Colour in the Schools

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ABSTRACT
During the Twentieth Century the debate on the use of colour in architectural design has been very significant. The outstanding contributions of Bruno Taut, the Bauhaus, the school of Ulm, Max Bill and many others have created a new conception of colour in architecture. The colour is not just the stationery of a surface, but becomes a real source of energy that can simulate sensations, images and experiences. A research on this matter, subject to a MSc degree, has been carried out with the mentoring of professor Pietro Zennaro. In this research were analyzed school buildings built between 2000 and 2009. The research aimed to identify the various types of application and use of colours in buildings with different levels of schooling. The analysis did not concern only Italy, but also Europe and some American significant buildings. The objective of this paper is to report some results of this research in relation to a correct approach to chromatic choices in school buildings.

Keywords: schools, colour, environmental quality

1. INTRODUCTION
Most of our life is spent in artificial environments: school, home or office. In these environments, where we can live and work with or without the sunlight, light-energy is frequently re-emitted by walls painted in white or with “no color”. This chromatic situation encourage us to seek a bit of color balance by the use of paintings or watching the scenery outside home. It does not seem distracting, but the attempt to satisfy a physiological need: in those moments our body is seeking the energy of color, with the same intensity that makes us feel the sense of hunger or thirst. The Italian law seems to leave freedom of choice about the color in the schools, so the colors applied are often the result of economical choices. The people involved in this process are often unprepared and unaware about the effect that color has on the psyche of the students. What was the teaching of the major schools of architecture on this matter? And what information can we draw from contemporary literature and from built architecture?
2. THEORETICAL CONTRIBUTIONS

Among the most reliable contributions on the color in the areas of education, we can find Jorrit Tornquist and Frank Mahnke. Their contributions contain general advice on what may be the more suitable choice of colors and lighting for the different functional areas that make up the school habitat.

The choice of colors and light must be made in relation to the age of the students. They think that the use of bright and warm colors for kindergarten and elementary schools is basic, because they have the ability to reduce the tendency of children to the tension, the nervousness and possible anxiety. Salmon clear, light and warm yellow, pale yellow-orange, coral and peach are the most suitable colors (Fig.1).

When the children grow up they have a greater need for concentration, so they need colorless lights and colors at low saturation.

For middle schools and secondary schools, they recommend the use of soft and cooler colors to recreate the effect of reactive liabilities, increasing the power of concentration. Featured colors are beige, light green, pale green and blue-green.

In the classroom, side walls and the bottom wall should have distinct colors. The purpose is to drive the boys attention on what they have in front and to rest their eyes when raising them up from the bench, giving them a clear color contrast between the blackboard, walls, materials and the teacher himself. The suggested colors for the sides and the bottom are: beige, sandstone and light brown. For the front wall: intermediate shades of green or blue.

In the recreational rooms recommended colors are extroverts because they help to project the emotions of children to the outside and can help them to dissolve nervous tensions.

Lobbies and corridors may have facing walls painted with different colors, making them wider and exciting. This feature facilitates the orientation.

Particularly among the lower classes there can be vibrant colors and in the case of a multi-storey school each corridor can be colored with different shades of color schemes that include complementary colors. The lighting should not be monotonous, but you need to create areas with different brightness.

The range of protective paint on the walls, contrasting with the color of the portion above, should reach a maximum height of the children sides so it can be bypassed psychologically and therefore not become overwhelming.

Gyms and laboratories must have no flashing lights because they are environments where you play fast movements. They recommend cool colors like blue or green.

For the reading rooms relaxing colors are recommended. They create a reactive effect of liabilities and increase concentration. Among the recommended colors there are: pale green and light green.

The refectories should be painted in clear and warm colors that blend in with the food and the incarnation. Direct lighting on the tables is preferred.

In general, it is recommended a full spectrum lighting: if not in the entire school building at least in the classrooms and lecture rooms. Any visual disturbance inevitably has an impact on school performance and increases children hyperactivity.
3. RESEARCH METHODS AND TOOLS

54 cases of architectural buildings realized in the period 2000-2009 were collected. After gathering as much information on each case, we proceeded to the classification. In each project were identified: authors, project description, colour variations, photographic detail and related bibliography. Each form was completed with a table of analysis, in which were recorded the colours of the space analysis and corresponding chromatic combinations.

The data emerged from this analysis were then collected and sorted in synopses. The first synopsis is composed of a first column representing the form number, in a second column they were listed the functional areas of the schools, a third column describes the type of chromatic combination (two, three, four colours etc...), in the fourth column there is the representation of the colours generating the chromatic contrast. In the fifth (and last) column were listed the different shades of gray.

The individual functional areas of the schools were then summarized in a subsequent synopsis, such as to obtain a summarizing chart of the chromatic combinations and a graphic summary of the colours, ordered by Itten’s colour circle. These values were expressed as a percentage. In Itten’s colour circle, the shades of gray are not represented, which is why the graphs of colour comprise a first portion in which there are white and black and related shades in between.

4. RESULTS: KINDERGARTENS

15 case studies were taken into analysis:
From the investigation it could be argued that the main used color combination is three-colors, 54% of total. The different percentages of the overall graph shows a high use of white (28%) and shades of gray, followed by smaller percentages of beige, orange-red, purple, blue, blue, yellow-green and yellow. The graphs for specific functional areas have shown that:

In the rooms used for didactic activities, applies a 32% of white and follow different shades of gray. The practice recommend the creation of warm yet vibrant environments with the use of colors at low saturation (Table 1).

In the spaces for free activities and in recreational spaces is preferred the adoption of high-white (24%) and follow different shades of gray. For the recreational use it seems advisable extroverted colors, but it is important to take care of those colors that can create excitement, as the effect produced by the reds. It seem preferable the use of cool colors such as shades of blue and green.

The refectories are white (15%) and gray of different grades. Following are the beige and shades of green-yellow. It seems necessary that these spaces are clear and the colors harmonizing with the flesh and the food.

For connectors and services it prevails the use of white (25%), gray, beige and green of clear tonality. The range of colors recommended for these areas is varied. The colors are bright with the walls facing each other in different colors, making them more exciting and encouraging the guidance. Color schemes that include complementary colors seem more appropriate (Fig.2).

Even in areas for assistance, seems to prevail white (31%), light gray (13%) and following the most intense colors of gray, beige, green and green-yellow. These environments should be extroverted and, at the same time, comforting.

5. RESULTS: ELEMENTARY SCHOOLS
15 case studies were taken into analysis:
From the analysis obtained by the survey it could be argued that the main used chromatic combination is three-colors with 51%. Regarding colors, the chart shows a general high application rate of white (32%) and shades of gray, followed by lower rates of beige and ocher, red, blues, greens and yellows.

The graphs for specific functional areas have shown that:
In the spaces for educational activities, the results show a widespread use (22%) of white and grays. It seems more appropriate the use of cool colors and slightly saturated because they increase students concentration (Table 1).

<table>
<thead>
<tr>
<th>Colours in Areas for Educational Activities</th>
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</thead>
<tbody>
<tr>
<td>Kindergartens</td>
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<tr>
<td>Elementary Schools</td>
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<tr>
<td>Middle Schools</td>
</tr>
<tr>
<td>High Schools</td>
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Table 1
Percentage of colors found in the case studies. Areas for educational activities divided by school level.
In the spaces for physical education, there is a considerable use of white (26%), but in particular the gradation of clear gray rather than dark, followed by shades of orange and green. It seems advisable the use of cold colors like blue and green, because they have a relaxing effect (Fig.3).

In the spaces for collective activities, which include several features including spaces for tables and libraries, there is an extensive use of white, gray, beige and green. It would seem preferable the use of soothing colors such as pastel green and cold, creating the effect of liabilities and increasing concentration.

For connectors and services there is a great use of white, gray from different shades, beige hues of ocher and blue colors (Fig.4).

In the spaces for complementary activities, the results show a wide use of white (23%) and gray, along with a wide variety of shades of beige, green and blue. It seems advisable to use bright and extroverted colors.

6. RESULTS: MIDDLE SCHOOLS
12 case studies were taken into analysis:
From the analysis obtained by the survey it could be argued that the most used chromatic combination is two-colors with 56%. Regarding colors, the chart shows a high percentage of overall use of white and shades of gray and black. Increased use of shades of beige and ocher, followed by red, purple, blue, green and yellow.

The graphs for specific functional areas have shown that:
In the spaces for educational activities, there is a wide use of white (21%) and shades of gray. It seems preferable the use of cool colors because the students concentration increases (Table 1).
In the spaces for physical education there is a large percentage of white (15%) and shades of gray, as well as a high percentage of beige and ochre corresponding to the floors that tend to be covered with wood or linoleum. Cool colors seem advisable for relaxing.

In the spaces for collective activities the results show a high percentage of white (15%) and shades of gray next to black. There is a good percentage of green and yellow.

It seems advisable to use cool and relaxing colors that create the effect of liabilities and students concentration increases.

In the connectors and services there is a wide use of white (20%) and shades of gray. We noticed a good percentage of dark red and greenish-yellow. The range of colors recommended for these areas is varied. The colors are bright with walls that face each other in different colors, making them more exciting and encouraging guidance.

In the spaces for ancillary activities, there is a wider use of white (21%) and shades of gray. There is also a good percentage of beige, purple and blue. It seems advisable to use bright and extroverted colors.

7. RESULTS: HIGH SCHOOLS

12 case studies were taken into analysis:

From the analysis obtained by the survey it could be argued that the most used chromatic combination is two-colors with 48%. The graph shows an overall high employment rate of white (32%) and shades of gray and black, followed by shades of beige, burgundy, green and yellow.

The graphs for specific functional areas have shown that:

In the spaces for educational activities there is a wide use of white (32%) and shades of gray and black, with beige and orange-red (Table 1).

It seems appropriate the use of cold colors because they increase the students concentration.

In the spaces for physical education, there is a large percentage of shades of gray and beige (23%), followed by a good percentage of red and blue. Cool colors are recommended for relaxing.

In the spaces for community activities there is an extensive use of white (30%) and pale gray, such as a good percentage of beige, orange-red, red and green.

In the connectors and services there is a wide use of white (29%) and shades of gray and black, as well as a good percentage of beige and orange-red. The range of colors recommended in these spaces is varied. The colors are bright with walls that face each other in different colors, making them more exciting and encouraging orientation.

In the spaces for ancillary activities, we have found a wide use of white (29%) and shades of gray. There is also a good percentage of red. It seems advisable to use bright and extroverted colors.

8. CONCLUSIONS

Although in the research results many colors are represented, white is the most used, with high rates for all functional areas of the schools. White certainly contributes to make the environments brighter and lighter. White at the same time is a neutral color, sterile, leading to the determination of anonymous environments, devoid of stimuli. According to Frank Mahnke “an impersonal environment always induces a reaction. In this case a classroom, poor of visual
pleasures or manifestation of care towards the children, drives the feelings of the latter toward irritability and restlessness" Mahnke [3]. That's why leaders in education must become aware that a school, besides having a structure suitable to the function which was designed and respects the rules, must be an environment that is conducive to the balanced development of the citizens of tomorrow. A correct approach to the use of color in these places is certainly interesting, if not necessary.

REFERENCES