 1 – The "emotion words" that were identified to summarize the recurring descriptions and suggestions used by the children to describe the school spaces and how they would like them to be.

The illustrative tables prepared in this way were object of comparison, discussion and verification during a round table with students, teachers and parents and open to the territory [4]. In this phase of discussion and verification, new questionnaires were also prepared, and each work group was given the opportunity to formulate specific questions consistent with the different design approaches and methods adopted. In the case of color, the questions formulated were directed to verify the methodological assumptions and the design objectives and, therefore,

above all the selected "emotion words" and the proposed associations with the color [5].

SOFT	Children (5 responses)			
2	1	1	1	
WHITE	RED	BLUE	LIGHT BLUE	
SOFT	Adults (10 responses)			
4	3	1	1	1
LIGHT BLUE	PINK	WHITE	BLUE	YELLOW
NATURAL	Children (5 responses)			
3	2			
GREEN	LIGHT BLUE			
NATURAL	Adults (10 responses)			
7	1	1	1	1
GREEN	LIGHT BLUE	BLUE	BEIGE	BROWN
WARM	Children (5 responses)			
3	2			
YELLOW	RED			
WARM	Adults (10 responses)			
5	4	4		
YELLOW	RED	ORANGE		

Table 4 – The color named by the children and adults sample in answer to the questions related to the color associations with the selected keywords. (Multiple color choices are reported).

In particular, the participants were asked what color they associated with the "emotion words" soft, warm and natural. The questionnaire was completed by 5 children (belonging to the same third grade class who had participated in the previous questionnaires), and 10 adults (mainly parents of children attending the school). From the answers to the questionnaires filled in by the children, we could observe a congruence between the colors associated with the warm and natural "emotion words" and the suggested palette – for the warm, the most mentioned colors were respectively yellow and red and for the natural, green and light blue – while the association of color with the soft appeared to be more heterogeneous and there was no congruence with the suggested palette (Table 4). From the answers of the questionnaires completed by the adults, we observed an analogous congruence between the colors associated with the warm and natural "emotion words" and the suggested palette – for the warm, the most mentioned colors were yellow, red and orange, and for the natural, green – and a certain congruence with the suggested palette for the soft, as regards the parameter of lightness and saturation (Table 4).

Although the number of participants in this questionnaire should be considered rather small, we decided to proceed with the formulation of the design hypotheses, consolidating the identified "emotion words", and possibly rereading the related chromatic-sensorial scenarios, seen as flexible matrices on which we could develop the emotional identity of the environments and then combine this identity with other design implications related to the functionality of color in school environments.

3.2. *Design hypotheses*

The proposed design hypotheses dealt with logic of recognition of the different functional distributions in which the school plans are organized, and of the different sections in which the school plan is divided. Each section was characterized by the presence of a dominant color that made it recognizable among the others. That dominant, for the two floors housing the primary school classrooms, was identified in the conjugation of the two "emotion words" Warm and Rainbow, defining the following 4 colors to differentiate the four sections: yellow, orange, red, purple, while the basement was identified also by the "emotion word" Natural, in addition to the previous Warm and Rainbow, defining thus 4 other colors to differentiate the existing 4 sections: yellow, yellow-green, green-yellow, green (Figs. 4-5).

Within this logic, the design and illustrative hypotheses relating to the specific areas of the school were formulated. For example, within the standard classroom and relative relaxation area, it was foreseen that each dominant could be flexibly used according to different, potentially even alternative, distribution forms (Fig. 6). The color palette developed for the classroom was based on the "emotion word" Warm, while for the relaxation area there was a different color palette based on the two "emotion words" Natural and Soft, offering a different color saturation and lightness on the yellow-green and blue-green shades.

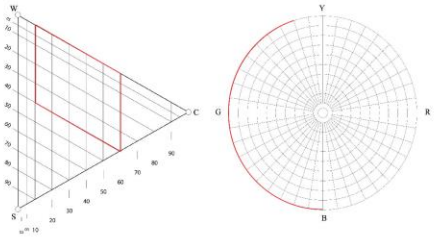
NATURAL

"Classroom of aquarium and plants"

But could you tell how the floor is made in the classroom and how would you like it?
Marble but I would like parquet. Marble and I would like aquarium. A rainbow floor.

How would you like to stay to be more focused and concentrated?
Within the grass. In the grass.

[The school I would like, Excerpts from the children's questionnaires]



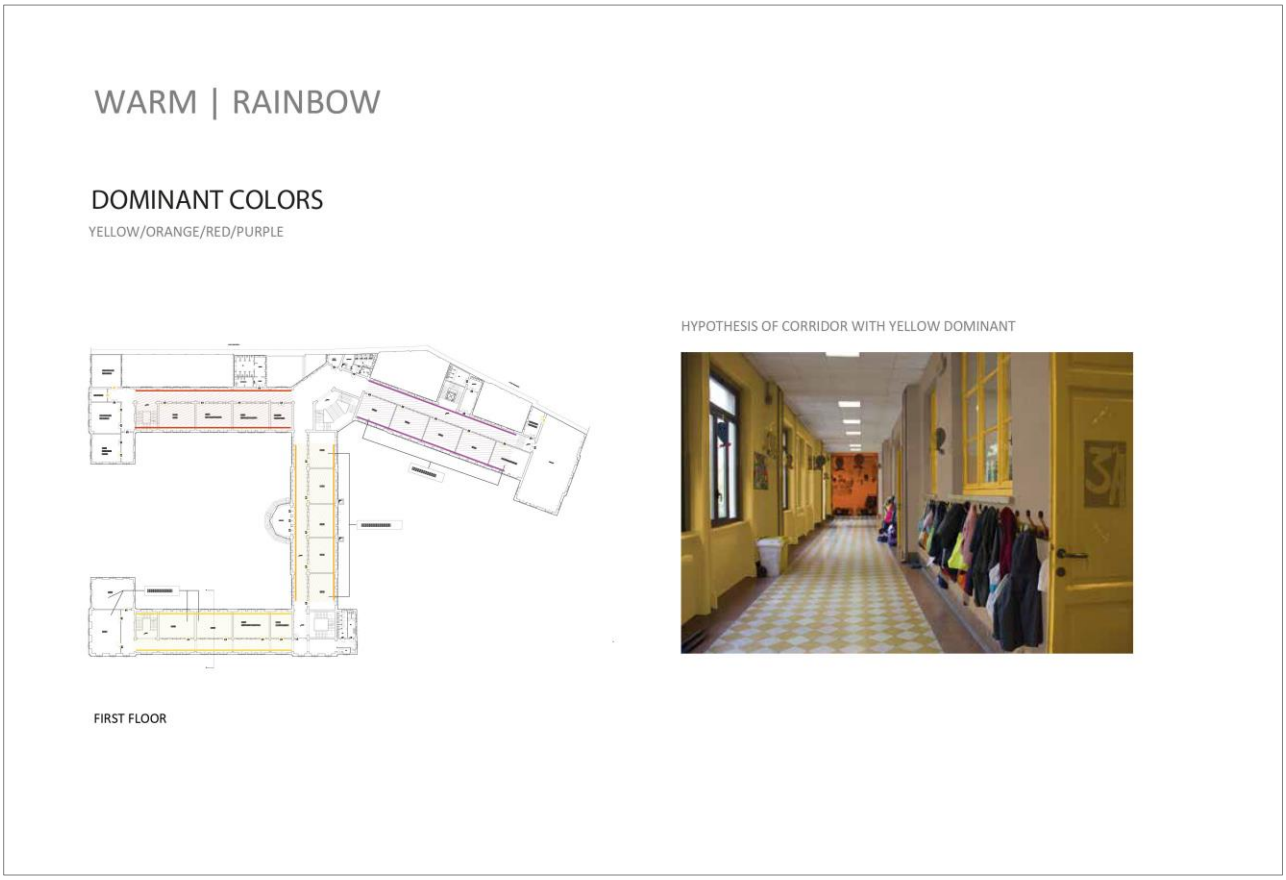
COLOUR	MATERIAL	SHAPE	FINISH
green blue-green	wood	organic	matte transparent

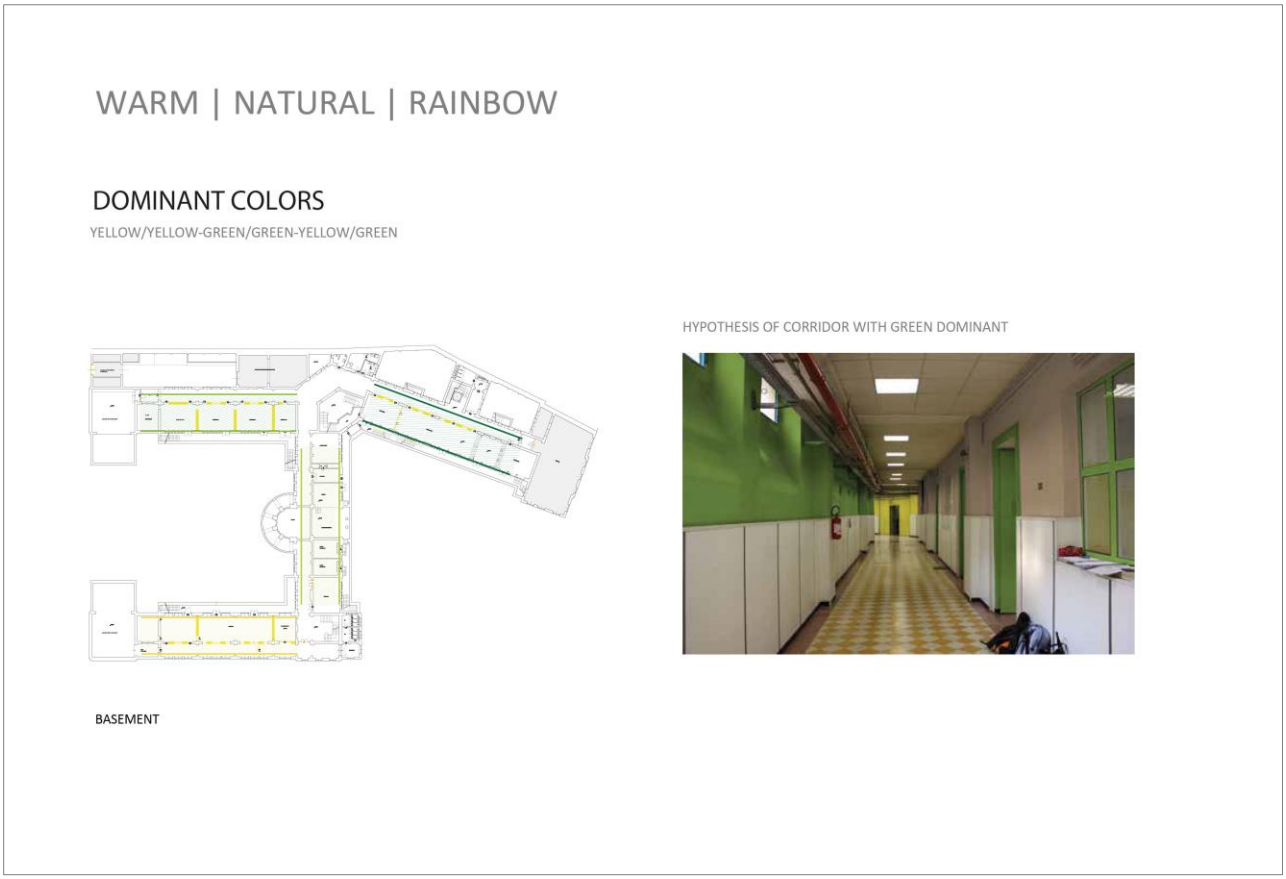
NATURAL

"Classroom of aquarium and plants"

Taktik Design, Sainte-Anne Academy, Quebec, 2015
McBride Charles Ryan, PEGS Junior School, Melbourne, Australia

Figures 2-3 – An example of the tables showing, for each "emotion word", the associations with exemplifying 4-colors palettes, the possible associations with materials, shapes and finishes and image examples related to school environments.





Figures 4-5 – The color concept developed for the Cadorna Primary School.

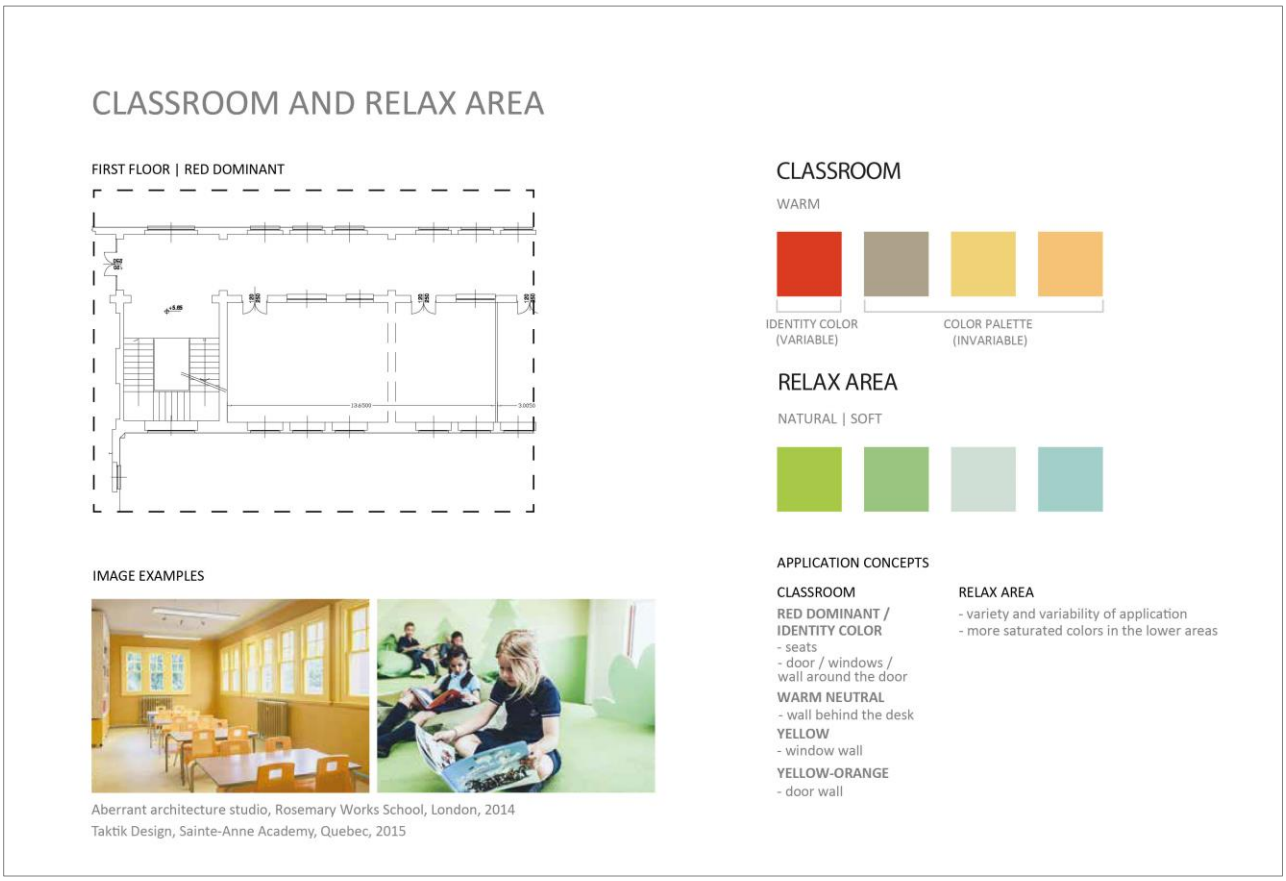


Figure 6 – The design hypotheses for the standard classroom and the relative relaxation area.

4. Results and discussion

The experimentation conducted during the participatory pilot project for the Cadorna Primary School explored possible design applications in the area of research called “color emotion”, having as a main goal the possible implementation of polychromatic settings in school environments based on color preferences and emotional responses. To this purpose, the “emotion words” we selected to summarize the most recurrent descriptions and suggestions used by the children involved to describe how they would like their school environments to be, turned out to be an optimal tool to build associations of color combinations, related to possible chromatic-sensory scenarios and illustrative images of real environments, as a basis for comparison, discussion and verification, and, therefore, for the development of design hypotheses.

Even if we cannot, on a numerical level, consider significant the reference sample used within the participatory process – both in the preliminary and in the verification phase of the methodological assumptions –, the results of the experimentation led us to assume that the methodology we identified and adopted proved to be functional in order to facilitate comparison and verification within the participatory process and subsequently develop design hypotheses based on the same comparison and verification.

The design implications raised by the experimentation contributed to frame color preferences and emotional responses to color in terms of combinations of multiple colors, and also highlighted the need, for the purposes of the possible design applications in this area of research, for greater contextualization, as Küller (1981) observed, also in reference to the preference accorded to the use of color combinations.

A second aspect raised by the experimentation was related to the possibility of using color preferences in order to promote a greater, and desirable, participation by children, in the design and configuration of school environments (Read and Upington 2009; Gaines and Curry 2011). In this experimentation, the role of color within the participatory process was understood on the basis of the attribution and association possibilities that can be established between the “emotion words” and the color-sensory scenarios. Thus attributing the function of conveying the visual, sensory and meaningful qualities upon which to build the emotional identity of school environments to color.

5. Conflict of interest declaration

The author declares no conflict of interest related to this publication.

6. Funding source declaration

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7. Short biography of the author(s)

Cristina Boeri - Architect PhD, her activity in the research, teaching and professional sectors, deals with aspects related to the color perception and design. Since 2001, she carries out educational and research activities in the Color Lab of the Department of Design of the Politecnico di Milano. She is adjunct professor of Color and perception at the School of Design, Politecnico di Milano.

Notes

[1] Project team: Arch. Cristina Boeri, Arch. Paola Branduini, Dr. Daria Casciani, Landscape Architect Gwenaëlle Charrier, Dr. Chiara Iemmolo, Arch. Francesca Lanz, Eng. Maria Gabriella Mulas, Arch. Ilaria Oberti, Landscape Architect Rosi Sgaravatti, Arch. Linda Poletti - Project Leader.

[2] The design workshops and questionnaires have been designed and edited by Linda Poletti.

[3] Working group for color: Cristina Boeri with the collaboration of Chiara Iemmolo.

[4] Round table "Let's design the school together", December 5, 2017, Aula delle Culture, Scuola Cadorna, Milan.

[5] The development, collection and synthesis of the questionnaires was edited by Linda Poletti.

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