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## WYMAGANIA DOTYCZĄCE WYPOSAŻENIA WNĘTRZ SZKOLNYCH: EWOLUCJA, STAN OBECNY, PERSPEKTYWY

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**Adnotacja.** Meble szkolne są nieodłącznym elementem szkolnej przestrzeni edukacyjnej. Analiza wyposażenia szkoły obejmuje rozważenie typologii mebli, tworzenie zestawów i przestrzenną organizację klasy. Na podstawie wymagań społeczno-kulturowych wyodrębniono trzy okresy rozwoju wyposażenia szkoły. W średniowieczu i renesansie wyposażenie szkoły było zorientowane na nauczyciela. Wyposażenie klas z połowy XVIII-XIX w. koncentruje się na prezentacji treści nauczania. Od początku XX w. przestrzeń edukacyjna staje się skoncentrowana na dzieciach, czyli elastyczna. W ostatniej ćwierci XX w. pojawiają się nowe wymagania społeczno-kulturowe oparte na paradygmacie szkoły partnerskiej i procesach partycypacyjnych „oddolnych”. W przestrzeniach edukacyjnych wyposażonych w meble w ramach procesów współpracy „oddolnej” nie można jeszcze kompleksowo uwzględnić wszystkich wymagań, co jest przedmiotem dalszego rozwoju.

**Słowa kluczowe:** przestrzenie edukacyjne, meble szkolne, historia projektowania, wymagania projektowe.

## REQUIREMENTS FOR SCHOOL INTERIOR FURNISHING: EVOLUTION, CURRENT SITUATION, PROSPECTS

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**Abstract.** Classroom furnishing is an integral part of the school learning space. Analysing classroom furnishing means considering furniture types, suit completing and classroom arrangement. Based on socio-cultural requirements, three phases of classroom furnishing development are distinguished. Medieval and Renaissance school had a teacher-centred furnishing. Classroom furnishing of the 18th–19th centuries centres on content presentation facilities. From the turn of the 20th century learning space becomes child-centred, meaning flexible. In the last quarter of the 20th century, new socio-cultural requirements arise, based on partner school paradigms and participatory bottom-up processes. The learning spaces furnished in bottom-up cooperative processes are not yet able to consider all requirements integrally, which is a point of further development.

**Key words:** learning spaces, classroom furniture, design history, design requirements.

## ВИМОГИ ДО МЕБЛЮВАННЯ ШКІЛЬНИХ ІНТЕР'ЄРІВ: ЕВОЛЮЦІЯ, ПОТОЧНИЙ СТАН, ПЕРСПЕКТИВИ

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**Анотація.** Шкільні меблі є невіддільним складником навчального простору школи. Аналіз меблювання школи передбачає розгляд типології меблів, формування комплектів і просторову організацію класу. Виходячи із соціально-культурних вимог, виділили три періоди розвитку шкільного меблювання. У Середньовіччя та в епоху Відродження шкільне меблювання було орієнтоване на вчителя. Меблювання класів середини XVIII–XIX ст. орієнтовано на презентацію змісту навчання. З початку XX ст. навчальний простір стає дитиноцентричним, тобто гнучким. В останній чверті XX ст. виникають нові соціально-культурні вимоги, що базуються на парадигмі партнерської школи й учасницьких процесах «знизу вгору». У навчальних просторах, умебльованих у рамках процесів співпраці «знизу вгору», ще не вдається врахувати всі вимоги комплексно, що є предметом подальшого розвитку.

**Ключові слова:** навчальні простори, шкільні меблі, історія дизайну, вимоги до дизайну.

**Introduction.** The issue of organizing the school space and classroom furnishing for supporting the needs of modern education is relevant and widely discussed around the world. In this context, it seems to be necessary to understand the historical genesis of the school space organization. To our knowledge, this aspect has been studied insufficiently. Some studies have only focused on the development of classroom furniture in some depicted countries or considering certain periods. For instance, P. L. Moreno Martinez (2005) examines the evolution of school furniture in Spain during the 19th century. Herman, Van Gorp, Simon, & Depaepe (2011) focus on this issue at the turn of the 20th century in Belgium. M.L. Bencostta (2013) studies the school furniture design in France in the 1920–40s considering the works of J. Prouvé and A. Lurçat. L. Cuban (1984) focuses on the practical implementation of new approaches to classroom organization in the United States from the late 19th century up to the 1980s. Tondeur, Herman, De Buck, & Triquet (2017) investigate the development of the spatial organization and classrooms furnishing taking into the consideration the memories of teachers since the 1960s. An extensive overview of the school furniture history is given in the catalogue of the *Vereinigste Spezialmöbelfabriken Schulumuseum* (Müller & Schneider, 2010), but this study covers only the period of classroom furniture industrial production (approximately from the end of the 19th century). In this respect, the research paper of H. Lange (1998) devoted to the of school architecture and, in particular, its spatial organization in the period before the beginning of the 19th century should be noted. In general, modern authors focus on the historical and cultural concept of school development that can be found, for example, in J. Atkin's (2011) study. This concept distinguishes three periods of school development and, accordingly, educational spaces: pre-industrial, industrial and post-industrial. Thus, the space of the modern, «post-industrial» school is considered not by its own characteristics, but as an opposition to the «industrial», that limits the possibilities of analysis. A more accurate examination of the historical evolution of school spaces, including the classroom furnishing and spatial organization, aims to identify the characteristics of individual periods and stages of this development, and allows us to predict trends in its future development.

**Main part.** The design of the built environment should determine the properties (characteristics and parameters) of space and its elements including furniture. However, a systemic approach to design requires considering not only the individual elements of space (furniture items) but their relationships, i.e. types, assortment, method of use, location in the room etc. A system that considers all these aspects is called furnishing. The properties of the designed objects are formed based on the analysis of stakeholders needs (first of all, the direct consumer). These needs are specified in the requirements for the designed objects. In design theory, requirements are generally divided into consumer requirements and manufacturing requirements (Smardzewski, 2015; Bartashevich, 1988). Consumer requirements focus on meeting the users' needs, and manufacturing requirements consider the most efficient conditions for the manufacture of the products. Classification and approaches to the analysis of design requirements differ depending on the type of projected object (building architecture, interior design, furniture, etc.) (Abyzov, 2009; Bartashevich, 1988; Myhal, 1999; Strilets, 2018). Regarding furniture, it is possible to generalize such kinds of consumer requirements as social, cultural, aesthetic, functional, safety requirements, ergonomic, environmental. Some authors also highlight educational requirements for school furniture (Belov & Ianov, 1985), but this issue is debatable. Manufacturing requirements are technical and economic, constructive, technological. Modern design involves the fullest possible consideration of all these requirements in a comprehensive solution, although this approach is relatively new. But even with this approach, in each situation, a significant number of these requirements are mutually contradictory, and the right design decision is possible only based on setting certain priorities as to which requirements to meet prior and which ones to consider secondary. Also, different requirements have different sources. Different stakeholders claim to meet different needs. They are fixed in regulations and recommendations based on researches or kept in a tradition, often unconscious. As a result, some requirements become irrelevant or outdated, and new requirements appear to meet new, previously unknown or ignored needs. Design innovations arise through the rethinking of outdated requirements and identifying and prioritizing new ones. Historical consideration of the school furniture evolution allows us to identify and characterize the basic requirements for school furniture in the dynamics, in the process of their identification, clarification, implementation and rethinking.

**Methods.** The research methodology is based on both general and special research methods. The paper uses two main groups of special methods within the historical-cultural and systemic approaches. Within both groups, both methods specific to educational research, design theory and history are used. The historical-cultural approach involves the consideration of school development as a general cultural phenomenon in history (Dzhurinskii, 1998). A similar approach is considered to be the most promising in the study of the history of design (Fallan, 2010), which, among other things, allows to include material artefacts of earlier eras that are not formally part of the history of design as a recent phenomenon (Koveshnikova, 2009). The systemic approach in educational research is specified in the theory of the learning environment (*Innovative Learning Environments*, 2013; Iasvin, 2001). In this theory, the physical space of the school is considered to be one of the educational resources to support efficient teaching and learning. In design theory, in particular furniture design, the systemic approach is transformed into integrated design projecting methods (Linden, Lacerda, & Aguiar, 2011; Myhal, 1999; Smardzewski, 2015), which involve determining the characteristics of objects and subject complexes based on the analysis of stakeholders needs, specified in the form of requirements for the designed objects.

**Results and discussion.** The formation of the modern secular public school in Europe began in the late Middle Ages and the Renaissance. Data on school furniture from that time can be obtained from visual materials (miniatures, engravings, etc.). These data show that the main, and sometimes the only element of school furniture in the late Middle Ages was the teacher's workplace, equipped with a heavy chair or cathedra and a lectern to accommodate

the book. Students sat around the teacher, sometimes on benches, but often they used bags of straw or they sat just on the floor (Kosenko, 2019 c). Obviously, such furniture did not meet even the basic needs of the main user – school students. We can assume that those requirements for school furniture were not put forward at that time. According to Lange, the school at that time has been considered to belong to the teacher (“Die Schule als Haus des Schulmeisters”), in contrast to later eras, when, on the contrary, the teacher belonged to the school (Lange, 1998). Furniture designed primarily or even exclusively for the teacher had to emphasize the importance of his personality; thus, the priority requirements for furniture were not functional, but socio-cultural.

In the age of the Renaissance spatial organization of the classroom remains teacher-centred, indeed more complicated. For example, in 1519 Erasmus described the building of St. Paul’s school in London in such a way: “Over the master’s chair is seated a figure of the Child Jesus, of excellent work, in the act of teaching; (...) There is also a representation of God the Father, saying, Hear ye him; (...) The boys have each their distinct forms or benches rising in regular gradations and spaces one over another. Of these every class contains sixteen, and he who is most excellent in his class has a kind of small desk by way of eminence” (Erasmus, 1519 as cited in McDonnell, 1909, p. 61). As we see, school rooms are equipped not only with a teacher’s chair – which, however, remains the most important element of the interior, additionally marked with images of Christ and God the Father. There are also students’ forms provided, arranged in a certain way concerning a certain number of workplaces; the best student also had the opportunity to use the desk, not because of convenience but as a distinction. In the 1653 book “Leges scholae bene ordinatae” Comenius hence describes a well-arranged classroom: “Qvodlibet Auditorium instructum esto suâ Cathedrâ, suisque (numero sufficiente) subselliis: iisque ita ordinatis, ut Magister Discipulos sibi obversos in conspectu habeat semper omnes. Cathedra ne stet ad fenestram, aut inter fenestras, sed ex opposito: ut lux a tergo discipulis veniens, Magistrum cum omnibus quae agit (et forte Tabulae inscribit) reddat conspicuum. (...) Pensa cujusque Classis per Auditorii parietes, januas, fenestras, columnas (seu gnomis et sententiis, seu picturis et emblematis) dispandi” (“Every auditorium should be equipped with a chair and a sufficient number of forms; the past must be arranged so that the teacher always had before his eyes all the students turned to him. The chair to be located not beside a window or between windows, but from the opposite side, so that the light that falls on the students from behind makes visible the teacher and everything that he does, especially when he writes on the board. (...) It is very helpful if the content of each class provided (in the form of verses, or short sentences, or paintings and emblems) on the doors, walls, windows, pillars of the classroom”) (Comenius, 1657, pp. 785–786). The desks are not mentioned here among the school equipment, but in his 1658 book “Orbis Pictus” Comenius included an artwork depicting the school where students are writing sitting at the desk (Comenius, 1705, p. 119). In German engravings of the time the rooms depicted are equipped with students’ workplaces, namely benches and tables, as well as presentation appliances; the teacher’s workplace here loses its solemn character. Thus, during the 16th–17th centuries school furnishing, remaining mainly teacher-centred, gradually focuses more on functional requirements, becomes more practical, relevant to the activities provided in the classroom. The students’ workplaces equipped with benches and desks appear, as well as a chalkboard and other presentation facilities. Since school activities at that time took place in various, often spontaneous forms, the spatial organization of the classroom was also rather spontaneous. This phase of the spatial organization of the school, which is usually defined as a pre-industrial, also can be described as a teacher-centred school.

Significant changes in the spatial organization of the European schools occur in times of Enlightenment, beginning with the second half of the 18th century. At the time development of national systems of compulsory school education began in many European countries. The purpose of creating a national education system was to provide a minimum base of knowledge and skills common to all citizens of the state, in fact, to level the country's inhabitants, turning them into people of the same kind. The most known of those systems have been introduced in Prussia; after that educational systems based on programmed unification of learning content and training methods are often called the “Prussian system of education”. The Prussian education system meant the involvement of a large number of school children; to provide unified work of large groups the frontal training techniques were established, which meant the work of a teacher with the whole class on one single task at a time (Bim-Bad, 2015). Such methods required new approaches to the classroom furniture. The front-row classroom arrangement has been developed and became the main characteristic of the Prussian school furnishing (Kosenko, 2019b). All students were placed facing one wall, where the teacher’s workplace was organized, including a blackboard, presentation desk, and various visual apparatus. The teacher's personality has no longer been in the centre of the classroom; the main place was possessed by the facilities for presenting educational content. A new type of classroom furniture has been introduced to equip the front-row classroom: one-sided sloped desks. Such desks could be fastened to the benches, forming a desk unit (Moreno Martinez, 2005).

The new kind of spatial organization and a new type of furniture appeared based on new social and cultural requirements. But other requirements, including functional ones, have been poorly satisfied with that kind of furnishing, allowing only placing a certain number of students in a particular manner to ensure minimal workspace. Over this basic level, such furniture has been uncomfortable. For example, to get out of the place and come up to the board to answer was almost impossible in such a classroom. It is known that for a long time such furniture did not meet even the basic ergonomic requirements, being just too high for children. American educator H. Mann, visiting Europe in 1843, reported with amazement: “The rooms themselves are small in every dimension, excepting the distance between the scholars’ seats and the floor. (...) I saw scarcely one where the children, while seated at their desks, could touch the floor with their feet. (...) It may be said, that if one of these low-studded

rooms, with its enormously high seats, should by any chance be preserved for a thousand years, and should then be revealed to posterity as the ruins of Pompeii and Herculaneum have been to us, the antiquarians of that remote day would be likely to infer, from an inspection of the low ceiling and the great distance between the seats and the floor, that the children of their ancestors were a race of monsters, giants at one end, and pygmies at the other” (Mann, 1868, p. 268). Other requirements have not been considered approximately to the middle of the 19th century when the development of scientific hygiene arose questions about the influence of school furniture on students’ health. Medical evidence was provided that incorrectly arranged furniture contributes to the damage of the musculoskeletal system, causing scoliosis; damaging organs of digestion and respiration through unnatural compression of these bodies; cause deterioration of vision (myopia) and even damage to the teeth, because children experiencing frustration because of an awkward position, spontaneously excessive grip teeth (Erisman, 1869; Fahrner, 1865). Thus, from the middle of the 19th century hygienic requirements are put forward to school furniture, meaning harmlessness for a child’s health. A way to ensure these requirements have been defined over 1860s: basic functional dimensions of the furniture should match anthropometric measurements of the child, as well as the parameters of a certain working posture, which has been identified as the healthiest (Kosenko, 2019b). Specific functional requirements also were added: to ensure discipline in the classroom long desk units were replaced with one- or two-seater school desks. Though, in the first cycle of the Prussian (“industrial”) school evolution, the new front-row arrangement of the classroom and a new type of classroom furniture (one-sided sloped desk) has been introduced based on new socio-cultural requirements. In the second cycle, classroom furniture has been improved to meet refined functional, hygienic, ergonomic requirements.

At the turn of the 20th century combined school desk became a point of criticism from the part of educators, who pointed among others that the final word in this matter should belong not to medical doctors, but teachers. The most famous characteristic of the school desk has been posted by M. Montessori: “It is incomprehensible that so-called science should have worked to perfect an instrument of slavery in the school without being enlightened by one ray from the movement of social liberation, growing and developing throughout the world” (Montessori, 1912, p. 18). Prussian-type classroom furnishing, introduced in the USA by H. Barnard and H. Mann in the middle of 19th century, have been criticized by the reformer of American education J. Dewey: “... if we put before the mind’s eye the ordinary schoolroom, with its rows of ugly desks placed in geometrical order, crowded together so that there shall be as little moving room as possible, desks almost all of the same size, with just space enough to hold books, pencils and paper, and add a table, some chairs, the bare walls, and possibly a few pictures, we can reconstruct the only educational activity that can possibly go on in such a place. It is all made for listening (...); it marks the dependence of one mind upon another” (Dewey, 1912, p. 48). Therefore, both M. Montessori and J. Dewey criticized school furniture not from the point of view of pedagogy, that is, not from the point of view which way it is better to teach children. Their critics have a social and cultural approach. They point to the inconsistency of the school space with the ideals of society, the ideals of freedom and free-thinking. This way progressive educators impose social and cultural requirements that lead to changes in functionality, partly also in ergonomic parameters of furniture, in typology, assortment, suits completing. New types of furniture are introduced. (Herman, Van Gorp, Simon, & Depaepe, 2011; Kosenko, 2019a). In her school, M. Montessori introduced low open storages, fully accessible to children. H. Parkhurst in Dalton Plan schools used personal lockers to provide students the opportunity to freely move around the school, not being tied to the workplace (Parkhurst, 1922). Combined school desks intended to fix working posture are replaced by mobile chairs and tables; various alternative ways of working are implemented (e.g. sitting in armchairs, lying on the floor, etc.). It can be argued that at the turn of the 20th century begins a new phase in the development of school furniture, caused by the ongoing changes in socio-cultural requirements, which altered the school from programmed unification to child-centredness, focusing on the needs of free development of every child.

Professional design of learning spaces primarily evolved starting from the 1930s, and especially since the 1960s. Architects and designers have been looking for an integrated approach to develop school buildings with the highest regard of all requirements. Typical examples of such integrated solutions are *École de plein-air de Suresnes* (architects E. Beaudouin & M. Lods, furniture by J. Prouvé; France, 1936) (Rougeron, 2017) so as *Crow Island Elementary School* (architects Eliel and Eero Saarinen, Perkins, Wheeler & Will, furniture by Ch. Eames; Winnetka, USA, 1940) (Hille, 2011). In the post-war times, such an integrated approach has been developed theoretically (Karakis, 1974; Manucharova, 1967; Perkins & Will Partnership, 1968) and became the basis for the project practice. Furniture is treated as a component of functional and aesthetically integral school interior, as a tool to support a variety of educational activities. Thus, a new phase of the development of school learning spaces begins at the turn of the 20th century, based on new socio-cultural requirements, aimed at primary consideration of the free development of the child. During the 1930–1970s the design of school space, including furniture, came to complete a comprehensive consideration of all requirements to meet the pupils’ needs holistically. This means the learning space should be harmless and safe, harmonious and beautiful, but primarily it aims to encourage and support the development of the child.

A new trend in the design of learning spaces begins in the 1970s, which also results in the changes of the school furnishing. At this time a participatory design method arose, and among the first examples of its implementation were H. Sanoff’s activities involving teachers, pupils, and parents in the designing of a school building (Sanoff & Barbour, 1974); later those approaches became widespread. In 1980–2000s the ergonomics of working posture has been renewed considering both medical and behavioral reasons, which lead to the development of new ergonomic types of classroom furniture (Domljan, Grbac, & Vlaović, 2007; Mandal, 1981; Motmans, 2006). Development

of educational space is focused primarily neither on the teacher, learning content, or student (as it has been earlier), but on their mutual interaction and communication with the external environment (Hammon, 2012; *Innovative Learning Environments*, 2013). To replace the administrative top-down principle of school supplies, a bottom-up process increasingly arises, where teachers and students seek to determine by themselves not only the classroom arrangement but also suits completing, and even furniture typology (Hammon, 2012; Minero, 2015). The participants of the educational process choose or even self-create furniture items, confronting ready-made solutions offered by manufacturers. This may be the beginning of a new phase in the development of school furniture. The new socio-cultural paradigm of “partner school” is rising, which requires a greater variety of solutions in the field of school furnishing. Meanwhile, in this paradigm not all the requirements to the school furnishings are comprehensively considered: created by teachers and students, furniture may not always be convenient, safe, ecological, economic, aesthetic, etc. But one can predict that over time all the important requirements would be considered based on a new socio-cultural approach, as it has been in previous phases of school furnishing development.

**Conclusions.** School interior furnishing is developed basing on complex requirements. The socio-cultural requirements determine the most basic elements: typology, suit completing, arrangement, and finally aesthetics. Based on those socio-cultural requirements three major phases of the evolution of school furniture can be identified, similar to pre-industrial, industrial, and post-industrial phases known in education history. In the first phase about the 13th–17th centuries teacher-centred classroom arrangement dominated. The feature of the second phase (18th – the turn of the 20th century) is the front-row classroom arrangement, focused on the means of presentation of educational content. During the third phase in the 20th century a flexible child-centred organization of school space is being developed. Inside these phases, while socio-cultural requirements remain constant, certain cycles can be distinguished, when other requirements are developed, mainly functional and ergonomic, but also such as economic, technological, aesthetic ones. For example, in the phase of the teacher-centred (pre-industrial) school, development of functional requirements in the 16th–17th centuries cause spontaneous diversity of classroom furniture. In the phase of industrial school in the middle of the 19th century refinement of the hygienic requirements led to the changes in student workplace ergonomics. In the child-centred phase of learning spaces evolution, an integrated approach to design was developed in 1930–70s, which makes it possible to consider all the requirements to furnishing. Today one can predict the next phase in the development of school furniture based on a new socio-cultural paradigm of “partner school”. So far, the new socio-cultural requirements may too often cause the erosion of established norms and rules of learning space arrangement. It is hoped that the further development of a participatory and partnership approach to school furnishing will create more holistic and harmonious solutions.

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