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Conditions and prospects for the application of Educational and Technological tasks at the pre–project stages

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At present, the Russian economy faces significant challenges in the field of technological development. Science and technology are acquiring a new role as fundamental elements in solving many national and global problems. It is expected that in the next 10–15 years, the priorities of Russia's scientific and technological development will be those areas that will enable the achievement of new scientific and scientific-technical results, the creation of technologies that form the foundation for the innovative development of the domestic market for products and services, the country's stable position in the external market, and, among other things, ensure the transition to advanced digital, intelligent manufacturing technologies, and high technologies. Consequently, systemic changes in approaches to the scientific and technological development of regions are necessary to achieve technological sovereignty in critical and cross-cutting technologies. This requires the consolidation of efforts by federal government authorities, regional government bodies, the scientific-educational and entrepreneurial community, and civil society institutions to create favourable conditions for the development and application of scientific and technological achievements in the interests of Russia's socio-economic development. And if the key universities and scientific organizations are defined as the drivers of technological development in our country, then, given the demand for a new institutional environment, the concept of modern campuses should more accurately be called the driver of technological development.

Keywords: *educational environment, material and spatial environment, design assignment, normative and technical documents, functional and technological requirements, educational and technological task, functional model of the building*

INTRODUCTION

In the transition from a post-industrial to an information economy, the approach to organizing the educational process is changing. The concept of new education (Education 3.0) involves integrating traditional and digital technologies in the creation of the educational environment and the organization of the educational process. Accordingly, the scientific and technological development of the country must occur in the changed realities [1]. At the same time, the Concept of Technological Development expects the strengthening of the role of key higher education institutions and scientific organizations as drivers of technological development [2].

Today, the Ministry of Education of the Russian Federation sets the following tasks for domestic universities:

- the use of advanced technologies in the educational process: artificial intelligence, VR/AR, blockchain, etc.;
- training personnel for high-tech industries;
- providing conditions for conducting scientific research and development in priority areas of Russia's scientific and technological development, the list of critical technologies of the Russian Federation, and other areas of scientific research and development ensures the implementation of measures within the framework of national projects, federal projects, including initiatives for the socio-economic development of the Russian Federation [3];
- ensuring conditions for the implementation of the target model indicators of educational organizations;
- providing conditions for personnel training in accordance with the goals of the regional socio-economic development strategy and the needs of strategic projects;
- ensuring the possibility of implementing educational programmes with practical training jointly with industry leaders or industrial partners, and network educational programmes;
- ensuring the possibility of creating intellectual property (IP) and high-tech products in accordance with the commitments made by educational organizations and/or scientific organizations — campus residents, based on the planned laboratory and technology park equipment;
- creating conditions and providing opportunities for testing new technologies and creating university startup projects;
- providing comfortable living and learning conditions that exceed regulatory standards, as well as safety throughout the territory;
- ensuring the creation of innovative products, technologies, and patents based on the campus research infrastructure;
- providing the opportunity to create (locate) on-campus structural units of educational organizations in collaboration with external partners.

At the same time, cities, regions, industries, and businesses are forming their demands not only for graduates but also for the educational and research

activities of universities, their infrastructure, and their campuses. In recent years, there has been an increasing demand for the multifunctionality of campuses, ensuring the implementation of practice-oriented and advanced training of personnel, flexible educational trajectories, the possibility of conducting exploratory and applied research, and the development of student startups [4]. Against this backdrop, the infrastructure and campuses of universities need to be organically integrated into the urban environment and regions to ensure mutual integration. Thus, university campuses must provide density and intensity of communication, quality of space (openness to the city, modernity, convenience), flexibility, the ability to reorganize and experiment, diversity of non-academic functions (including for city residents), and an effective economic and management model (management based on business principles, incorporating a business component into the campus strategy) [5].

DESIGN ASSIGNMENT

From the above, it follows that the modern development of higher education and science leads to the development and, accordingly, the complication of the material and spatial environment of university campuses. The concept of the "material and spatial environment" and the disclosure of its parameters was the focus of one of the previous publications [6]. It was established that the mismatch of the material and spatial environment of the university with the modern way of life, the realities of high-tech, knowledge-intensive, and "smart" production reduces students' motivation to choose a scientific trajectory, lowers the prestige of scientific professions, repels high-performing and creative companies in the real sectors of the economy from cooperation, and also hinders the formation of a scientific and technological elite, contributing to the outflow of scientific personnel abroad. In these conditions, universities, as functional clients responsible for creating a modern educational environment and ensuring a range of socio-economic effects and analytical indicators at the national, regional, and institutional levels, face a number of problems [7].

First, the university does not have sufficient information, skills, or understanding of how to prepare or formulate the necessary initial data for preparing a design assignment for a capital construction project in accordance with the Order of Ministry of Construction, Housing and Utilities of the Russian Federation dated April 21, 2022, No. 307/pr. "The approval of the form of the developer's or technical customer's assignment for the design of a capital construction object, the construction, reconstruction, and major repairs of which are carried out with the involvement of funds from the budget system of the Russian Federation" [8].

Second, universities currently do not have the necessary, objective tools for forming requirements for the educational process, research activities, educational environment, and corresponding spatial environment, which would be sufficient for further preparation of the technical assignment.

Third, universities are unable, during the coordination process, to establish the exhaustiveness of the design assignment, the compliance of the prepared design solutions with it, as well as to justify certain individual design conditions that may be necessary given the request for the transformation of the educational environment to meet the needs of advanced development and knowledge-intensive production.

Fourth, universities usually do not have the experience, skills, or effective tools for objectively evaluating the prepared design materials, especially the section "Requirements for the safe operation of the capital construction object" [9].

From the above, it follows that universities, as functional clients, are currently very limited in the tools available to them.

Now let's turn to the main developer of the design specification according to Order No. 307/pr. It turns out that when preparing the design specification for a higher education institution, the technical client also faces a number of difficulties, which ultimately affect the degree to which the campus or even its individual facilities meet the expectations of the functional client or the parameters of the functional model. The technical client lacks the necessary knowledge and understanding of the functional, technological, and operational properties of the created material-spatial environment, as well as the requirements for its flexibility and multifunctionality. The current form of the design specification does not allow for the reflection of which functions the university performs, in what scale and combinations, how they are linked within the space, and what material base is needed to ensure these functions are fulfilled. Moreover, there is not always the possibility or justification for preparing a traditional technological design specification for an educational facility [10]. In most cases, no matter how complex the functional-technological saturation of the campus is, its description and parameters can only be described by item 20, "Requirements for Technological Solutions", in the approved design specification form [8]. However, the technical client must oversee the parametrization when developing the project documentation for the construction or reconstruction of the campus, as well as the creation and maintenance of information models of its facilities.

As a result, in most cases, already established and often outdated approaches to the design of educational institutions are used in the preparation of the design specification. These approaches lack tools for parametric standardization, mechanisms, and rules for determining, forecasting, and describing the properties and parameters of the created modern, multifunctional, efficient, and safe material-spatial environment of campuses.

EDUCATIONAL-TECHNOLOGICAL ASSIGNMENT

In search of solutions to the identified issues, a systematic analysis was conducted, which revealed the existence and successful application of a specialized tool, the "Medical-Technological Specification", within Moscow's healthcare system. The work with this document is defined by the Moscow Government Decree dated July 29, 2021, No. 1148-PP [11]. This decree defines the structure and procedure for the preparation, coordination, and approval of medical-technological specifications for the design of capital construction projects, construction, or reconstruction financed by the Moscow city budget or non-profit organizations. The medical-technological specification is essentially a "doctor's specification" and a system of initial data for the preparation of the architectural-design specification. The document emphasizes the purpose, technical characteristics of the building, technical-economic and special conditions, and this is essentially the first step in developing project documentation [12]. Sometimes the term "Medical-Technological Specification" is replaced with the term "Medical-Technical Specification", which sounds closer to the familiar term "Technical Specification" [13]. Essentially, these are identical documents, but formally, the "Medical-Technological Specification" is closer to the considered functional-technological characteristics of the future healthcare facility. And it is the one that is implemented by an official regulatory act.

Similarly, to address the issues described in the first part of the paper, a pathway for the formation, development, and subsequent application of an "Educational-technological assignment" (ETA) is proposed, which will allow for the variation of functional and

technological requirements in design, depending on the specific needs of the functional customer. The approach to developing the ETA is based on the "implemented function", i.e., the type, scale, characteristics, and parameters of the educational or research processes.

The foundation of the ETA is proposed to be the synthesis of parameters of the material and spatial environment, the implemented educational process, research and production activities, applied educational and research technologies, properties of infrastructure elements, and engineering and technological equipment. The ETA can be oriented towards individual buildings and groups with various functional and technological configurations within new construction, reconstruction, and major repairs. It is evident that the ETA will allow for the alignment of the design assignment and the design solutions themselves with the types of services provided by universities, the products they produce, the educational programmes they implement, the forms of project-based learning they develop, the startups they nurture, and the number of students, professors, faculty, and researchers they attract.

In this paper, the author proposes the following definition of the ETA for the first time: it is a document that contains the initial data for design, including a set of fundamental functional, technological, and operational requirements established by regulatory documents, developed educational and technological conditions, and the target model of the educational organization. In previous publications, it was determined that, from a qualitative point of view, educational and technological conditions represent a system of engineering parameters — metrics of an efficient, safe, and comfortable educational environment [5]. Similar to the "Medical-technological assignment", the ETA is rational for implementation as the basis and part of the design assignment, as well as within the framework of the relevant procedures for the development, approval, and examination of design documentation. To achieve these goals, the ETA should be based on the following principles: enhancing the functional flexibility of the university environment; increasing the organizational and technological sustainability of the university during operation; improving comprehensive safety and resource conservation; ensuring the predictability of the personnel policy of the operational system, and more.

ETA STRUCTURE

Adhering to the position that the ETA is part of the design assignment and complements it, its structure should predominantly focus on issues that are absent or insufficiently covered in the standard assignment. Primarily, these are questions of functional zoning of buildings, floors, and rooms, as well as technological trajectories. It is necessary to reflect the functional model for the future development of the university. Requirements for organizing the flow of students, faculty, and researchers within functional and auxiliary zones. Requirements for functional efficiency, safety, and comfort related to the types of products produced and services rendered. Requirements for automated and high-tech workplaces. Lists of equipment and furniture linked to activities. Requirements for microclimate by room and zone. Restrictions related to the operational parameters of buildings. With the development of the ETA tool, the expansion of its structure is expected.

ETA APPLICATION PROSPECTS

Since the ETA can be considered a tool at the intersection of educational and architectural-construction design tasks, its primary, already evident prospects for application can be divided into two parts.

Solving tasks set by the education system:

- the ETA can take into account the requirements for the space and technical equipment of a university, considering the possibility of using high technologies in the educational process;
- the ETA can outline the types of activities and characteristics that the space and technical equipment of universities should meet (educational and research infrastructure) [3];
- within the framework of the ETA, the need for specific design solutions can be justified;
- the ETA can be applied in cases where a university does not have a clear understanding of the material and spatial base it needs to implement its forms of education;
- the ETA can disclose the functional model of the university in conditions of its further development and interaction with external partners [14];
- with the help of the ETA, functional and parametric planning of the university's activities can be ensured.

Solving tasks set by the architectural-construction design system:

- the ETA contributes to a more accurate and complete filling of points 10, 11.5, 11.6, 13, 19, 20, 21, 24.1, 24.2, 26, 28, 31, 37, 38, 39, 40, 43, 46.1 of the design assignment [8];
- by correlating in the ETA the parameters of the spatial environment and the university's requests for the functionality and zoning of this environment, it becomes possible to justify, during the examination, design solutions that exceed their parameters beyond regulatory and technical requirements;
- the ETA for the technical customer is a tool that allows correlating the requests of the functional customer and the generated design solutions;
- reduction of labour intensity and cost of design, including the preparation of digital information models.

CONCLUSIONS

At first approximation, it can be concluded that the ETA is a necessary modern tool for the functional and technical customer, as it contains and correlates two main components:

- functions necessary for the transformation of the educational environment to meet modern tasks and advanced development [15];
- parameters of the material-spatial environment and technical equipment that are subject to selection and composition within the design tasks.

The application of the ETA is a more universal trajectory since the method of parametric regulation can be taken as a basis, which will ensure greater adaptability and resilience of university campuses and infrastructure.

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Условия и перспективы применения образовательно-технологического задания на предпроектных этапах

В настоящий момент перед российской экономикой стоят большие вызовы в области технологического развития. Наука и технологии обретают новую роль как основополагающие элементы решения многих национальных и глобальных проблем. Ожидается, что в ближайшие 10–15 лет приоритетами научно-технологического развития России станут те направления, которые позволят получить новые научные и научно-технические результаты, создать технологии, являющиеся основой инновационного развития внутреннего рынка продуктов и услуг, устойчивого положения страны на внешнем рынке, и обеспечат, в том числе, переход к передовым цифровым, интеллектуальным производственным технологиям и высоким технологиям. Соответственно, становятся необходимы системные изменения подходов к научно-технологическому развитию регионов для достижения технологического суверенитета в области критических и сквозных технологий. А это требует консолидации усилий федеральных органов государственной власти, органов государственной власти субъектов РФ, научно-образовательного и предпринимательского сообщества, институтов гражданского общества по созданию благоприятных условий для развития и применения достижений науки и технологии в интересах социально-экономического развития России. И если драйверами технологического развития нашей страны определяются ключевые вузы и научные организации, то с учетом запроса на новую институциональную среду драйвером технологического развития точнее будет назвать концепцию современных кампусов.

Ключевые слова: *образовательная среда, материально-пространственная среда, задание на проектирование, нормативно-технические документы, функционально-технологические требования, образовательно-технологическое задание, функциональная модель здания*

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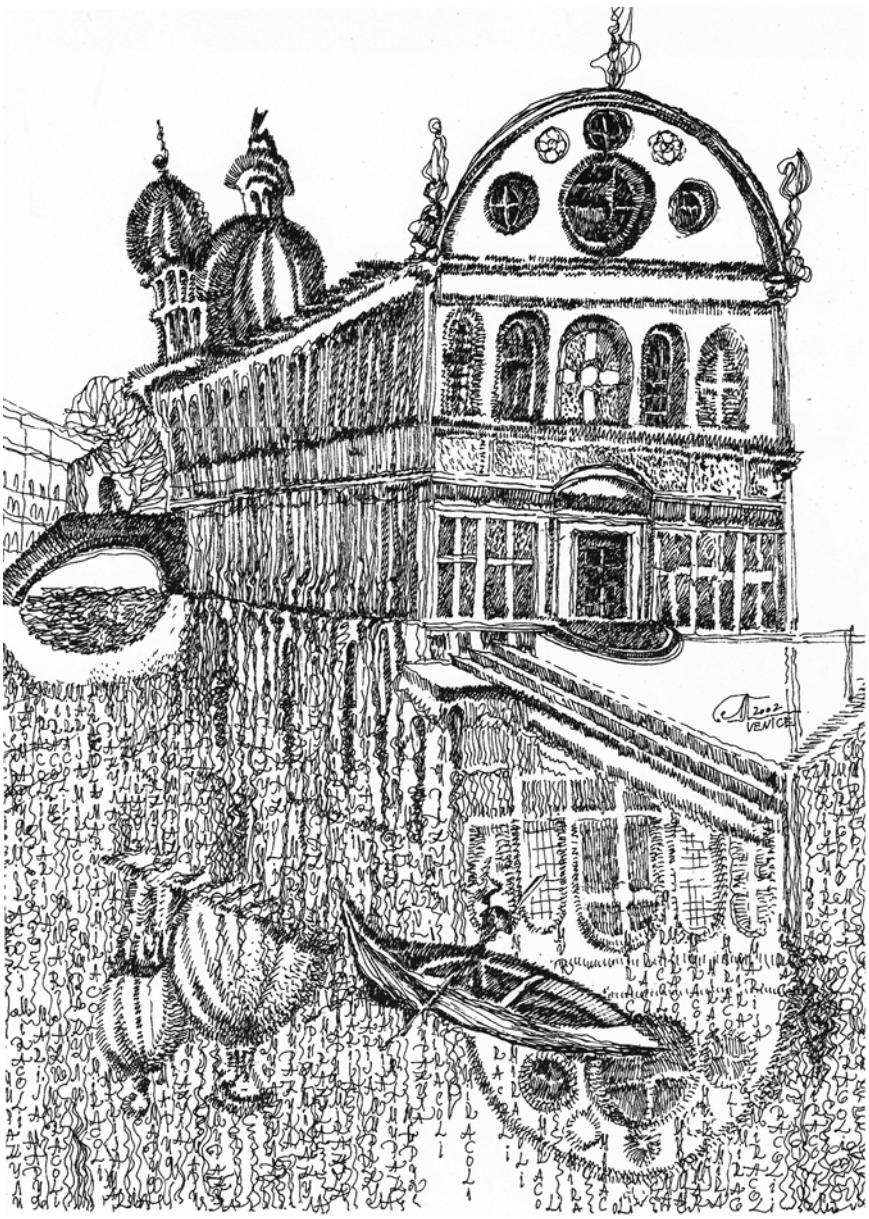

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