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VISUAL MODELING OF THE MANIFESTATION OF THE ESSENCE OF MATHEMATICAL CONCEPTS AND METHODOLOGICAL PROCEDURES

Abstract. One of the ways to enhance the effectiveness of mathematical education of schoolchildren is to actualize solutions to complex tasks by adapting modern science. This possibility arises in the identification of "problem areas" of mathematics education and the construction of generalized constructs that are associated with the "problem area". In this article, on the basis of the dialogue of cultures and means of mathematical and computer modeling structured stages of adaptation and technological constructs of actualization synergy in training at the study of the notion of limit of a function. Didactic mechanism of the development of the essence of this construct is the implementation of the model cluster founding, are equipped with the motivation, applied learning situations and tasks at different levels. Longitudinal study of problem areas allows us to effectively develop the intellectual operations of thinking, intercultural communication, creative independence and self-organization of the schoolboy.

Keywords: mathematical education, dialogue of cultures, synergy, clusters of a founding, functional literacy activities, computer simulations, solve complex problems, limit of a function.

Introduction. Young people of the modern world have become more intolerant of manifestations of established stamps in education, lack of flexibility in teaching influences, have become pragmatic in assessing the emerging circumstances of life, giving priority to building personal preferences and prospects for their future life. At the same time, intellectual operations of thinking (understanding, concretization, abstraction, generalization, modeling, analogy, associations, etc.), which underlie the formation of universal learning activities of trainees, have ceased to develop effectively in school education for various objective and subjective reasons. And in this process, the role of mathematical education is lost as one of the most effective tools for personal development and development of social experience of previous generations, including amidst grandiose applications of mathematics. Suffice it to mention the achievements of fractal geometry (B.Mandelbrot, M.Feigenbaum, M.Barnslow, E.Feder, V.S.Sekovanov, etc.), the theory of chaos and catastrophes (G.Khaken, E.Lorents, A.N. Kolmogorov , V.I. Arnold, G.G. Malinetskii, R. Tom, O. Ressler, etc.), the theory of fuzzy sets and fuzzy-logic (T. Zade, A. Koffman, R. Ronald, etc.), theory coding and encryption (K.Shannon, D.Huffman, L.S. Khill, etc.), the theory of generalized functions (L.Shvarts, L.V. Sobolev, I.M. Gelfand, A.Martino, V.P. Palamodov, etc.), etc. But it is under modern conditions of intensive application of mathematical methods in science, in the humanities, in technology and related sciences, and even in conjunction with information technology, these studies would certainly have to be reflected in the changing programs of school and university mathematical education. First of all, there is a growing need for the actualization of generalized constructions and relations in the content of school and professional mathematical education, connected

primarily with the solution and research of complex problems by means of mathematical and computer modeling. As S.L. Rubinshtein [2] "... the generalization of the relations of objective content is, and then is realized as a generalization of the operations performed on the generalized substantive content; generalization and consolidation in the individual of these generalized operations lead to the formation of the corresponding abilities in the individual. " In such a paradigm, the teacher plays the most important role in improving the quality of teaching mathematics in high school. For example, ideally the future teacher should master the generalized content and methods of activity in the university so that when he comes to school, learn the school subject together with the students at the level of a well-founded entity, thus denying the so-called known "double oblivion" Klein.

Our concept assumes that the teaching of mathematics should take place in an informationally saturated educational environment in the context of a dialogue between the mathematical, informational humanitarian and natural science cultures and the integration of the didactic efforts of the teacher and pupil in the direction of revealing the essences of the basic educational elements (established symbolic forms, concepts, theorems, procedures, algorithms, ideas). And similar processes are directly related to synergetic effects and mechanisms of perception of complex information by the student's personality, the development of his mathematical abilities and creative independence, the construction of special procedures for mastering mathematical sign forms, objects and phenomena. As a result of such cognitive activity, the growth of educational and professional motivation, the development and self-development of thinking, and the expansion of experience and culture in the context of applied and professional orientation will be noticeable. Therefore, the alignment of stages and hierarchies in the process of level identification of the essences of mathematical forms, concepts and procedures by means of visual modeling is the most important mechanism to overcome the formalism in mastering the content of mathematics and represents a serious and far from solved problem in the didactics of mathematics.

Methodology, theory and technology. The realization of the announced concept is connected with the mastering of complex knowledge by the means of mathematical and computer modeling in a saturated information and educational environment. An effective tool for mastering complex knowledge can be the research and adaptation to the school or university mathematics of modern achievements in science that are vividly and significantly represented in applications to real life, the development of other sciences, high technologies and industries. The development of the philosophical concept of complexity (I.Kant, G.V.Gegel, I.Prigozhin, G.Khaken, V.V.Orlov, I.S.Utrobin, H.Alven, T.Vasilieva and others) is mediated extensive experimental material, practice and interdependence of integrative processes in science, technology, economics, social transformations and educational paradigms. Polyvalence, multiplicity, multipolarity, unpredictability, emergence and disequilibrium of the modern world cannot be unrelated to the categories of development of the essence of objects, phenomena and processes through the manifestation of the regularities of transitions to higher levels of complexity as components of a concrete general theory of development (V.V. Orlov, St. Bir, N. Winer, G. Neumann, and others). The researchers conclude that complexity is an integrating characteristic of the ability to self-organization when certain critical levels are reached. So French P.A. and Funke D. [8] define the RHC as a multi-step behavioral and cognitive activity aimed at overcoming a large number of previously unknown obstacles between fuzzy, dynamically changing goals and conditions. Psychological features of mastering complex knowledge were studied in detail by A.N. Poddyakov [1]. We further explore the directions of pedagogical support for mastering complex knowledge by students on the basis of adapting modern achievements in science to school and university mathematics with the manifestation of synergistic effects.

1. The basic notion of the presented concept is the concept of foundation as a philosophical category, pedagogical technology and psychological mechanism of personality development [3]. What is the phenomenon of foundation? Funding is the term used in phenomenology (and in other sciences) to describe the relationship of ontological justification. E. Husserl defines the funding relation as follows: A is founded by B, if for existence of A it is essential that B, only in unity with which A can exist. The foundation ratio can be one-way (A is weighted in B) or two-sided (A and B are weighted into each other). According to the phenomenological teaching, all complex high-level acts and objectifications are grounded in the original simple acts and subjects. In pedagogy for the first time the concept of foundation was introduced by V.D. Shadrikov and E.I. Smirnov in 2002 [4] as the process of creating conditions for