


Oleg Sleptsov  <https://orcid.org/0000-0001-5441-5453>  
o.sleptsov@me.com

Anna Karban  <https://orcid.org/0000-0003-1246-3283>  
Department of Architecture Fundamentals and Architectural Design, Kyiv National  
University of Construction and Architecture. Ukraine

## SPECIFIC FEATURES OF DESIGNING EDUCATIONAL CENTERS IN THE AREAS WITH CHALLENGING LANDSCAPE IN UKRAINE

### SZCZEGÓLNE FUNKCJE PROJEKTOWANIA OŚRODKÓW EDUKACYJNYCH NA OBSZARACH O WYMAGAJĄCYM KRAJOBRAZIE W UKRAINIE

#### Abstract

This article is aimed at providing a rationale for the need to introduce a new type of educational institution in Ukraine today, namely educational centers in the areas with challenging topography. This article identifies specific features of construction, given the difficult geographic topography and architectural environment of the educational institutions, and lists conditions impacting the volume and planning of educational facility construction. It defines how urban planning of school centers influence the areas with difficult topography and establishes their location type. The authors analyzed architectural and construction solutions for school centers in areas with challenging landscape. They have also identified form-shaping types of buildings and established the best slope ratio for each of the types.

**Keywords:** educational institution, educational facility (school center) on difficult geographic terrain (challenging topography), architectural construction solution, space and volume arrangement, space and planning design of the building

#### Streszczenie

Artykuł ten ma na celu uzasadnienie potrzeby wprowadzenia dziś na Ukrainie nowego rodzaju instytucji edukacyjnej, a mianowicie ośrodków edukacyjnych na obszarach o trudnej topografii. Określono szczególne cechy konstrukcji, biorąc pod uwagę trudną topografię geograficzną i środowisko architektoniczne instytucji edukacyjnych, oraz wymieniono warunki wpływające na wielkość i planowanie budowy placówki edukacyjnej. Tekst określa, w jaki sposób urbanistyka ośrodków szkolnych wpływa na obszary o trudnej topografii i definiuje ich typ lokalizacji. Autorzy przeanalizowali rozwiązania architektoniczne i konstrukcyjne dla szkół w obszarach o trudnym krajobrazie. Zidentyfikowali także kształtujące typy budynków i ustalili najlepszy współczynnik nachylenia dla każdego z tych typów.

**Słowa kluczowe:** placówka edukacyjna, placówka edukacyjna (ośrodek szkolny) na trudnym terenie geograficznym (trudna topografia), architektoniczne rozwiązanie konstrukcyjne, układ przestrzenny, projekt przestrzenny i planistyczny budynku

Currently Ukraine is facing changes and undertakes reforms in many areas. One of the major reforms is the education reform under the “New Ukrainian school” and “New educational space” programs. Educational reform is of crucial importance, since it is the education of the young generation that defines the future of the state. Unfortunately, current school educational and material resources do not fully meet modern public demand and personal development expectations, economic needs or world trends. Therefore, it requires research of the world’s best practice and its introduction to change approaches and attitudes pursued at school and streamline tuition. Educational reform also involves changing the educational facilities and their spatial organization, therefore, it provides for the development of new types of educational hubs complying with revised technological requirements, improving the range and planning parameters of the premises.

Architectural environment is one of the crucial factors that have a key role in shaping personality. It serves as the basis for developing a new means of teaching and methods. The main objective of an educational center’s architectural environment is to create the most favorable environment for people using it, assisting educators in shaping students’ world outlook and promoting students’ abilities to master knowledge. The factors contributing to the philosophy of efficient educational centers include encouraging a creative environment of inclusivity that meets technological and energy efficiency requirements. The space and equipment of school facilities reflect modern architectural trends and technical needs of educational institutions. Special attention is paid to the environment there that can be transformed into multifunctional open space. This is achieved with the help of partitioning, glass walls, large windows that create an impression of an absence of any boundaries, etc. Premises that can change their floor space and configuration is a new trend for educational institutional architecture in Ukraine that is gaining in popularity. Its main advantage is to enable students and educators to get engaged in free communication and socializing; this space organization allows for effective group work and leisure activities. Thus, it develops students’ communication skills which are important for social and community life and motivates them to study as well as giving the feeling of freedom, encouraging their development.

The architectural solution for educational institutions is the intrinsic combination of construction and design methods, ensemble of the development area and modern scientific research in pedagogics.

Research of educational institution architecture and their chain in the build-up area, developing the architecture of educational institutions with non-traditional methods of teaching in an information age in all spheres of our life including science and architecture, are covered in the works of scholars/architects Leonid Kovalskiy [3], Helena Kovalska [2], Serhiy Syomka, Iryna Merylova, Tatiana Ernst. Elements of building organization and construction was the subject of research by Volodymyr Krogus, Yuriy Kurbatov and Ladislav Gorniak. Oleg Sleptsov specifically focused on modern educational institutions [4] as well as studying school construction in complex geologic and engineering terrain [5].

Research on general theoretical issues of modern education development, history of pedagogics, psychology and philosophy are of particular importance for new educational center development. These issues were covered in the works of the following scholars:

Myhailo Levkivskyi, Vasyl Madzigon, Valentyna Dorotuk, Lubov Tarabasova, Hans Bruggelmann and Ken Robinson.

Educational (school) centers in an area with difficult topography are multipurpose multi-sector educational development centers intended for functions related to education, the bringing up of children, leisure, physical development and sports, cultural development and entertainment, catering, health care, administrative and maintenance services. This type of institution is very important to develop in Ukraine now, since, on the one hand, they are an alternative to the educational institutions existing now, and on the other, Ukraine has a shortage of even land for construction.

Areas with difficult (rugged) topography are less attractive for large scale residential development or agricultural use. Thanks to the development of construction and structural opportunities and approaches, challenging terrain no longer causes considerable difficulties for architects, and with new approaches to space and design it might be turned into an advantage. Challenging terrain (slopes, hillsides, ravines, rakes) are widespread in Ukraine. Here, the land plot price is normally lower than that of an even land piece, therefore, it makes it more affordable for developers, however, the complexity of the construction work needs more investment and effort than the construction of buildings on even areas. South, south east and east facing slopes have sufficient insolation and visibility conditions that allow for the construction of energy efficient buildings. Therefore, it saves money on electricity and heating bills and the construction costs pay off in the course of building upkeep. Additional advantages here are green terraces and unimpeded surface water outflow. A sloping area influences architecture and design works, scope and spatial arrangement and building construction, resulting in a unique architectural solution.

The area of influence and organization design of school centers in the areas with challenging topography in Ukraine depends on their location. The centers should rather be located in areas easily accessed by public transport or on foot to best meet the needs and conditions of the following aspects (environmental, climatic, social and demographic). The centers could be located in the outskirts of cities – local situation or within a residential area – directly in the urban structure. The centers are meant to be used by children from the surrounding residential area where the educational institution is located. School centers in the areas with challenging topography can also be built in rural areas. There they automatically become an alternative to the hub schools that are currently being introduced in Ukraine. Hub schools are reorganized secondary educational institutions established by joining educational institutions as branches (divisions) to one educational institution (hub) [7]. School center development in rural areas plays a special role in Ukraine, since most of the schools in Ukraine are rural; where almost two thirds (67.8%) of Ukrainian students study [6]. These schools are outdated and in need of revival.

The architectural and construction solutions for such school centers should look like an integrated composition of forms cooperating with each other. These forms can be divided into smaller sized rooms (classrooms, offices, labs), large format community rooms (concert halls, gyms and catering facilities) and large open spaces (stadiums, gardens, sports fields and playgrounds).

Classrooms and offices are constructed as a terraced type of development along the slope. Then every classroom would be provided with sufficient insolation and good visibility and would have a roof leisure facility on top of the building constructed at the lower level.

Large community rooms take up a lot of space and should be located horizontally. Thus, it is best to use an even piece of land for them, however, there is an option of using cantilevers and truss or to make the building caved into the slope.

Large open spaces can be divided into the ones that should be built on level area: stadiums and sport grounds; those that can have some grade of slope: playgrounds; and those that can be constructed on any type of geographic terrain: gardens, parks (they can be developed on terraced areas).

The grade of slope for the set of buildings and facilities should be acceptable for construction. Based on Volodymyr Krogus' research [1], it has been established that the grade of slope should mainly fall within the acceptable range of 33.5–100% (18.5–45°). This range is considered to be appropriate for the main construction. Areas with a grade of slope of 33.5% should be used for sports fields and playgrounds. In case of the building being adjacent to the slope or caved in, 45–90° is believed to be acceptable.

There are two stages in planning and designing school center architecture and construction work in areas with challenging terrain. The first stage involves identifying a spatial solution. It shapes the construction and landscape arrangement of the buildings in the hub. This stage is focused on the overall appearance of the center, its urban location and spatial arrangements on the slope. The second stage is focused on the design and planning of buildings, defining their size, forms and positioning.

Space and town planning construction of school centers can be of various types: pre-engineered, pavilion, line, compact centralized and combined. Pre-engineered means arranging separate building blocks with rooms used for similar purposes; these facilities are not connected by heated passages. A pavilion type is aimed at dividing functional groups of buildings into separate blocks linked by heated passages. A line type of construction lines up the buildings along the slope. A compact centralized type arranges compactly located buildings into squares or circles linked by passages. A combined type is a combination of several types of composition options.

Space and planning structure allows one to single out buildings by chamber type, enfilade layout, hall type, perimeter and corridor-ring type. Chamber type involves positioning functional groups of buildings along the main communicative block of corridor or gallery – like type of space. Enfilade layout positions premises one after another and links them with a passage. General type is aimed at arranging integrated space to comply with functions that do not require large undivided areas. Perimeter type consists of functional blocks of premises that have an entrance to a common area uniting them (atrium, foyer). A corridor-ring type of layout positions functional blocks of premises around one large space (hall, atrium) through a passage or corridor. All space and planning structures can be combined in one school center to create a combined appearance.

Building space and planning structure is an integral part of the space and design solution; they are interdependent and shape each other.

To choose the best solution of space and design layout of the buildings making up the school center in an area with challenging topography, it is necessary to take into consideration the construction territory configuration, slope orientation, ratio of grade (angle of the slope), built up area, horizontal and vertical division of the construction area, transport accessibility from nearby residential areas, convenient access, utility services arrangement, environmental factors, erosion, if any.

Globally and in Ukraine, more attention is being paid to efficient land use and preserving their natural uniqueness. It is especially pertinent for urban areas where challenging terrain is the last piece of land to be used for residential buildings due to the complexity of construction work. However, these plots of land could have valuable recreational and aesthetical features and create unique distinctive views. Buildings constructed on complex terrains tend to dominate the skyline and shape the entire image of the area. Areas with challenging terrain have lots of potential in Ukraine. Building up these areas will contribute to the development and expansion of existing residential areas and will support progress in architecture and construction. Landscape chosen for school center construction will enable us to have more options for effective and unique architecture, planning and designing the space as well as artistic solutions.

In the modern world, education is one of the most decisive factors in developing personality. It plays a significant role in any state: it is education that serves as one of the major means of revival and development of the culture, intellectual and professional potential of its society. It is the basis and foundation for community development and improving quality of life. It enhances the competitive ability of education and its integration into the global educational space.

School centers in the areas with challenging topography are technologically unparalleled educational institutions. They not only comply with the standards, needs and general purpose requirements under the education reform objectives, but also offer more opportunities and choices for children to meet their individual needs. School centers in the areas with challenging topography contribute to raising conscientious active citizens capable of providing for the economic growth and cultural development of the country.

## References

- [1] Krogus V.P., *Urban construction on the slopes*, M.: Stroyizdat 1988.
- [2] Kovalska G.L., *Urban development fundamentals of development network of preschool and secondary educational institutions*, Doctoral Thesis, Kyiv National University of Construction and Architecture, Kyiv 2016.
- [3] Kovalskiy L.M., *Issues of development of architecture of educational institutions buildings*, Doctoral Thesis, Kyiv National University of Construction and Architecture, Kyiv 1996.
- [4] Sleptsov O.S., *Modern school architecture: gymnasium of the latest biotechnologies*, K.:A+S, 2011.

- [5] Sleptsov O.S., *Designing space planning structure of school buildings in challenging engineering and geological conditions (collapsible soil and undermining areas)*, Doctoral Thesis, Kyiv National University of Construction and Architecture, KievZNIIEP, Kiev 1986.
- [6] Yurchuk L.M., *Mechanism of establishing education constituency*, <http://academy.gov.ua/ej/ej12/txts/10ylmuoo.pdf> (online: 14/10/2019).
- [7] Establishing hub school, <https://mon.gov.ua/ua/osvita/zagalna-serednya-osvita/oporni-shkoli/stvorennya-opornoyi-shkoli> (online: 14/10/2019).