

# Study of Selected Components of Architectural Environment of Primary Schools - Preferences of Adults and Analysis of the Specialist Literature

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**Abstract.** The school is one of the oldest social institutions designed to prepare a young man for an adult life. It performs a teaching and educational function in child's life. It is a place where, apart from home, the child spends most of the time in a day, therefore it is one of the most important institutions in the life of a young person. The school environment has a direct impact on the student's personality and ambition, and it shapes an attitude of the young person. Therefore, the design process preceding the establishment of school facilities is extremely responsible and should be conducted in a conscious and thoughtful way. This article is a summary and an attempt to synthesize the data obtained from the survey carried out by the author in the context of the design guidelines contained in the specialist literature. The questionnaire survey was designed to make an attempt to determine adult's preferences, opinions and perceptions about selected components of the primary school environment, including the factors which determine the choice of school for children, the priorities of architecture components made for early childhood use, also to specify the type and the scale of existing drawbacks and problems in the school construction industry, as well as expectations about the contemporary architecture of primary schools and its future changes. Moreover, in the article, based on the analysis of the available specialist's literature, the following are broadly discussed: the general division and characterization of school spaces, issues related to the influence of selected components of the architectural environment on the physical, mental and psychological safety of children. Furthermore, the author raises the subject of the influence of the architectural interiors and furniture on the mood, emotions or comfort of children in the early school age, based on the anthropometric characteristics of children and issues related to the perception of space with an extra attention on the subject of perception of colours and the influence of the architectural space components on the frame of mind, fettle or comfort of children in the given age. Although there exists a limited body of literature on the subject and the results of the study show that the aspects of elementary school architecture relevant to adults, including parents of children, are different from those described in the literature, the analysis was necessary to show these differences and to highlight the different values and priorities of users and designers. The paper is also an introduction, which identifies qualities and social preferences on educational architecture, to the deeper research aimed at developing the criteria of designing and shaping the architectural environment for primary school children, which takes into account the regularity and developmental needs of children at studied age.



## 1. Introduction

Over the last century, children have acquired many rights and privileges justified by their age. Today, society is paying ever more attention to the nature of the environment, including the architectural space, which is designed exclusively for children. This is, first of all, related to the increase of the professional activity of women and consequently the need for institutions outside the home circle to take over looking after children. Second, thanks to scientific research and the advancement of science related to environmental psychology, the adult population's knowledge and awareness of the importance of the environment for the development of children at a given age has grown.

The school is one of the oldest social institutions designed to prepare a young person for adult life. It plays an educational and upbringing role. It is a place where children spend most of their day outside the home; therefore, it is one of the most important institutions in the life of a young person. The school environment has a direct impact on the development of the pupil's personality and ambition, and thus the young person's attitude. This is why the design process preceding the establishment of school facilities is extremely responsible and should be conducted in a conscious and thoughtful manner.

## 2. Selected components of the architectural environment of primary schools - an attempt to specify the preferences of adults based on the author's survey studies.

### 2.1 The purpose and description of the study

Apart from internal factors such as genetics, external factors also influence the child's development. Depending on the values recognized in a society, an environment is created for teaching and strengthening desirable traits, skills, and behaviours. Taking into account social norms and culturally defined principles, the architectural environment's impact on the child is determined primarily by the perceptions of adults. Due to the desire to create an appropriate architectural space for children, the author has attempted to set preferences and priorities of adults concerning selected components of the architectural environment addressed to children at early school age. In the following paragraphs, the author will present a summary and synthesis of survey data containing questions on general information about the surveyed entity, its current relationship with the architectural environment of primary schools, as well as preferences, priorities, feelings and observations related to its selected components. This is also a way to identify the values and social preferences for research designed to elaborate criteria for shaping the architectural environment for children at an early learning age, taking into account the developmental regularities and needs of children.

The study conducted using a survey questionnaire composed of 25 questions aimed at attempting to identify the preferences, opinions and perceptions of adults on the selected components of the primary school environment; this included finding the factors which determined the choice of school for children, the priorities of architectural components for children at an early learning age, as well as the type and scale of the existing problems and disadvantages in school construction, and also the expectations towards the current architecture of primary schools and its changes in the future. Questions in the survey questionnaire were divided into four parts. The questions in the first part concerned general information about the respondent, their gender, age, place of residence, education including whether the respondent has an education in architecture and whether they are professionally connected with work in a school facility, as well as questions about the number and age of the respondent's children. The questions in the subsequent sections of the questionnaire concerned the opinions and perceptions of respondents on selected components of the primary school environment, attempting to raise discussion or problematic issues in relation to each of the indispensable architectural elements of educational institutions. In the first part of the questionnaire, the priorities related to the next elementary parts of the architectural space of educational facilities were examined, while in the next part the questions concerned the type, scale, and intensity of the defects and problems existing in the architecture of primary schools, as well as the most important functions and features of the school architecture and also the determinants of choosing a primary school for the child. In addition, the survey questionnaire included questions ranging from

very positive to very negative, as well as obligatory open questions about the respondent's opinion on the selected aspect of the examined school facilities. The questionnaire was computerised, completed electronically and anonymously. The questionnaire was visited by a total of 178 respondents and it was completed correctly and positively by 61 respondents, based on their surveying the author presents the results of the study.

## 2.2 Presentation of the study results

Among the respondents, there were 34 women and 27 men. Five of the respondents were younger than 25 years, thirty were in the 25-35 age range, eighteen of the respondents were between 36-45 years old, six were between 46-55 years old, and two were older than 55 years old. 54.1% of the respondents classified their place of residence as a city between 200 thousand to 499 thousand inhabitants, 29.5% of the respondents stated their place of residence as a city of over 500 thousand inhabitants and 8.2% of the respondents stated their place of residence as a village and town under 200 thousand inhabitants. Of the respondents, 57.4% have one to four children, twelve children of the respondents were under the age of three, seven were 3-5 years old, eleven were 6-12 years old, two were 13-16 years old, five were 17-20 years old, two were 21-25 years old, and six were over 25 years old. Fourteen respondents have a degree in architecture, and nine respondents work professionally at school.

The first question in the survey questionnaire was designed to generally identify the most important elementary architectural space in the school, and so the individual spaces were ranked by respondents from the most important to the least important. Below is a compilation of the individual spaces and the significance given to them by the respondents:

- classrooms - 7.8
- corridors and common spaces for spending free time (e.g. during breaks) - 6.0
- gym halls - 5.7
- rooms for extra-curricular activities (e.g. a computer room, art room or pottery room) - 4.3
- outdoor sports fields and playgrounds - 4.2
- canteen - 3.4
- common room or other rooms where children are under the supervision of adults before or after class - 3.2
- additional spaces such as the library - 2.3
- auxiliary spaces such as locker rooms – 1.

The next questions focused on the subsequent spaces listed in the first question, as well as the neighbourhood of the school building and the priorities of the individual components of these spaces and their impact on the optimal development of children. According to the respondents, the three most important elements of classroom space conducive to better absorption of knowledge are: daylight, constant circulation of fresh air, and room size. The most important elements of gyms that promote better physical development are: size of the hall (area), height of the hall and constant circulation of fresh air. With regard to the most important features of corridors and common areas that encourage better development of children, the respondents indicated: the width/length of corridors, division into zones for various activities (e.g. rest, play, running, learning), and constant circulation of fresh air. From the adults' point of view, the most important elements of outdoor sport fields and playgrounds which promote the better development of children are the following: a variety of equipment (adapted to the age of children and activities); safe surface and proximity to the school building. According to the respondents' answers, the most important aspects of the primary school environment include: urban area, noise level and proximity to nature such as a park. The study shows that the respondents agree that the most important thing for a child is to feel safe at school. The next places are given to provision the child with the best possible conditions for learning, and then for comprehensive social development. In the opinion of the respondents, ensuring the best possible conditions for the child's comprehensive physical development at school comes in last. In an open question, which asked respondents to specify in one

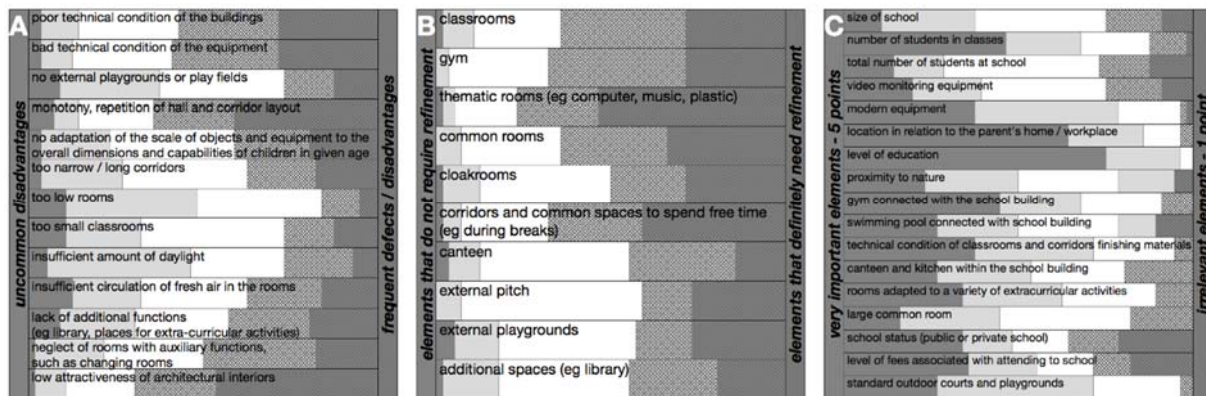
word or phrase what the primary school architecture should be like, the most common phrases and general features were: "child-friendly; safe; comfortable; cheerful but not infantile; versatile; functional; adapted to the needs of children and youth; conducive to the development of imagination and interest in architecture; multi-functional; conducive to the comprehensive development and affecting the imagination". On the other hand, in the semi-closed question concerning the most important features (functions) of good architecture of primary schools, the respondents indicated respectively:

- ensuring the child's feeling of mental safety and comfort - 7.6
- ensuring safety against a child's physical injury (e.g. fall, injury) - 7.1
- providing diverse spaces for comprehensive development - 6.6
- ensuring safety from unauthorised persons from the outside - 5.3
- adjusting the scale of architecture and elements of equipment to the size and capabilities of children at an early learning age - 5.3
- stimulating the imagination of children - 5.3
- ensuring children's contact with nature (e.g. through outdoor activities) - 3.8
- other (what?) - 1

In the open section of the above question, individual responses of the respondents appeared such as: "it should provide children with art experience through art exhibitions" or "it should provide the opportunity for children to create the appearance of the school directly". 47.5% of the respondents strongly wanted the architecture of primary schools to be characterized by pro-ecological solutions, the other 50.9% agreed with this claim and only 1.6% were not enthusiastic about this idea. Another part of the survey questionnaire focuses on the existing architecture of primary schools in Poland, its disadvantages and weaknesses, and elements of the most demanding refinements. Respondents were asked, in an open question, to give a word or sentence that best describes the existing architecture of primary schools in Poland. They most often answered: "boring; outdated; trite; old; repeated; archaic; poor; lack of funds; sad; better than a few years ago; great willingness and lack of financial resources for their implementation". In another obligatory open question, the respondents were asked to indicate the weakest points in the school's architectural space: "corridors and common areas, narrow, gloomy, no possibility to rest before the next lesson; old and poorly equipped gyms and outdoor courts; lack of rooms for personal development; old classrooms; locker rooms omitted as unimportant, yet they welcome children each day, too small to accommodate the parents too". Using the semantic differential, the respondents indicated on a scale the defects of primary schools' architecture by determining their degree of intensity figure 1a, and the elements of architectural space with a points score determining how much the given element requires improvement, figure 1b. The results of these responses are shown in the figures below, (figure 1a and 1b).

The next question in the survey questionnaire concerned the respondents' ideas for increasing the attractiveness of the interior space of the primary school through architectural elements, equipment and interior finishing materials. 75.4% of the respondents believe that in order to increase the attractiveness of school interiors, separate thematic areas should be provided, e.g. for group and individual play, learning, and silence. 67.2% of the respondents said that introducing elements of equipment which the children could arrange at their discretion would increase the attractiveness of the school. 54.1% of the respondents are for the introduction of a visual identification system (a coherent colour scheme that facilitates orientation in the school space). 47.5% believe that the introduction of toys encouraging teamwork will increase the attractiveness of school interiors, while 44.3% of the respondents say that this effect can be achieved through vibrant colours. 29.5% of the respondents pointed to multimedia toys and 26.2% to vary lighting as elements that could enhance the attractiveness of school interiors. Only one of the respondents pointed to a factor, which was not listed in the scheme, which could increase the attractiveness of the school, and this was universal access to the school space, including the needs of people with disabilities. The most important factors determining the choice of a primary school for the child were specified by the respondents using a semantic differential. They marked the items listed above according to a rating scale where 1 point meant insignificant elements, 2 points - rather

insignificant elements, 3 points - neutral elements, 4 points - rather important elements, and 5 points - very important elements, figure 1c.



**Figure 1.** a) - intensity of the most frequent disadvantages of primary schools architecture in Poland; b) - architectural spaces in existing schools that demand refinements most of all; c) - the most important elements determining the choice of school for the child; source: author's studies;

### 3. The selected components of the architectural environment of primary schools - an analysis of the literature on the subject

#### 3.1 The general distribution and characterisation of school spaces

Regardless of the varying primary school curricula over the years, in the school building, we can distinguish permanent groups of rooms resulting from the function performed by the institution and the purposes for which the given rooms are to serve. Within the educational buildings, the following functional spaces and groups of rooms can be distinguished [1]: main entrance space, group of classrooms, group of sports facilities, group of dining rooms, group of rooms of social space, group of administrative rooms, group of utility and technical rooms, as well as locker rooms.

The careful formation of the external entry zone of the building should be an essential element of the design process. Characteristic, unique places in the building can have a positive influence on the sense of belonging and identification with the place. The most important of the dominants should be the main entrance to the building [1] or the entrance gate to the school premises. This is a place of special importance, due to the importance of crossing from a public area to a safe area, respecting the child's age. Among the group of classrooms, we distinguish two main systems of division of the rooms. The system of parent chambers is one in which students have all subject lessons in one classroom, with the exception of specialised classes such as music, art or computer science. This is a better option for the student because it gives them a sense of security in a place they know. Assigning specific classrooms to appropriate classes also allows students to personalise these places and helps them to take care of them, as they are aware of being responsible for keeping them in order. The second distinctive system is the laboratory system, where the rooms are associated with a specific subject, and therefore a teacher, not a group of students. This variant, although more convenient for the teacher and school administrators, causes that the group of students have no place of their own and they are "homeless" [1].

In primary school, physical activities that take place in gym halls are of a more playful character (figure 2a), and not training as is the case in middle schools and high schools, which is related to developmental stages of the child [1]. Movement and fun are very important for primary school students and they are an indispensable part of their proper and comprehensive development. The importance of fun is invaluable in the process of developing skills in the areas of motivation, intelligence, and social adaptation [2]. Through fun children learn, for instance, to focus on acting, manual work, developing their strength and movement coordination, helping other, cooperating, feeling but also experiencing



danger and coping with fear. All these activities should be done in an atmosphere in which the child has a sense of self-determination whilst being under the control and observation of adult carers. For these reasons, gym halls should be designed to improve visual control of the entire space where students stay and exercise, avoiding nooks and crannies (often for storing equipment), where the child is out of control of care-takers and can be harmed.

In primary schools, rooms of social space could be assembly halls or special rooms for social meetings, however, this function is mainly played by corridors and other large-area passageway spaces. Nonetheless, it is important to remember that the quality of space for relaxation after lessons, for mental and somatic regeneration, is extremely important; combining them with main passageways intensifies the negative effects of noise and crowding. The size determined for the individual and social distance, resulting from the proxemics laws, may be disturbed. It is desired to design recreational space in a way as to create separate space for traffic, separate space for a static form of relaxation, which is suitable for talking or concentration. The concentric layout of recreational space, which is also the consequence of such a layout of classrooms, is considered to be the best. When using this layout, it is important that the main passageway does not interfere with the space in which students can relax between classes, which would cause traffic collisions and distractions. [1]

In order to fulfil all the functions of the school, there are also groups of rooms necessary connected with the administration of the school institution as well as utility and technical rooms. Teachers' rooms, staff rooms or directors' offices should be clearly separated from the children's area. These rooms should be primarily adapted to the needs of adults as they are the main users; at the same time, they should not cause discomfort among the children who are sometimes there. In the case of utility and technical rooms, it is important to apply means of formal control as to the availability of these spaces in order to avoid undesirable accidents of children outside the control area of school teachers.

### 3.2 Issues related to school safety aspects

Safety is one of the basic needs of a person. Schools as an institution, but also as a building, by modelling individual architectural elements and equipment, should provide safety to its students. In primary schools, safety must be considered as: prevention against accidents during use and the limitless manner of children's play, the limitation and prevention of third-party access with unknown intentions towards the children, as well as psychological and emotional security to ensure that children are comfortable in the given space. The school facility has the task to provide its students a sense of physical, psychological and mental safety; therefore, by creating an architectural form, it should prevent accidents, injuries, protect against falling but also create harmonious spaces where the child can comfortably learn, broaden the scope of their knowledge, experience, develop social bonds, as well as recreate mentally after and between classes. Accidents cause physical injury and can leave mental traumas, which can consequently affect fear of action, withdrawal, and lack of self-acceptance [3]. The elements that should characterise furniture and equipment, which increase safety of use and help reduce the number of injuries, are rounded corners, with no sharp edges, non-toxic materials, and frequent checks of the technical condition. [4]

### 3.3 Equipment and layout of school spaces

Equipment in primary school space can be divided into basic (standard) and special equipment. Elements of basic equipment will be considered standard equipment of the main classrooms at school, such as: benches, chairs, student tables and, for example, cabinets and shelves for learning aids. Standard equipment will be similar in different locations, even within different countries with different teaching programs. [1] In order to create the space and elements of its equipment tailor-made for its users, during the design process, the average anthropometric measurements of children should be used as the primary data for designing space for children at a specific age. Based on the data presented, normative dimensions can be determined such as height and arm reach of children at a specific age, and then accordingly determined the right heights and distribution of work surfaces, the widths of passages and the location of everyday objects in the interiors, like the reaching distance from a standing, sitting or

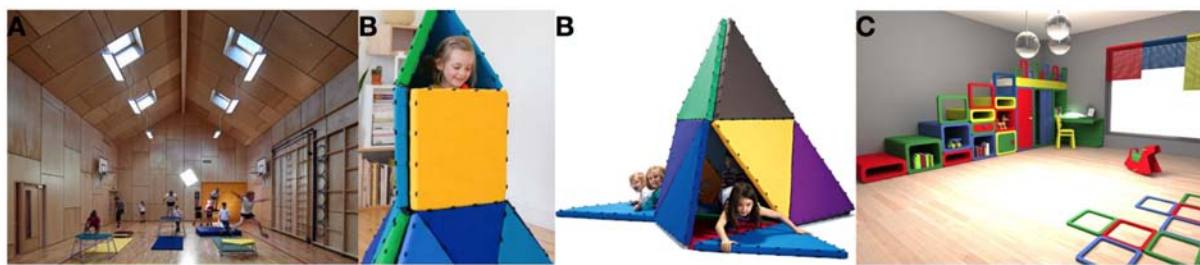
lying down position. Adapting space to the child's dimensions to enable independent actions in a safe environment increases self-reliance, encourages imitation and cooperation. [4] When designing and selecting children's furniture, attention should also be paid to such elements as their shape and weight, as well as additional accessories that serve for the connection of several elements or wheels, allowing children to move their furnishings independently and thereby customise and adjust the space according to the current need of its users. Multi-functionality should be one of the basic characteristics of children's furniture, as the fast nibbling on toys with narrow application possibilities lies in the nature of their users. At the stage of the design process, furniture and toys should inspire children's imagination, assist in the acquisition and consolidation of diverse skills, but also shape aesthetic preferences, figure 2b.

### 3.4 Colour in architecture designed for children

Children perceive and experience colours and tints differently than adults. This is closely related to the stages of emotional and physical development of young people. The colour of the architectural space designed for children, such as child's room, needs to be changed and adapted to the age of the child. Based on the experiments conducted, the author of the book "A Child in the Adult World" [5] states that the favourite colour of younger children is red (later in the order they are dark blue and yellow). In general, younger children like vibrant and intense colours, but they reject faded colours. In school-age children, colour preferences are subject to unstable and impulsive changes, but the older they are, the more likely they opt for cooler and more complex shades. An important consideration in shaping children's interiors is to take into account the psychological characteristics of the users of the space such as temperament, sensory and chromatic type of the child. Space users presenting various psychotypes require different arrangements, equipment, furniture and lighting, as well as various colour forms. And so it is suggested in the interiors for children with choleric temperament to use a range of cold colours, on the surfaces not much contrasting accents of spectral colours, neutral background. For the sanguine type, however, the interior is rich in colour and light contrasts, with red, dark blue or white in combination with black and gold, figure 2c. The interior for phlegmatic type should be in a quiet colour range consisting of white, grey, ochre and blue. At the same time, lively contrasts should be avoided in this interior. For a melancholic child, it is necessary to provide a space consisting of a range built on nuances. Soft colour combinations with a group of saturated colours (purple, lilac, terracotta, ochre and dark blue) should be provided, [5]. A functional colour code is often used in primary school spaces. By emphasising the functional differentiation of space and equipment through the use of coherent colour code and various materials and textures of facilitated orientation, we thereby contribute to the development of self-reliance and the sense of security in the child. The materials used and their colouring affect the amount of stimuli that reach the children, which in turn can affect the way they behave, and the appropriate styling of the space can influence group or individual activity, motivation and creativity of children. The same space stimulates and promotes the development of the child, and can limit the inventiveness of children only to the behaviour provided by the designers.

## 4. Results and discussions

Bearing in mind the ever-changing laws and educational programs in primary schools, designing educational facilities should be based on available literature and good professional practice, with the design process being exceptionally conscious and well thought out, and an architect in a special way should follow the ability of empathy.



**Figure 2.** a) - gym used as a playground, Kirkmichael Primary School, Aberdeenshire, UK, Holmes Miller; source: [www.archdaily.com](http://www.archdaily.com); b) - examples of a good design created for children, playing furniture which increase creativity and stimulate the imagination, Tukluks – award-winning play mats and play furniture game 2050 by Amaury Poudray; source: [www.afilii.com](http://www.afilii.com); c) - author's design of the exemplary interior for a child with a sanguinic temperament, rich in numerous colour and light contrasts; source: author's private resources.

Extremely extensive topic is the group of rooms in the school space. Although teaching rooms seem to be the most important sphere of the building, do not underestimate the weight of the other rooms forming a complementary functional system. In a well-functioning facility all of the above-mentioned space units are needed and each of these groups should be included in the spatial planning of the facility as they closely interact and form one unit. These interactions determine how the whole facility and the social environment of the school function. Bypassing any group of rooms makes the school a place with underdeveloped usability program. *The role of school architecture is special in the upbringing of society, it is a factor in the life of a young person that provides an opportunity for the first contact with shape of the space and the first reaction to it* [1]. During the design process, the architect should be aware of the importance of the scale of tools he uses and of the influence it may have on the education and upbringing of subsequent generations of children. During the design process of primary schools, it is important to ensure that the physical safety and psychological well-being of students is preserved, bearing in mind that a child-friendly space is a harmonious combination of all available architectural attributes, taking into account the preferences, needs and physical characteristics of a young user.

Because interior design significantly influences the choice and course of the activity of children living in it, the characteristics of furnishings and equipment and other elements of room design targeted to children in early school age should be based on the physical development of children of that age, i.e. their physical parameters such as height, line of sight and range of hands, as well as determinants of the mental development of children of that age, in terms of the variety of stimuli provided and the potential for change and manipulation of the elements and the emotional development of children, as regards the enhancement of self-reliance and the ability to fantasise, [4]. One of the most important factors contributing to the implementation of the appropriate and optimised environment for the development of early school children is provision of the teaching facilities of school in an ergonomic workplace of study.

## 5. Conclusions

Space affects the behaviour of a person living in it. Layout of planes, surfaces, axes. Colours. Textures. Can expose, cover, direct, lead, open, close, divide, combine... At all levels: physical, physiological, psychological, emotional, mental... at all levels of subconscious, conscious, super-conscious. And the person is subjected to this influence to a greater or smaller extent - it depends on the state of their consciousness, on their knowledge of themselves and on the world surrounding - but they cannot slip away from this influence, always staying in a fixed, physical space. And the one who knows the mysteries of the space and the secrets of its shaping can direct behaviours, moods, ideas, feelings, steps... of those who are staying in this space, [6]. Although studies on the development of the child and the development of the human being in general, and the impact on the architectural environment are still



ongoing, there is no doubt that through the survey and analysis of available literature, the existence of a proxemic phenomenon was confirmed, that in the context studied the influence of the architectural environment on the behaviour, feelings and emotions of the person in it. Available studies on the perception of architecture and colours, as well as the impact that the components of the architectural environment exert on emotions and feelings mainly concern adults. Therefore, it is important to continue studying the perception of architecture and the colour of the environment with the eyes of the child and the impact that this environment may have on supporting the proper development of children. In conclusion, the psychological and physiological influence of elements of architecture, the furnishings and materials used, colours and textures are related to everything that surrounds us, as we are not able to exist outside of the surrounding environment. However, in the case of the architectural environment, the designer has a particular influence on the shape of the space, its function, the colour scale and texture of the applied materials. The space in which we are living has a strong connection with the associations we have established since the very first moments of our lives. Therefore, it is important to remember of the impact and influence of the architectural environment on its users. In the case of children and not only, the applied architectural treatments can foster their overall development, create the space suitable for concentration and learning or recreation, motivate to action or reassure.

From the results of the survey conducted through questionnaires it can be concluded that adults attach greater importance to other aspects of architectural space designed for children, than designers. Building architectural elements seems to be of secondary importance in the eyes of adults. Priorities include all aspects of physical and mental security of school children, and aspects of the physical environment of school spaces, such as adequate sunlight or fresh air, which provide comfort to their users. While the results of the study indicate the existence of a number of defects and problems with respect to the architectural space of primary schools, newly established and modernised school facilities, both at home and abroad, can show more thoughtful and innovative tendencies in architectural design, that take into account the needs of children of a given age and their predisposition resulting from the stage of physical and mental development. Because children are the future of society, and the young person whose personality is still shaped is more susceptible to external stimuli, the author must make every effort to ensure that the architectural environment of the primary school and its surroundings, where the children spend a considerable part of the day, enables them to develop as versatile as possible, physically, mentally and socially.

## References

1. J. Włodarczyk, "School architecture", *Arkady*, pp. 13, 54-65, 79-81, 1992.
2. A. Palej, "Formation of the space for children and adolescents in urban housing environment" *Edition of Krakow University of Technology*, pp. 37-38, 1991.
3. E. B. Hurlock, "Child Development", *PWN*, pp. 255-257, 1985.
4. A. Kołodzińska, "Shaping the architectural environment for a pre-school child", *Edition of Wroclaw University of Technology*, pp.129-138, 2008.
5. E. Agranowicz-Ponomariowa, A. Mazanik, J. C. Żarnowiecka, "Child in the adult world. Formation of interiors with regard to human psychophysical features", *Publishing House of the Bialystok Technical University*, pp. 46-63, 79, 2009.
6. M. R. Hall, E. T. Hall, "The fourth dimension in architecture: study of the influence of building on human behaviour", *Muza*, pp. 71, 2001.