Primary school is where a child first begins his or her education. It is here, after kindergarten, that a child’s early childhood education begins. After kindergarten, most students must learn to function in a new community and in a new space (completely different from the one they have known before).

Currently there are not many new primary schools in Wroclaw. Most of them are located in existing buildings. These objects do not have a consistent visual identity in the interiors. Each building is shaped separately and freely. Taking into account these conditions, in 2016 Wroclaw Contemporary Museum, E. Geppert Academy of Fine Arts, Institute of Psychology at Wroclaw University, Tekturowo – Katarzyna Bury and Wroclaw Teacher Training Centre came up with a project for principals and teachers of primary schools, entitled: “Constructing cultural educational space” [1]. The aim of the project was to initiate the process of conscious shaping of aesthetic and cultural policy in Wroclaw primary schools, as well as to draw attention to the need to redefine the space for creative and imaginative work with children.

This article presents a key part of the idea of transforming the common space in school facilities using selected forms of artistic expression such as colour. For this purpose, Maria Dąbrowska Primary School No. 1 in Wroclaw was chosen. However, the developed design of changing the colours has not been implemented so far.

The results of a study conducted by researchers from University of Salford published in 2015 presented what factors affect the perception of space and thus the behaviour of a student [2]. They took primary school students under observation. They studied not only the impact of the school environment on students’ behaviour but also on their learning ability and quality of education. After the research, two types of students were selected: those associated with the school space (mega-space), and those associated with the classroom (micro-space).

The same researchers also selected factors influencing the perception of space. They divided them into three groups: natural, such as light, temperature, air quality; subjective: sense of ownership and flexibility of space; stimulating: complexity of solutions, colour. Figure 1 shows the extent to which they affect students. It shows that the most important are natural conditions, and the perception of space is especially influenced by natural light (in 21%). Colour turned out to be the most stimulating factor for the student [2, pp. 8–15]. Most of these factors can be controlled through proper space design. It would seem that regardless of what colour and in what proportions it is used in the space of a school or class, it will have a beneficial effect on us in the same way. The first documented studies on the influence of colour on human behaviour appeared in the 1840s [3], but they did not concern primary school students directly. This topic was also dealt with by Professor Andrew J. Elliot from the University of Rochester, who in his publications deals with the subject of colour and its influence on human behaviour. In one of the works entitled Historically based review of empirical work on...
Human perception of colour is a phenomenon that combines two opposing disciplines – science and art. Depending on which discipline we use to describe it, we will have a different point of view and reference. It was not until the 19th century that an attempt was made to organize the phenomenon of colour perception in a scientific way. Among contemporary art historians dealing with colour, we should mention John Gage and his work *Colour and Culture: Practice and Meaning from Antiquity to Abstraction* [9]. He describes the meaning of colour, colour theories and the way it was perceived in different periods and cultures as well as in different fields of art. The knowledge of colour until the 19th century was applied in an intuitive way based on the experiences of past epochs and artists. The colour theory is interdisciplinary – it defines the phenomena of seeing colours on the ground of many sciences like physics (optics), chemistry, biology and psychology, but also on the ground of art, experiences and theories of many artists, painters, as well as many others. Colour can be defined in various ways as a phenomenon that is scientific and physical (wavelength and frequency of vibrations), psychological (dominant wavelength, purity, photometric quantity) and artistic, which is the most subjective of all because it depends on the viewer, his cognitive abilities, biological conditions, as well as his own subjective sensual and extrasensory perception, up to and including the phenomenon of synesthesia [10, pp. 35–40]. The feeling of colour and its perception depends on the perception of the world which is the result not only of visual experience but also of cultural experience, knowledge, but above all of individual sensitivity. This phenomenon is uncountable and difficult to examine objectively [11]. We can talk about colours in a subjective way, but also use the observation of their influence on our mood as a more objective tool of analysis. There is a cultural norm that warm colours are psychologically “active” and cool colours are “neutral”, while bright colours are “light” and dark colours are “heavy” and depressing [12, pp. 221–227]. In order to assign a colour in space we must consider it as a surface colour. It is the colour that appears on the surface of an object, constant and unchangeable, but its reception depends on many factors such as lighting, the background on which it appears and the texture of the surface [13].

**Meaning of colour**

All colours interact. The first attempts to create a colour wheel were made at the beginning of the 17th century by Aron Sigfrid Forsius. The most perfect scale is considered to be created in 1704 by Isaac Newton, which he placed in his work *Opticks* [14] (Fig. 2). It shows the basic colours that will be used to further analyse the influence of colour on the student’s behaviour (Fig. 3).

In the discussed project for analysis the influence of colour on student behaviour and the space in which the selected colours could be located, colours defined as chromatic primary and complementary were used, such as red, orange, yellow, green, blue, indigo, purple, and achromatic colours – grey, black, and white.

**Red**

It is the first colour that appears in the language of colours after black and white. It is the colour identified with fire, blood and also love. It is the colour full of emotions.
In Roman mythology, it is considered to be the colour of aggression, associated with the masculinity of the god Mars and the red planet. Aristotle places it just after the colour of light. Red combined with gold enhances the feeling of joy [16, pp. 47, 48].

Red is the colour associated with strong behaviours such as excitement, simulation, emotionality, passion, energy, agitation, but it also has negative tones such as aggression and intensity. It is the dominant colour over all colours, optically it appears closer than the others [17, pp. 38–40]. This colour, due to its energizing nature, should be used in outdoor spaces, gardens, where the stimulation of children is not a problem, quite the opposite [16, p. 130].

Orange

It is a combination of two primary colours, red and yellow, also in terms of their emotional significance. It is a positive colour in which yellow loses its beneficial brightness taking away from red its positive passion. It is the colour of good destiny. It is associated with the ripe fruit of late summer and the colours of autumn [16, pp. 50, 51]. Orange is the colour of balance between the vibrant red and the intellectualizing yellow. It stimulates the nerves and supports coping with emotions. Its shades evoke excitement, stimulation, joy, it causes a positive attitude, and energizes in a more subdued way in contrast to red [17, p. 40].

Due to its positive emotional colouring it can be used in workplaces, workshops, laboratories, cafeterias and gymnasiums [17, p. 130].

Yellow

It is the most joyful of all colours. It is associated with the gold colour and has a similar meaning to red, but is not as exciting as red. Yellow is the symbol of enlightenment. It is the brightest of all colours [16, p. 48].

Yellow is the colour of the mind. It is the colour of the sun, which stimulates and allows us to develop our mental abilities. Yellow stimulates our nervous system and allows it to relax and make it easier to solve problems. It also deflects negative emotions. Its emotional tone is positive and evokes joy, encourages and inspires [17, pp. 40–43].

It should be used in the entrance area, where it will initially awaken positive energy and inspire further creative work, and in verandas. It can also be used in classrooms, staff rooms and art and music rooms [16, p. 130].

Green

This colour combines the contemplative meaning of blue with the sense of happiness of yellow giving green symbolizing hope. It is the colour of hope, promise, expectation of happiness and good news. Green is bright, warm, it is a symbol of new life and nature awakening every spring. The secondary colour created from mixing green orange and purple is considered the most positive of all [16, pp. 49, 50].

Psychologically green is a colour that allows you to calm down, cut off from stimuli, it is also the most calming colour for our eyesight, affects our circulatory system by lowering its pressure. It is a symbol of nature, the human living environment. It is also the colour of balance in the colour wheel located opposite the red and purple. It gives a sense of equality between the material and spiritual worlds. Green strongly determines the feeling of harmony and peace in space. However, not all of its shades are so positive for our body. In the case of shades with low light saturation and cold colour temperature, they evoke completely opposite impressions. They are associated with
In some cultures it is a symbol of mourning. Black is an exclusive character. In a school the only place where this colour is used is in the lab and, like in the case of yellow, classrooms, staff rooms, music and art rooms [16, p. 130].

Black

This colour starts the colour scale. It is considered a negative colour but in combination with other colours its meaning depends on the context and can have a positive aspect. Generally black represents chaos, darkness and at the same time pure potential. In some cases it gives things an exclusive character. In a school the only place where black can be used as a dominant colour is the theatre room [16, p. 45].

White

It is the brightest of all colours and draws its radiance from the sun, which symbolizes mystical illumination. White because of its close proximity to yellow draws its joyful character from it. It is a symbol of purity [16, p. 45].

White is the colour that provides the most reflection of the visible spectrum. The perception of this colour is variable, it depends on the context and colours in its vicinity. White used in rooms gives a sense of neutrality, purity, sterility. It is also a background for other decorations [17, pp. 46–48].

**Principles of colour composition**

When designing the colour scheme of the school, it is necessary to pay attention to several important aspects. It is necessary to combine the architectural idea with the colour proposal of the interior. They should harmonize with each other, not compete, according to the principle that [...] different colours should be mixed in such a way that the painted object, viewed from a distance, gives the impression of balance [18, p. 26]. At the same time, they should reflect the function of the space. Colour should be used to aid the development of form and to help distinguish between objects or their parts or functions [18, p. 25]. There are several factors that influence the perception of a colour effect:

- size and proportion of the room – spaces that have a light coloured ceiling appear taller,
- rhythm, patterns, texture and structure – the use of colour when using a strong pattern can neutralise its rhythm,
- size and location of the coloured areas – warm colours on walls with a cold background will have a positive effect. If the area of the wall in relation to the rest is significantly smaller, then we should intensify the colour to get the same effect as on a large area,
- orientation in relation to daylight – the perception of colour depends on the location of windows in relation to the directions of the world and the availability of daylight,
- surface texture – the same colours will be perceived differently on different textures,
- dominant colour – introduce dominant colours to harmonise the space [18, pp. 59–62],
- the use of colour is intended to support the effect of light and shadow,
- primary colours should be used on the higher parts of the object, while secondary and tertiary colours should be used on the lower parts,
- colour planes should never overlap [18, pp. 25, 26].

Knowing the basic principles of composition and the importance of colour and its effect on us, we can easily choose the appropriate colour palette for a given school, taking into account the functions to be found in the space. In addition to the principles of composition and appropriate selection of colours, cultural considerations should also be taken into account when designing a colour scheme.
The use of colours in school interiors.

Case study

In Poland we have become accustomed to the lack of colour in the school space or its small amount, which completely does not correspond to the function in a given space. Most of the currently existing schools built before the 1990s do not take into account colour as a factor influencing student behaviour. At that time, knowledge of this subject was scarce, not easily accessible, and if it was, it was a difficult subject to push, and the effects of colour were rather the result of many subjective factors, sometimes only intuitive awareness of the creation of space favoured the appropriate choice of colours. Recently attention has been drawn to this issue; however, it is still done practically without deeper analysis, only on the basis of a certain sensitivity and intuition of the designers. When designing new school spaces it is easy to introduce the correct colours for the relevant spaces, all that needs to be done is to carry out a detailed study of the function in the space and the appropriate choice of colour for it, taking into account the basic principles of composition in the design phase.

There are many schools around the world that are incorporating the principles of colour composition, although there are still far too few of them. Worth mentioning here are some well-known examples such as Cassata Primary School (Bogotá, Colombia), Anglo-Colombian Primary School (York, Pakistan), Kirkmichael Primary School (Blantyre, South Lanarkshire, Scotland) and The Sheikh Zayed Academy (Abu Dhabi, Emirates). Approaches to using colour in teaching spaces may differ, and sometimes only intuitive awareness of the creation of space was a difficult subject to push, and the effects of colour were rather the result of many subjective factors, sometimes only intuitive awareness of the creation of space favoured the appropriate choice of colours. Recently attention has been drawn to this issue; however, it is still done practically without deeper analysis, only on the basis of a certain sensitivity and intuition of the designers.

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Over the decades, successive layers of these paints were applied, only the shades were changed, the colours of the woodwork were altered, and the brick details of the corners, pilasters, and reveals were lost under the layers of paint, depriving the building of its unique expression. Old paint coats of the interiors are now also made in oil painting technique in yellow and bright yellow colour. They were made on plastered surfaces as well as on brick pilasters and corners of corridor walls and brick reveals.

In order to reintegrate the colour scheme of the interiors, it is necessary to remove the secondary layers of paint with particular emphasis on the conservative cleaning of brick reveals and pilasters. Also plastered surfaces should be cleaned of secondary oil paints, mainly in yellow colour.

In the corridors, a new coat of paint in the colour of broken white (RAL 9002) is proposed, with a distinction of the historical dado zone to a height of about 1.3 m and the upper part of the wall. It is proposed to make new coatings with mineral paints of grain matching the historic plaster and paint. The dado area should be additionally covered with washable paint ensuring the possibility of keeping the surface clean. After conservator’s cleaning, the brick faces of the pilasters, reveals and corners should be protected with an impregnating preparation which makes it possible to preserve the natural colour of the brick face and protect it against soiling, making it easier to keep the brick surfaces clean. It was also planned to clean the steel balustrades and to reconstruct the historical colours oscillating in shades of warm grey. An analogous procedure was to be applied to the door joinery. In this case, it was proposed to standardize the paint coating in grey (RAL 7035), due to the internal variation and lack of information about the original (not preserved) colour of the door frames. Other surfaces, such as terrazzo floors and steps should be preserved and left without colour changes.

Elements of furniture such as pouffes, foam blocks and seats have been proposed as colourful elements in the interior, which can be freely used in the space depending on the needs, bearing in mind the requirements concerning fire protection of escape routes. Therefore, these elements should be located outside the escape routes, and the materials from which they are made should be at least fire retardant and non-flammable. Such an assumption allows for creative play, activates imagination and adaptation of common spaces to the given moment. Based on the information received about the layout of rooms in the school, an analysis of the functional-spatial layout was carried out.

**Ground floor**

On the ground floor there are: a porter’s lodge, a library, a common room, a canteen with a kitchen, a sanitary facility, a principal’s office, a secretary’s office, a school pedagogue’s room and an accounting office. This zone is generally accessible to everybody, unlike the other floors. Due to the public character of this storey, the colour scheme should remain neutral, in this case grey is proposed. Chromatic elements may be used to complement the interiors of such rooms as the cafeteria (orange), the library (blue), the teacher’s room (green). Other rooms should keep neutral colours, i.e., grey and white. The entrance area is currently a place of information for visitors and parents. Unfortunately in front of the main entrance there is an extremely unsightly main energy distribution board of the building, which dis-harmonises the space. It is proposed to cover this wall with perforated non-flammable composite panels in white colour according to the accepted colour scheme. It will be a place where information will be located, as well as the plan of the building with the projections of individual floors (Fig. 5). This place is to be a kind of signpost facilitating moving around the facility.

**1st floor**

On the 1st floor there are rooms for children from the elementary education (grades 1–3) and sanitary facilities. In order to encourage children to play and stimulate them to engage in creative activities, the yellow colour (RAL 1018) has been proposed (Fig. 6). It is associated with sunshine and joy, it is another element important at this age because it is often difficult for such young children, especially during their first days in a new place, to stay without...
their caretakers. It allows them to dismiss negative emotions. At the same time it is not as intense as the red colour.

2nd–3rd floor

On the following floors there are classrooms for children from grades 4–8. On the 2nd floor there are classrooms for Polish language, mathematics, science, history and sanitary facilities. For this floor the colour green (RAL 6018) was chosen, which is the colour allowing to calm down and concentrate, giving the feeling of harmony (Fig. 7). On the top floor there are rooms for German, English, art and music classes, a computer lab, speech therapist, auditorium, psychological-pedagogical consulting room and sanitary facilities. The colour which best suits this functional arrangement is blue (Fig. 8). Similarly to yellow, it is relaxing, evokes the feeling of comfort and at the same time it is an inspiring colour.

The staircase is an important element connecting the floors with each other. On the landing there are modern cast iron radiators which cause spatial dissonance. In order to reduce this feeling, covers have been designed in the form of cuboids made of perforated composite panels in the colour corresponding to the particular storey they lead to (Fig. 9). This is another element serving the purpose of visual identification, which is to facilitate moving around the school.

Conclusions

Colour is very important in our lives. Often we do not even realize the role it plays in our daily perception of the world and the effect it has on our well-being. School education is a very important event in the life of a child, especially in primary education. Here in particular, it is important to facilitate a good start for children in a new space by designing harmonious interiors adapted to the development of children, rather than hindering their entry into a new, supra-primary community, through disharmonious school spaces that make integration, learning and various activities difficult, as it is often the case in Polish...
The project “Constructing cultural educational space” was a starting point for further considerations on this subject. During meetings with teachers and headmasters, a discussion was opened on the subject of colour in the school space. They pointed out that it is possible, at a low cost, to create a harmonious space in which it will be easier to move around, and at the same time it will have a positive impact on student behaviour. Maria Dąbrowska Primary School in Wrocław can become an example of introducing colour to a historic interior, taking into account its influence on the behaviour of the student and on the consistency of visual identification. However, due to high costs, the project is waiting for implementation.

Creating a template and a catalogue of good practices for designers seems to be a good and necessary postulate. Of course, individual needs and conditions should be taken into account because it is impossible to create a universal template for all schools. However, knowing the impact of colour on the psyche of children, we can shape their behaviour through the appropriate selection of colours. As shown by a study conducted by researchers from Stanford University, a well-designed educational space can increase the efficiency of students, even by 16%. For this reason alone, it is worth creating a space that is friendly to students and all users of the facility. Colour schemes can also be transferred to other areas of architecture, not only to educational space, but also to public buildings.

Translated by Biuro Yellow, Wrocław
The article discusses general issues related to creating the space of educational objects in terms of colour. The perception of school space is influenced by many factors such as light, temperature, air quality, space flexibility, sense of belonging, space complexity and colour. The latter plays an important role in the perception of rooms and influences human behaviour, because apart from sound and smell, it is one of the most important stimuli perceived by our brain. Nevertheless, most of the existing schools in Poland which were built up to 1990 do not take into account colour as a factor influencing student behaviour. This issue has only recently received attention. This article presents a case study of Maria’s Dąbrowska Primary School No. 1 in Wrocław. For the needs of this school, as part of the “Constructing Cultural Educational Space” program organized by Wrocław Contemporary Museum, a project was prepared to introduce colour into the interior while maintaining the historical character and substance of the object and taking into account the influence of colour on the child’s psyche. The presented interior rearrangement project may become the beginning of further research on the issue of colour and its role in shaping educational spaces.

**Key words:** colour, primary school, composition.
