The relationship between pedagogical design and simulations

In pedagogical activity, due to the complexity and multifactorial nature of pedagogical systems and situations, design is an essential condition for obtaining a high-quality predictable educational result, that is, a high-quality solution to the tasks of teaching and upbringing in given conditions. The objects of pedagogical design can be a system, a pedagogical situation, or an educational process.

Currently, there is no unity in the definition of the concept of "system". We will define a *system* as a set of elements in relationships and connections with each other in a certain way and form some integral unity. Under the element, we will understand the most straightforward indivisible part of the system, i.e., the limit of the division of the system in terms of solving a specific task and goal. The system can be divided into elements in various ways. They depend on the formulation of the goal and its clarification in the study. At the dawn of applying a systematic approach to the study of systems, it was presented as a black box with certain functions at the input and output. This maximally simple model emphasizes two system properties: integrity and isolation from the environment. The definition of a system in a black box allows for multiple attachments but requires considering all the relationships. The disadvantage of the black box model was the technical orientation of the system's understanding of the simulated object, insufficient attention to the system's structure, and underestimation of synergetic phenomena, which is not suitable for pedagogical processes.

The pedagogical situation is a set of elements of the system that are significant at a specific moment of its functioning and development. These can be a way of interacting with participants in the pedagogical process, the choice of the subject area of the system, the conditions of communication in solving a pedagogical problem, etc. In a pedagogical situation, we can observe the intersection of participants in the pedagogical process and circumstances at a given moment. This intersection sets the event community. In it, the past intersects as the cause of the present state. The future appears as the prospect of solving a pedagogical problem. The pedagogical situation is a multifactorial phenomenon; therefore, it is characterized by non–linearity, and there is no unambiguous certainty. At the same time, it assumes the need for choice, taking responsibility for the results of its decision. The solution to the pedagogical situation is set on the ideological and professional basis of the teacher's personality, his ability to combine knowledge of different levels from different fields into a single semantic field. Thus, there is a pedagogical goal and readiness for action. The pedagogical situation is transformed into a pedagogical task.

The educational process means a two-pronged process of education and upbringing, the unity of the transfer to new generations of knowledge and life experience accumulated by humankind, and at the same time, the socialization of individuals entering life, introducing them to the moral foundations of coexistence with the rest of humanity.

In designing a pedagogical system, the analysis of the pedagogical situation and the related pedagogical activity involves the initial receipt and processing of information about objects that interact in the system, both among themselves and with the external environment. In general, an object means everything that human activity is aimed at. In other words, it is everything that we perceive as something that exists or arises in our consciousness and has specific properties. A property is a characteristic feature of an object that a researcher can qualitatively and quantitatively evaluate. From the researcher's point of view, properties are divided into internal, called object parameters, and external, called factors, representing the properties of the environment affecting the parameters of the object or model under study.

The object of research in which the research is conducted is the original. An object that is studied instead of the original to study specific properties is called a model.

In the first stage, the main direction of design is constructing a predictive pedagogical model based on the analysis of its nature, structure, and purpose. Depending on the goal, it can be a system model or a model of the situation. The dominant content is highlighted in the model based on selected value-semantic accents. A particular sequence of implementation of the upcoming

developing interaction is revealed, the possibility of integrating theory and practice to increase the project's productivity, determining the positions and roles of project developers.

Thus, a model is a mentally imagined, schematically, or materially implemented a system that, by displaying or reproducing the object of research, can replace it so that its study gives new information about this object. A system model describes the system (the original), which displays a specific group of its properties. Modeling is a way of studying objects on their framework structures, reflecting the essential features of objects and the construction of these structures to determine, refine their characteristics, rationalize the ways of their construction, etc. Currently, modeling has acquired a general scientific character and is used in studies of living and inanimate nature, in the sciences of man and society, including pedagogy.

By the nature of the side of the object that is being modeled, there is a distinction between modeling the object's structure and modeling its behavior (functioning of the processes occurring in it, etc.). For successful modeling, it is helpful to have already established theories of the phenomena under study, or at least satisfactorily substantiated theories and hypotheses indicating the maximum permissible simplifications when building models. The effectiveness of modeling increases significantly if, when constructing a model and transferring the results from the model to the original, you can use some theory that clarifies the idea of similarity associated with the modeling procedure used. Modeling necessarily involves the use of abstraction and idealization. Reflecting the essential properties of the original and distracting from the non-essential, the model acts as a specific form of abstraction, i.e., some abstract, idealized object. At the same time, the whole process of transferring knowledge from the model to the original largely depends on the nature and levels underlying the modeling of abstractions and idealizations. It is essential to identify three levels of abstraction on which modeling can be carried out. This:

1) the level of potential feasibility (when the mentioned transfer involves a distraction from the limitations of human cognitive and practical activity in space and time;

2) the level of "real" feasibility (when this transfer is considered a feasible process, although, perhaps, only in some future period of human practice);

3) the level of practical expediency (when this transfer is not only feasible but also desirable to achieve some specific cognitive or practical tasks).

At all these levels, however, we have to reckon with the fact that modeling of this original may not at any stage give complete knowledge about it. This feature of modeling is especially significant when the subject of modeling is complex systems whose behavior depends on a significant number of interrelated factors of different nature. In cognition, such systems are displayed in various models, more or less justified; simultaneously, some of the models may be related to each other, while others may be profoundly different. Therefore, there is a problem with comparing (assessing the adequacy) of different models of the same phenomenon, which requires formulating precisely defined comparison criteria.

Modeling in education is a vital starting element of practical management activities. At this stage, the initial parameters, statics, and possible system dynamics are determined, and organizational and economic resources are calculated, for example, bringing education out of systemically destructive relations with the state and society and translating them into systemically effective ones.

A model of an educational system can be a sign system that displays its essential features for solving the tasks set. It can take the form of a diagram, layout, graph, matrix of indicators, or exist as a descriptive system object. The described empirical pedagogical fact or educational process can be a model. Modeling helps to reproduce the integrity of the studied object, its structure, functioning, and preserve this integrity at all stages of the study. It is an indispensable condition for measuring the characteristics of an object. Each variable contains meaning only if these variables are displayed in a system of indicators presented in the form of an object model and its structure.

In addition, modeling covers the pedagogical object's statics and dynamics. Ultimately, the function of the model is to serve as the basis for forecasting. For education, this principle is

essential because the educational system has an increased dynamic orientation, the need to correct actions for the future state since education is the preparation of the subject for future activities, distant in the future. The model's dynamism will manifest itself in the ability of variables to reflect any changes characterizing socio-cultural dynamics mutually.

For the effective functioning of the educational model, it is of great importance to develop normative models that reflect our excellent idea of the studied or projected phenomena of reality. Normative modeling closely correlates with normative forecasting, with predicting the future state of an object or process, considering pre-set parameters to be achieved. Forecasting is part of normative modeling.

Firstly, a forecast is needed to build a normative model. Secondly, the normative model can be reasonably considered a retrospective turn (return) of the predictive model to the modern or advanced concerning the object's current state.

The forecasting procedure analyzes projective situations under the influence of input factors, identifies the consequences of such factors, and assesses their assessment. The most dynamic factor is implementing new and folding old models. The education system is susceptible to such actions. Under the influence of automation, computerization, labor content in all its traditional professions is changing qualitatively. Forecasting can be considered a complex multi-way process of designing and analyzing various models based on experiments. Ultimately, the optimal model of the most effective resolution of problem situations is determined as the permissible limit of the ratio of positive and negative actions.

Activity, its object, and means are not something frozen, static. In the activity model, its elements should appear as representations of specific processes. It should be noted that human activity is a way of subordinating elements to a particular order, involving the regulation and organization of these elements. This regulatory and organizational aspect is the subject of research in the model of activity considered as an example.

In the considered activity model, three blocks of elements can be distinguished, represented by a subject-functional and value orientation, an intersocial (external), and an intro social (internal) organization. The subject-functional value orientation elements constitute a particular axis around which the field of activity is formed. There is mutual repulsion and attraction of elements between two poles in this field. Thus, the field symbolizes the value character of the activity: the vector of value is enclosed in the acceptance and repulsion of intersubjective content.

In the subject-functional value orientation, such components as goal, function, and result are distinguished. Their meaning can be conveyed in a certain way. The value content of the object of activity is displayed by the function, the connection of the external being of the object with the state of the needs of the subject. The function is reproduced in the goal, which is determined due to the activity performed. The function is the direction and content of the activity, which, on the one hand, is set as a result of the interaction of the subject with his subject and social environment and expresses involvement in the processes of community life. On the other, it is a consequence of the subject's choice of goals and ways to achieve them - methods and technologies. Empirically, this pattern can be designated as a "type of work". The concept of function is revealed in research, modeling, diagnostics, forecasting, design, and several other processes in work, life, culture, education, management, etc. The next component of the subject–functional orientation is the goal, which is the product of value orientation in the form of a model of the intended result, reflecting the needs of the subject and the functioning of the content of the activity, which is determined by the ways to achieve the intended result. The result is a direct by−product of a valuable activity in a particular life situation. The work results are actual data, analysis conclusions, recommendations, draft programs, methods, technologies, models of the state and dynamics of processes, forecasts, etc.

Dynamic models, by definition, include a time factor. In the education model, the role of the "time" component of modeling is particularly significant. Modern education is quite complex in its content and duration—the terms of certain types of training range from several weeks to decades. The education system is already ahead of practice in its technological and social

development by its purpose. Shifting the forecast model too far into the future reduces its reliability. There are difficulties translating cultural experience into an adaptive educational model, working out methods and technologies of educational work.

So, modeling in pedagogy can consider the first, most significant stage of pedagogical design.

In the second stage, developing a way to reproduce the model in actual practice is relevant, which is defined as the design process itself. At this stage, algorithms for implementing the developed model are being developed. Furthermore, since they are copyrighted, it can be argued that design is a way of innovative transformation of pedagogical systems and pedagogical situations.

In the third stage, repeated practical construction of the pedagogical system or situation in variable conditions is carried out (the design stage).

The fourth stage can be characterized as a reflection on assessing the revealed patterns and analogies within the pedagogical system or situation.