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THE TECHNOLOGICAL CONSTRUCTS OF MATHEMATICAL TRAINING FOUNDING IN HIGHER EDUCATION

Abstract. The article presents the development of innovative technological constructs of professional training of future specialists in higher education on the basis of the deployment of spirals and clusters of founding of mathematical knowledge in the course of synergetic effects actualization in teaching mathematics. The founding procedures are based on the study of complex knowledge, fractal interactions and integrative relationships in modern mathematics and their transfer into the technological field of training. The components and content of teaching mathematics technologies and innovative activity of students to master the complex content of mathematics as a pedagogical task in various conditions of information technologies support are presented. Effective development of professional competences, communicative and personal qualities of students, increase of motivation of future specialists are predicted.

Keywords: founding principle, technological constructs, professional training, visual modeling, fractal geometry.

The basis of an innovative approach to the selection of the content of mathematical education of the future specialist in higher education in the conditions of modernization is the mastery of complex knowledge with the manifestation of synergetic effects and cognitive style of future professional activity on the basis of the processes of personal experience founding and visual modeling of mathematical objects and processes [20]. Pedagogical technology of mathematical education synergy is the essence of the joint activity of the teacher and the student, leading to self-organization and achievement of the planned and probabilistically guaranteed results of the development of complex mathematical knowledge. However, in real life, university developments are usually reduced to the traditional content of vocational training, a proven set of subjects and their volume in the structure of curricula (unfortunately, this trend applies not only to higher but also to secondary school). Technological constructs of founding concept developed by V. D. Shadrikov and E. I. Smirnov, presented in this article, provide real opportunities for a particular university to build innovative educational constructs, a new structure and content of vocational training , based on already tested theories and technologies of vocational education [12]. A unique experience of the Yaroslavl State Pedagogical University named after K. D. Ushinsky on implementation of innovative content of professional training of the future teacher of mathematics within the experimental educational standard in the specialty "mathematics" (order No. 2046 of 14.05.2001, MO of the Russian Federation). in the period from 2001 to 2006, and then in a pilot experiment on the manifestation of synergetic effects [2] showed the high efficiency of the developed technology and the possibility of its transfer to new conditions of vocational education [2]. Control sections on mathematical preparedness of control and experimental groups of students showed significant positive changes of students of the experimental group studying on the experimental program on the basis of the founding conception. As a result, a third of the students of the experimental group graduated from the university with honors (which exceeds the average indicators of graduates of the faculty of physics and mathematics over the past decade in YSPU by 20%). Moreover, 25% of graduates continued professional pedagogical education (postgraduate studies, job seekers, real work in universities, management in the education system) with elements of research activities. Significant effects in the development of motivation, creativity and communication are revealed [3].

Purpose of research

As the analysis of the state higher pedagogical education conducted above shows, the lack or complete absence of a sound methodological basis in determining the vocational education content leads to the fact that the new content is not much different from the previous special training. At the same time, the reduced volume of subject training, weak professionalization, practical destruction of professional selection system will lead to deepening of crises and contradictions in professional training. Therefore, the purpose of this study involves the identification of technological constructs for the effective development of complex mathematical knowledge on the basis of founding conception and actualization of modern achievements in science , which determine the trends of implementation. The basic educational program of the university should be formalized and materialized in the form of specific academic disciplines, tools and forms of educational activity not only justified methodologically didactic (cognitive) processes that form the goal-setting, acquisition, application and transformation of personal experience. It should be improved the adaptation processes of characterizing technological professional tests of acceptance by the student the profession and the personal processes directed on manifestation of self-organization, features and development of motivations and emotions, reflection and self-regulation, self-assessment and a choice, intelligence and creativity of the personality in the course of development of difficult knowledge. The student should already get acquainted with the nonlinear style of thinking in post-non-classical sciences , know and find associations in real life of such phenomena of collective ordering as the effect of Zhabotinsky-Belousov, Binar Cells ("the road of giants" in Ireland), the Ginzburg-Landau theory of superconductivity in the quantum system, the Tray - Volterra equations in the predator-prey system, the Koch snowflake and the Schwartz cylinder, the Ferhulst scenario and the "butterfly effect" of the strange attractor Lorenz, etc. The leading idea is that a key aspect of synergy manifestation effects in mathematics teaching of complex knowledge-based adaptation of modern achievements in science. It state the possibility of the phases actualization and study the characteristics of essence development of sophisticated mathematical knowledge, phenomena and procedures, creating the conditions for communication and dialogue of cultures, identify attributes of self-organization of the content, processes and interactions (attractors, bifurcation points, basins of attraction, iterative procedures) during the development of "problem areas" of mathematics. Thus, the present study is an attempt to develop a technology of modern achievements adaptation in science to teaching of mathematics based on computer modeling and design, visual and mathematical modeling of complex knowledge in the "problem areas" of mathematical education with the manifestation of synergetic effects and the identification of new research by-products based on self-organization of cognitive activity.

Methodology, methods and technological constructs

The implementation of the announced technology is associated with the development of students ' complex knowledge by means of mathematical and computer modeling in a rich information and educational environment. An effective tool for the development of complex mathematical knowledge and the development of intellectual operations of students thinking can be a study and adaptation to school or university mathematics of modern achievements in science, clearly and significantly presented in applications to real life, the development of other sciences, high technology and industry. Mathematics education as a complex and open social system carries with it a huge potential of self-organization and positive manifestation of synergetic effects in different directions: the development and education of the individual in the project activities, ordering the content and structure of cognitive experiences of communication and social interaction of the subjects on the basis of cultures dialogue. Synergy of mathematical education will be considered by us as a symbiosis and qualitative change of nonlinear effects of self-organization and self-development of the individual during the development of mathematical activity in the control of complex stochastic processes based on the coordination of different factors and began in three contexts: content (semiotic), procedural (simulation) and social adaptation. Synergy of mathematical education is characterized by the presence of internal attributes (mechanisms) of self-organization and order parameters, which form the success of the educational system at increasingly complex levels. At the same time, didactic processes acquire a new quality: natural science knowledge is enriched with a humanitarian aspect, humanitarian knowledge acquires a scientific basis for substantiating the essence using natural science and mathematical apparatus and methods.

An important context is the external factors formulation of influence in the form of a plurality of goal-setting, building stages and hierarchies of symbolic and figurative-geometric activities in the direction of essence founding of mathematical objects and procedures [3], search and analysis of side solutions using information technology , identify bifurcation transitions and basins of attraction in the processes under study on the basis of variability and parameterization, ensuring the coherence of information flows in the emergence of a new product based on the cultures dialogue (including, in the conditions of network interaction). In [13] identified and characterized in all stages of mathematical education synergy manifestation: preparatory, informative, technological, assessment, corrective and generate transforming. In recent decades, the post-non-classical scientific picture of the world as a paradigm effect has become the most important concept, which is based on the priority of the processes of self-organization of dynamic nonlinear systems ((G. Haken [9]), T. Kuhn, E. N. Knyazeva, B. Mandelbrot [5], I. R. Prigozhin [8], S. P. Kurdyumov, G. G. Malinetsky [7], K. Mainzer, etc. That is, there were opportunities and the principles of technique of self-organization and dialogue of cultures of the students through the development of synergetic paradigm of development of mathematics in the context of a reasoned, coherent and level of opening-up and creative to overcome the "problem areas" of mathematical activities.

Scientists, philosophers, educators and psychologists (I. Kant, G. Hegel, I. Prigogine, S. P. Kurdyumov, G. Haken, K. Mainzer, V. V. Orlov, A. N. Polyakov [8], V. S. Stepin, I. S. Utrobin, H..The alfvén, T. S., Vasilyev, etc.) convincingly demonstrated that the effective development of the individual occurs during the development of complex knowledge (different levels of difficulty depending on student's personal development, including inclusive education), creating situations of overcoming difficulties in the process of mastering knowledge and a unified picture of the world on the basis of a high degree of deployment of students educational and professional motivation in a single network of interactions, independence and coherence. In cognition of the complex, the process of cognition itself "becomes a communication, a loop between cognition (phenomenon, object) and cognition of this cognition" (E. Moren).

We highlight the following system - genetic contexts of mathematical education synergy at the University (also A. A. Verbitsky [1]).

1. Procedural contexts. The basic concept of presented concept of modern achievements adaptation in science is the principle and technology of founding of personal experience (E. Husserl, S. L. Ru-binstein, V. D. Shadrikov, E. I. Smirnov [10],[14], etc.). Therefore, the concept of founding of the personality formation process acts as an effective mechanism for overcoming professional crises of becoming a specialist and actualization of integrative links between science, vocational education and school. Adaptation processes are considered by scientists psychologists and teachers as a dynamic complex of integral interaction of internal results (system of knowledge, skills, attitudes, competencies, values) and adequate mechanisms of adaptation of the individual to changes in the environment and the activities results with developing effect (A. A. Rean [11], Yu. I. Tolstykh [19], S. I. Soroko [18], etc.). In accordance with S. N. Dvoryadkina and E. I. Smirnov [4] such can be as the synergetic effects of adaptation processes realization: cognitive, motivational, professional, creative, socio - economic and spiritual-moral. The processes of creating a motivational field for the study of complex mathematical constructs require the computer design and visual modeling of modern achievements in science (strange Lorentz attractor, fuzzy sets and fuzzy-logic, Menger's sponge, Ferhulst's script, etc.). Building hierarchies in the deployment of the essence of the generalized construct of "problem zone" in mathematics education on the basis of parameterization and abstraction, search for bifurcation points and basins of attraction by means of construction of iterative processes on the basis of information technology support and create the mechanisms of complex knowledge adaptation to school and university mathematics.

2. Meaningful context of the synergy in mathematical activity is the sensitive mechanism that will allow to actualize the factors of success in solving creative problems on the basis of research activity and self-organization of students. Therefore, the primary means of manifestation of synergy, mathematics education, and the mechanism of formation of exploratory behavior of students in learning mathematics we consider the development and introduction in educational process of research practice-oriented complex problems in the "problem areas" of mathematics education in the form of a complex multi-step mathematical-informational tasks (M. Klakla, V. S. Sekovanov, E. I. Smirnov, etc.). Research activity of the students is realized in a specially organized environment (for example, resource classes [4]) against the background of growth of motives of self-actualization and self-organization, identification of priority of value orientations in mathematical activity. An important factor in the context of the meaningful manifestation of the synergy of mathematical education is the productive work on the study of new mathematical properties and characteristics of generalized constructs of self-organization: fractal objects, mathematical models of instability of solutions of nonlinear dynamic systems, means of coding and encryption, cellular automata, fuzzy sets and fuzzy logic, computer simulation of multi-faceted surfaces of the cylinder Schwartz, stochastic structures on strange attractors, etc. (V. S. Sekovanov, E. I. Smirnov, S. N. Dvoryadkina [4] E. I. Smirnov, A. D. Uvarov [15].

3. Personality - adaptation and social context of the synergy of mathematical education. Human interaction with the world and people activates with its internal potentials, which is the basis of his self-knowledge, self-regulation and self-actualization, thus ensuring his personal self-development. In this regard, special attention is paid to the problems of group interaction organization of students, which is the most important source of their self-actualization and development, an incentive for creative activity and further personal growth. Ponderous procedure of transition from cash of an entity to a generalized potential development in the form of a perfect object (process or phenomenon, status, personal qualities) are multi-stage, multifunctional, integrative and aimed at actualization within and cross-curricular links. The personal adaptation component is associated with the expression of the characteristics and qualities of personal development and adaptation of the students in the process of mastering in modern scientific knowledge in the direction of self-actualization ("I'm interested"), self-determination ("what I can do"), self-organization ("I'm able to manage the process"), self-development ("I can do something new")[17].

Technology of synergy in the study of "problem areas" of mathematical education

The technology of identification and research "zones of modern achievements in science (problem areas)" in the relation to teaching mathematics allows you to design and implement the stages of adaptation of modern achievements in science to the current state of the experience of students mathematical activity , allows you to integrate knowledge from different fields of the science in the context of the development of complex knowledge. We highlight a number of technological stages of the founding procedures in the process of modern scientific knowledge adaptation to school mathematics with the manifestation of synergetic effects and the reflection of phenomenological type of an essence modeling of generalized construct:

1. **Development of standards and samples of phenomenology of visual modeling of generalized construct and results of diagnostic procedures** of specific manifestations of the essence of the generalized construct.
2. **Creating a motivational field in the development of generalized construct**: visual modeling (lessons, lectures, video clips, project activities, presentations, business games) motivational and applied situations of different interpretations of standards and examples of synergy.
3. **Practice-oriented and research complexes of tasks** for updating the deployment of individual educational trajectories for small groups of students (determining the composition and orientation of small groups , the distribution of roles, selection and updating of practice-oriented research activities on the stages of founding and adaptation of the generalized construct).
4. **Multiple goal-setting of the research processes** of generalized construct of "problem zone".
5. **The willingness to debate and multiplicity of solutions to the problem**; identifying selection criteria for making a diagnosis and finding solutions to the research practice-oriented tasks based on diagnostic information, systematized in the form of thunderous complexes.
6. **Creation of the creative environment** in the process of the essence mastering of generalized construct (stimulation of success situation; work in small groups and dialogue of cultures; tolerance to uncertainty and development of divergent thinking; identification and popularization of patterns of creative behavior and its results); collection and variety of forms and methods of information presentation; development of statistical packages and office editors, computer algebra systems and Web-support.

7. **Ability to adapt and develop in social communications** based on the dialogue of mathematical, information, natural science and humanitarian cultures. **An effective dialogue of mathematical, informational, natural science and humanitarian cultures** on the basis of components computer and mathematical modeling and stages of generalized construct adaptation in "zone of modern achievements in science" of university mathematics.

8**. Updating the attributes of synergy (bifurcation, attractors, fluctuations, basins of attraction)** in the research process, the generalized construct of founding; identify patterns, analogies , associations, the dynamics of the investigated processes, phenomena and facts; forecast and "by-products" of the research.

A synergistic effect of the study of polyhedral surfaces of Schwartz cylinder.

Example 1. Mathematics education as a complex and open social system carries a huge potential of self-organization and positive manifestation of synergetic effects in different directions: the development and education of the personal, the orderliness of the content and structure of cognitive experiences of communication and social interaction of the subjects on the basis of cultures dialogue. It is necessary to design techniques and methods of reflection and study of technological parameters of the generalized construct against the background of the functioning of the adaptation system and obtain new results: in our case, the generalized construct of scientific knowledge – the concept of surface area is indirectly updated through computer and mathematical modeling of the research processes of the "area" of the side surface of Schwartz cylinder [16-17].

Multiple goal-setting of the actualization processes of surface area concept by methods of investigation of the "area" of Schwartz cylinder (content aspect)): pathological properties of the "area" of lateral surface of the cylinder are well studied in the so-called "regular" case (see for example [2]). This occurs when its height H is divided into m equal parts (respectively – layers of the cylinder), and the circle lying at the base is divided into n equal parts, followed by a shift φ on each layer by $\frac{\pi}{n}$. With such a triangulation of lateral surface of the cylinder, the formula for calculating its "area", by means of the resulting polyhedral with $m, n \to \infty$ is:

$$S_q = 2\pi R\sqrt{R^2 \frac{\pi^4}{4} q^2 + H^2}, \quad \text{where:} \quad q = \lim_{m,n\to\infty} \frac{m}{n^2} \qquad (1)$$

Thus, the "area" of lateral surface Sq of regular Schwarz cylinder of height H and radius R (if this limit exists – finite or infinite) is completely determined by the limit (1). At the same time, due to the independent nature of the aspiration $m, n \to \infty$, the result of the limiting process becomes weakly predictable, multivalued, with the absence of regularities in the chaotic deployment of fractal structures of polyhedral. B. Mandelbrot [5] showed that $m = n^k$ the area of a polyhedral surface grows as n^k $(k \neq 2)$. There are the hierarchies of issues related to the study of multi-faceted surfaces of Schwartz cylinder and solved by means of computer and mathematical modeling of research activities in small groups of students in a remote environment or in the form of research of multi-stage mathematical information tasks. Such studies conducted by students in resource or laboratory-calculation classes, in the performance of multi-stage mathematical and information tasks, in the course of project activities or network interaction develop intellectual operations of thinking, increase educational motivation and the quality of mathematical actions development.

Consider a circle centered at point A and a radius $g_1 = 1$. A regular hexagon is inscribed in the circle and a radius is drawn so that it crosses the side of the hexagon at the point U. Suppose that the point T moves along the circle. In this case, we put in accordance with the central angle $c_1 = \alpha$ of the length of the segment *UT*, we get the function *f*(*α*). The introduced function is limited and periodic, namely $0 \leq |f(\alpha)| \leq 1 - \frac{\sqrt{3}}{2}$ and period $T = \frac{\pi}{6}$. The function *f*(*α*) can be defined explicitly:

$$f(\alpha)=1-\frac{\frac{\sqrt{3}}{2}}{\sin(120^0-(\alpha-[\frac{\alpha}{60^0}]\cdot 60^0))} \qquad (2)$$

It is easy to determine a function $f_n(\alpha)$ similar to the function in formula (2) in the case where an arbitrary regular n-gon is inscribed in the circle. Indeed, denote by $\varphi=\frac{360^0}{n}$ the central angle of the inscribed n-gon, and then $f_n(\alpha)$ take the form:

$$f_n(\alpha)=1-\frac{\sin(90^0-\frac{\varphi}{2})}{\sin(90^0+\frac{\varphi}{2}-(\alpha-[\frac{\alpha}{\varphi}]\cdot\varphi))} \qquad (3)$$

We define the following function $g(\alpha)$ as a functional series:

$$g(\alpha)=\sum_{n=1}^{\infty} f_{k\cdot n}(\alpha) \qquad (4)$$

where functions $f_{k\cdot n}(\alpha)$ are defined by formula (3). It is easy to see that the graph of the function $g(\alpha)$ has a fractal structure, like the graph of the van Der Warden function [21]. Now consider the layer of the cylinder Schwartz, crossed by the plane of its orthogonal axis. There is a natural problem. Let Schwartz cylinder with height H = 1 and radius R = 1 be given. In this case, its upper base is divided into n equal parts, and the height into m equal parts. Draw a section perpendicular to the axis of the cylinder through an arbitrary point x on it. If it tends to infinity, and fixed, what kind of function $g(\alpha)$ will be defined in formula (4)?

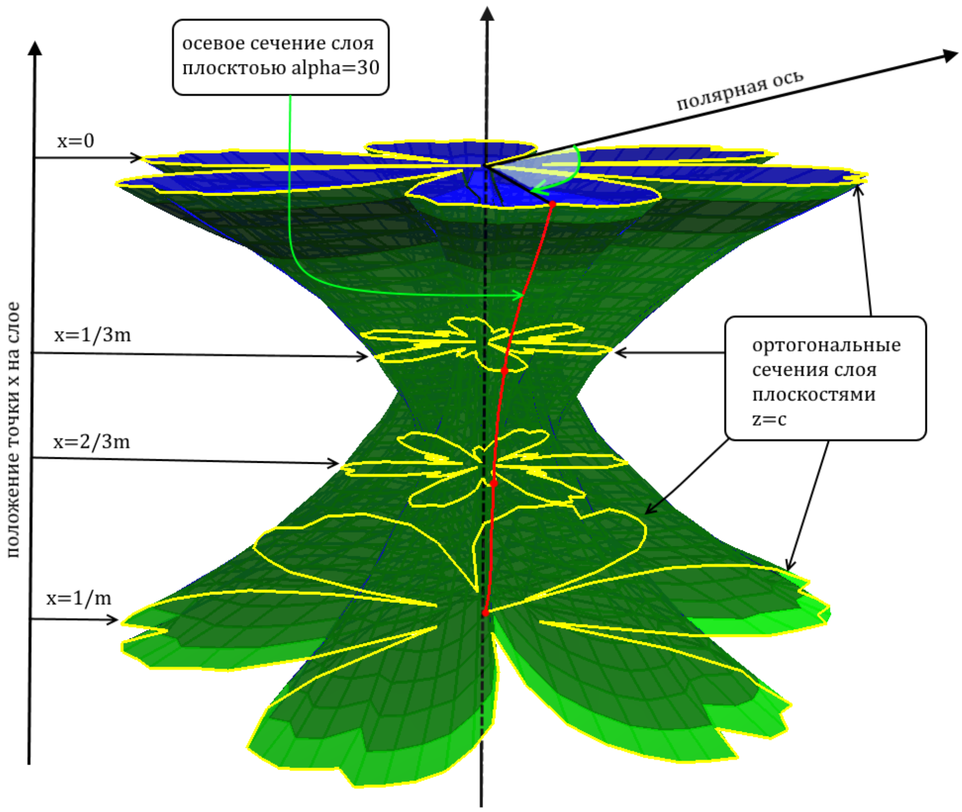

Figure 1 - A portion of the surface $z = s(\alpha, x)$

If we assume that in formula (4) variables α and ε are independent, then the series defined by this formula can be viewed as a function of two variables *s*(*α*, *x*). The graph of this function is the surface. The following figure shows a portion of the surface *z* = *s*(*α*, *x*), with $0^0 \le \alpha \le 360^0$ and $0 \le x \le \frac{1}{30}$. We believe that the height of one layer of Schwartz cylinder is equal to $\frac{1}{30}$ (for clarity, the surface is depicted in a cylindrical coordinate system). In the last figure, the level lines shown in yellow correspond to the graphs of the function *g*(*α*) in the polar coordinate system at $k = 0, k = \frac{1}{3}, k = \frac{2}{3}, k = 1$.

Similarly, other "zones of modern achievements in science" can be studied: elements of fractal geometry, cellular automata, coding and encryption of information, the theory of chaos and catastrophes. As the example shows, the longitudinal study of "zones of modern achievements in science" imposes increased requirements for their selection and number, at the same time developing the effect of the development of students ' complex knowledge in the context of modern achievements in science and dialogue of mathematical, information, natural science and humanitarian cultures is difficult to overestimate.

Results. Thus, the technological constructs of complex knowledge development on the basis of the concept of personal experience founding, as well as computer design and technology for the study of generalized constructs to identify the essence of "problem areas" of university mathematics are identified and characterized. Fractal characteristics of the surface area in detail of nonlinear dynamics of growth of polyhedral complexes areas at crushing of triangulations of lateral surface of Schwartz cylinder or "boot" by means of computer and mathematical modeling are investigated. Bifurcation points, attraction pools, computational procedures and fluctuations of state parameters, computer design and side results of the study of the "area" of lateral surface of regular and irregular Schwartz cylinder are identified and characterized. Hierarchy forms and means of students ' research activity: resource and laboratory and design classes, complex multi-step mathematical and information jobs, design methods and networking.

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ЖОҒАРЫ БІЛІМ БЕРУДЕ МАТЕМАТИКАЛЫҚ ДАЙЫНДЫҚТЫ ЖҮЗЕГЕ АСЫРУДЫҢ ТЕХНОЛОГИЯЛЫҚ КОНСТРУКТІЛЕРІ

Аннотация. Мақалада математиканы оқытудағы синергетикалық әсерлерді өзектендіру барысында математикалық білімді фундаментациялау кластерлері мен спиральдарды өрістету негізінде педагогикалық ЖОО-да болашақ мамандарды кәсіби даярлаудың инновациялық технологиялық конструкторларын әзірлеу ұсынылған. Фундаменталды процедуралар негізінде күрделі білімді, фракталды өзара іс-қимылдарды және қазіргі математикада интегративтік байланыстарды зерттеу және оларды кәсіби дайындықтың технологиялық алаңына көшіру жатыр. Ақпараттық технологияларды қолдаудың әр түрлі жағдайларында педагогикалық міндет ретінде, математиканың күрделі мазмұнын меңгеру бойынша студенттердің инновациялық қызметі және математиканы оқыту технологияларының компоненттері мен мазмұны ұсынылған. Студенттердің кәсіби құзыреттілігін, коммуникативтік және жеке қасиеттерін тиімді дамыту, болашақ мамандардың уәждемесін арттыру болжанады. Модернизациялау жағдайында болашақ маманның математикалық білім мазмұнын іріктеудің инновациялық тәсілі – синергетикалық әсерлер мен болашақ кәсіби іс-әрекеттің танымдық стилін, математикалық нысандар мен процестердің тұлғалық қалыптасуы мен визуалды модельдеу негізінде көрінетін кешенді білімді игеру. Математикалық білім берудің синергетикалық педагогикалық технологиясы – бұл өзін-өзі ұйымдастыруға және күрделі математикалық білімді игерудің жоспарланған және ықтимал кепілдендірілген нәтижелеріне қол жеткізуге әкелетін мұғалім мен оқушының бірлескен іс-әрекетінің мәні. Алайда, нақты өмірде университеттің дамуы, әдетте кәсіптік білім беру мазмұнының дәстүрлі мазмұнына, бекітілген оқу пәндерінің жиынтығына және оқу жоспарлары құрылымындағы олардың көлеміне азаяды. Өкінішке орай, бұл үрдістің көрінісі тек жоғары деңгейге ғана емес, сонымен бірге орта мектепке де қатысты. Осы мақалада келтірілген В.Д. Шадриков пен Е.И. Смирнов әзірлеген іргетас тұжырымдамасының технологиялық конструкциялары белгілі бір университеттің бұрыннан бекітілген кәсіптік білім беру теориялары мен технологияларына негізделген кәсіби білім берудің жаңа құрылымы мен мазмұны бар инновациялық білім беру құрылыстарын салуға нақты мүмкіндіктер береді. К.Д. Ушинский атындағы Ярославль мемлекеттік педагогикалық университетінің «математика» мамандығы бойынша эксперименттік білім беру стандартының бөлігі ретінде болашақ математика мұғалімін кәсіби даярлаудың инновациялық мазмұнын жүзеге асырудағы бірегей тәжірибесі ұсынылады.

Түйін сөздер: қорландыру принципі, технологиялық конструкторлар, кәсіби дайындық, көрнекі модельдеу, фракталды геометрия.

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ТЕХНОЛОГИЧЕСКИЕ КОНСТРУКТЫ ФУНДИРОВАНИЯ МАТЕМАТИЧЕСКОЙ ПОДГОТОВКИ В ВЫСШЕМ ОБРАЗОВАНИИ

Аннотация. В статье представлена разработка инновационных технологических конструктов профессиональной подготовки будущих специалистов в педагогическом вузе на основе развертывания спиралей и кластеров фундирования математических знаний в ходе актуализации синергетических эффектов в обучении математике. В основе фундирующих процедур лежит исследование сложного знания, фрактальных взаимодействий и интегративных связей в современной математике и их переноса в технологическое поле профессиональной подготовки. Представлены компоненты и содержание технологий обучения математике и инновационной деятельности студентов по освоению сложного содержания математики как педагогической задачи в различных условиях поддержки информационных технологий. Прогнозируется эффективное развитие профессиональных компетенций, коммуникативных и личностных качеств студентов, повышение мотивации будущих специалистов. В основе инновационного подхода к отбору содержания математического образования будущего специалиста в высшей школе в условиях модернизации лежит овладение сложным знанием с проявлением синергетических эффектов и когнитивным стилем будущей профессиональной деятельности на основе процессов фундирования опыта личности и наглядного моделирования математических объектов и процессов. Педагогическая технология синергии математического образования представляет собой существо совместной деятельности преподавателя и студента, ведущее к самоорганизации и достижению планируемых и вероятностно гарантированных результатов освоения сложного математического знания. Однако в реальной жизни вузовские разработки сводятся, как правило, к традиционному наполнению содержания профессиональной подготовки, апробированному набору учебных предметов и их объёму в структуре учебных планов. К сожалению, проявление этой тенденции относится не только к высшей, но и к средней школе. Технологические конструкты концепции фундирования, разработанной В.Д. Шадриковым и Е.И. Смирновым, представленные в настоящей статье, дают реальные возможности для конкретного вуза выстраивать инновационные образовательные конструкты, новой структурой и содержанием профессиональной подготовки, опирающиеся на уже апробированные теории и технологии профессионального образования. Уникальный опыт Ярославского государственного педагогического университета им. К.Д. Ушинского по реализации инновационного содержания профессиональной подготовки будущего учителя математики в рамках экспериментального образовательного стандарта по специальности «математика».

Ключевые слова: принцип фундирования, технологические конструкты, профессиональная подготовка, наглядное моделирование, фрактальная геометрия.

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