Complex (All-Round) Method of Architectural Modernization of Rural School Buildings

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Abstract: Modernization of school buildings in villages demands complex (all-round) approach in order to make effective project and organizational decisions, which means the survey of different components of educational space of rural territories and their assessment. Difficulty of such process is in different town-planning conditions of rural territories, their unsteadiness in time and space which negatively influences the effectiveness of rural schools’ functioning. Besides that school fund (all school facilities within specific territory) of rural territories is characterized by great diversity of school kinds which greatly complicates its assessment and identification of the necessary measures aimed at modernization within educational space of rural region. This article investigates complex method of architectural modernization of educational facilities in a village. Proposed method allows to choose necessary direction of modernization, select optimal reconstruction measures and assess effectiveness of decisions before the implementation of the project.

Key words: Modernization • Reconstruction • School buildings • Complex approach.

INTRODUCTION

Today modernization of education is one of the most important components of improvement of social sphere in Russia which determines future development of socio-economic, scientific and technical and cultural spheres of the country. The final target of modernization of Russian school is reaching the goals of accelerated development [1]. One of the 5 prioritized directions of modernization of school education in Russia is elimination of moral decrepitude of school buildings and development of infrastructure of schools including rural ones in order to put them in compliance with new and perspective requirements to teaching and upbringing of children [1, 2]. Main task of implementation of prioritized directions of Russian rural school modernization is optimization of functioning of school network in accordance with future and factual development of territories and modernization of school buildings in order to improve their appearance and architectural-planning structure to comply with requirements of innovative education and principles of sustainable architecture [2, 3].

Different aspects of school construction works and use of school buildings in Russia form huge area of scientific knowledge. Fundamental, in scientific and practical terms, are the PhD works of V. Smirnov and V. Stepanov which investigate the issues of typology and architecture of school buildings. Scientific study of reconstruction and modernization of school buildings was made by A. Mironyuk (as exemplified by the city of Ukhta), O. Bunik (as exemplified by Yaroslavl) [4, 5]. Special importance must be paid to scientific and creative inventions made by young Russian architectures - they were searching for new principles of organization and functioning of schools and scientific – and practical studies of different aspects of sustainable development of architecture of school buildings [6-8].

It is worth noting that coverage of issues and problems of schools modernization was made through example of city schools. In the same time modernization of school buildings in villages has its own specific features - connected with functioning of schools in rural areas and particular conditions in which they exist: unstable demographic and town planning showings,
socio-economic conditions, lack of alternatives of educational space, networking functioning, modern interpretation of the significance of school in life of rural society [9,10]. This situation demands development and use of complex method of modernization of educational space of rural territories, which will include recommendations on organization of school network and updating of architectural and planning structure of existing school buildings.

**MATERIALS AND METHODS**

Study of data on approbation of different variants of educational space organization in rural areas and functioning of village schools in Russia [11] determined the concept of the method: “factual” and “benchmark” models in different typological levels - school network, territory adjacent to a school, school building, internal environment of a school – must be formed.

The essence of the method is comparison of “factual” and “benchmark” models, it looks like this:

Firstly, it is necessary to find out regional particularities of organization of school network for different districts - conceptual calculation of “benchmark” variants of organization of effective school network on the base of differentiated town-planning conditions and demographic indicators. The result of calculation is nomenclature of school buildings differing in size, capacity, organizational-pedagogical and functional-planning structure, which is necessary for specific town-planning conditions.

Secondly, to make the list of rooms for different types of rural schools corresponding to the particularities of “benchmark” variants of organization of school network and new requirements to school buildings taking into consideration the targets of accelerated development, principles of sustainable architecture [3,15] and foreign practices in organization of comfort environment for studies [12-14]. The result of calculation is “benchmark” program-offer for design works, with which at pre-design stage design solutions are compared.

Thirdly, comparison of already existing school fund (school network and its components) with “benchmark” values in order to choose effective solutions, identification of the list and scope of necessary measures on modernization.

As calculation base of the method we propose algorithm for identification of specific directions and scope of measures on modernization of rural area school funds. Its analytical component is presented in the Figure 1 and contains known methods of calculation of school networks, finding out the need for school places, evaluation of effectiveness of use of a school building’s rooms [4, 5].

Proposed complex method of architectural modernization allows to identify necessary direction of modernization, select optimal reconstruction measures and evaluate the scope and effectiveness of decisions before the implementation of the project. It differs from surveys performed earlier by [4,5] complex (all-round) approach - while evaluating effectiveness of interaction with each other and effectiveness of independent functioning of different-level objects of educational space of rural areas both in factual and predicted (model) conditions.

**Main Part:** Approbation of complex method of architectural modernization was performed through study of Rostov Region school fund with the purpose to find out typological patterns of its modernization [16]. Study was made by 2 stages - in 1998 and 2009 which allowed to collect comprehensive analytical material and to find out dynamics of changes of town-planning conditions (village structure, demographic showings) and the structure of school fund of the region.

For evaluation of the condition of rural schools fund of the region we performed interview by questionnaire and site survey of buildings in 29 districts. The aim of study was registration of main architectural, typological and operating characteristics of schools and their complex evaluation by set criteria - particularities of territorial distribution by kinds and types, construction period, ratio of designed capacity with real and predicted needs of population, deficit or surplus of areas and rooms.

Generalization of the results of complex evaluation of the rural districts’ showings, characteristics of rural school fund of the region, study of particularities of functioning of rural schools and modern approaches to the organization of educational environment allowed to form organizational-functional model of rural school (Figure 2)

This model is of generalized character but contains all necessary organizational and functional criteria for choice depending on particularities of rural districts.

Analysis of village structure, demographic conditions and economic potential of rural administrative districts of Rostov region allowed to formulate 3 variants of characteristic regional town-planning conditions [9].
Fig. 1: Calculation component of algorithm.

Fig. 2: Organizational-functional model of rural school.
Then, using calculation component of algorithm of complex method of architectural modernization it is possible to elaborate “benchmark” models of educational space - variants of organization of school network and necessary nomenclature of school buildings.

Comparison of typological characteristics of existing school fund with proposed “benchmark” variants led to 4 project situations which are characteristic for rural territories of Rostov region:

- Typological characteristics of educational institution exceed to great extent real needs of population - this leads to great reduction in effectiveness of functioning and use of school building;
- Organizational - functional structure of existing school satisfies needs of local population but designed characteristics of school building do not correspond to this structure and modern requirements to organization of educational environment at schools;
- Typological characteristics of educational facility are insufficient for satisfaction of needs of local population - it means that both educational facility and school building must be transformed;
- Regardless of the needs physical wear-and-tear of school building is more than 70% which determines the necessity of new construction under modern program-offers taking into consideration local town-planning conditions.

Every one of these project situations can exist regardless of the type and kind of school but every one needs specific organizational and reconstructive measures. To fix average list of necessary measures we formulated 4 variants of modernization of rural school buildings - de-enlargement, adaptation, enlargement and functional re-orientation (partial revalorization).

Principles are based on interaction in different project situations of 3 categories: organizational-functional structure of school (appearance, needed capacity, number of parallels of students); designed characteristics of school building (designed capacity, list and areas of rooms, functional-planning interrelations); typological characteristics of educational facility (combination of organizational-functional structure of a school and designed characteristics of school building). Realization of each principle suggests application of internal or external methods of reconstruction. Internal methods - measures of reconstruction which do not change dimensions of the building: functional re-distribution of areas and rooms, re-planning, use of basement and attic space, use of not occupied areas and rooms. External methods are measures intended for changing of building dimensions and its volumes - building of adjacent functional-planning wing, substructure of planning modules (additional storeys), erection of a new additional building.

Principle of de-enlargement. It is adjustment of organizational-functional structure of a school to designed characteristics of school building. It suggests such organizational measures as change of appearance of educational facility (status downgrading), reduction of parallels of students and therefore reduction of capacity. This principle suggests maximal use of available material and technical base of educational facility and minimal scope of reconstruction measures. Implementation of de-enlargement principle suggests use of one of internal methods of reconstruction - functional re-distribution (including little re-planning or without it) in order to obtain additional needed rooms.

Principle of adaptation. It suggests correspondence of organizational-functional structure of the school to town-planning conditions and real needs of the village. It means adaptation of school building for school intended to satisfy modern requirements to organization of learning environment, to preserve its status and town-planning significance. It is based on updating of designed characteristics of a school building to comply with necessary normative values determined by organizational-functional structure of the school.

Implementation of adaptation principle is possible at the expense of active use of internal and possibly external methods of reconstruction:

- Functional over-distribution and re-arrangement, use of attic space to obtain needed auxiliary rooms;
- Use of attic space or erection of additional storey by means of planning module (for class rooms, information center, rooms for project activity of students);
- If it is impossible to reinforce capital constructions of the building which prevents from adding new storey - construction of adjacent functional-planning block of rooms of primary school and information center.

Enlargement Principle: It is used when the status of educational facility is increased, or when micro-district covered by the school is broadened. It suggests such
measures as increase of the number of parallels of students, obligatory extension of functional capabilities of school, formation of new enlarged types of schools on the base of factual project characteristics of school building.

While enlarging educational facility it is necessary to perform big modernization of school building in order to bring its project characteristics in accordance with the needs of new (enlarged) organizational-functional structure of school. The choice of effective reconstruction measures in a case of enlargement depends mainly on technical and operational characteristics of school building (number of storeys, structural diagram, type of roof deck) layout (floor-plan) diagram and availability of reserved territory for development.

It assumes complex use of external methods of reconstruction (complex reconstruction) at the expense of adding a top storey and adjacent functional-planning blocks of needed (not available) rooms - universal learning or multi-functional sections, information center and sports rooms etc.

Principle of functional re-orientation (partial revalorization). It is partial change of school building's functions in order to preserve it when typological characteristics of e-f (organizational-functional school structure and designed characteristics of school building) exceed greatly the real needs of population in student places. It suggests such measures as realization of functions of social orientations - library, computer centers, sports center, cinema-video hall, small hospital. It means little reconstruction measures - functional re-distribution of areas and rooms, organization of separate entrances (if necessary).

CONCLUSIONS

Complex method of architectural modernization based on application of “benchmark” models for specific town-planning conditions allows:

- To evaluate effectiveness of the solution before the implementation of the project.

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REFERENCES

1. President’s initiative “Our new school” of 15.08.2010. Date Views 15.11.2013. kreml.org/topics/198294691.
11. Abankin, I., T. Abankina and A. Vavilov, 2006. Recommendations on regulatory support of formation and functioning of educational facilities integrating different kinds, forms and levels of educational and socio-cultural activity. Moscow: SU-HSE.


