Modern Educational Technologies in Vocational Training of Future Teacher of Mathematics

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ABSTRACT

The research is timely, due to the relevance of the studied problem by the practice of training of a future specialist, a subject teacher. The article is aimed at studying the innovative orientation of modern education, ways of increasing the effectiveness of the didactic interaction of the educational process participants, within the framework of higher professional pedagogical education, using the example of training of future mathematics teachers.

At present, the problems, related with the realization of didactic capabilities of modern educational technologies, in particular, the formation of highly developed professional thinking of the future specialist, remain insufficiently investigated.

The following methods were used in theresearch: theoretical (the analysis of psychological and pedagogical literature on the investigated problem, the study of mass and the generalization of advanced pedagogical experience, pedagogical modeling), empirical (pedagogical observation, conversation, questioning, interviewing, testing).

The materials of the article can be useful for future mathematics teachers, postgraduates, teachers of higher educational institutions, interested in the problems of modern didactics, the theory and methodology of teaching the disciplines of the natural science cycle, and the professional training of subject teachers.

Keywords: modern educational technologies, metacognitive reflexive technologies, information and communication technologies, subject-specific thinking.

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1. INTRODUCTION

The modern educational process is inconceivable today without searching for new, more effective technologies, designed to promote the activity, creativity and independence of the future specialist's personality, as well as emphasizingthe personal mechanisms of thinking,which form intellectual skills and strengthen reflexive mechanisms in educational and professional activities (Mushtavinskaya I.V. 2014., Kudryavtsev V.B. 2011; Mahmood A.S., Khattak N., Haq N., Umair S. 2017).

A special role belongs to the innovative education, aimed at building the relationships between the educator and the student in the new conditions, through dialogue, partnership and cooperation (Sadykova E.R., Razumova O.V., Timerbaeva N.V.2012). Harmonious combination of metacognitive reflexive technologies with the means of information and communication technologies in the educational process allows future specialists, mathematics teachers,to come to the digestion of new material creatively,to help in knowledge structuring, to acquire completely new skills of the developer of information processes, at a new level. The integration of innovative, information and communication technologies provides the means for developing subject-specific thinking, as one of the types of professional thinking of the future subject teacher.

The aim of the study is to describe the developed didactic model of formation ofstudents' subject-specific thinking by means of metacognitive reflexive technologies in the synthesis with information and communication technologies.

2. MATERIALS AND METHODS

In the course of the study, the following approaches and methods were used: systematic approach for revealing the matter point of the problem; classification, systematization, generalization of pedagogical experience on the problem under study; observation, comparison, questioning; analysis of the obtained results.

The study was conducted with students of the pedagogical department of N.I. Lobachevsky Institute of Mathematics and Mechanics of Kazan (Volga Region) Federal University, teachers of the schools of the Republic of Tatarstan.

3. RESULTS AND DISCUSSION

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A significant number of studies were devoted to various aspects of the introduction of educational technologies in the teaching process and their influence on certain types of thinking (V.P. Bespalko, V.V. Davydov, V.I. Zagvyazinsky, N.V. Kuzmina, S.N. Lysenkova, P.I. Pidkasisty, G.K. Selevko, V.A. Slastenin, V.F. Shatalov) .

The opportunities to increase the effectiveness of the whole system of education,as a result of the use of information and communication technologies, are considered in the works of the following scientists: G.P. Andreeva, B.S. Gershunsky, A.A. Kuznetsova, C. Preston, I.V. Robert, T. Eisenberg .

At the present time, the metacognitive reflexive technologies, consisting in setting the emphasis on personal mechanisms of thinking, forming intellectual skills and strengthening reflexive mechanisms in educational and professional activities are put forward (Yu.N. Kulyutkin, I.V.Mushtavinskaya, G.S. Sukhobskaya, S.A.Terno, J. Thomas, P. Houston) .

Innovative technologies, implementing in the modern higher pedagogical school, bring professional pedagogical education to a new technological level. There are favorable conditions for the design of highly effective educational and managerial activities of students and teachers, respectively. The main thing in innovative technologies is the formation of the individual's readiness for rapidly advancing changes in society, towards an uncertain future through the development of creative abilities, to various forms of thinking, to cooperation with other people (Slastenin V.A. 2008).

One of the possible solutions to the problem of techniques in higher education is the development of the synthesis of metacognitive reflexive technologies with the means of information and communication technologies. This kind of integration provides for:

1) the organization of the training process, allowing to take into account the psychological, physiological capabilities of students, and also focused on the disclosure and development of key professional competencies of the future specialist (Abdullina G.T., Ortaev B.T., Torybaeva Z.Z., Zhetibaev K.M.2013);

2) the introduction in the educational process of teaching methods, aimed at metacognition, allowing to build own strategies of training and thinking, as well as to control and regulate knowledge (Hunaiyyan A., Bimba A.T., Idris N., Al-Sharhan S.2017);

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3) the predominance of organizational forms of lessons, which ensure the priority of creative independence of students in the educational process, on the basis of the integration of subject, methodological, didactic and,to a certain extent, engineering knowledge (Mahmood A.S., Khattak N., Haq N., Umair S. 2017);
4) the availability of mechanisms for the control of educational system (Ahmad N., Lodhi M.S., Zaman K., Naseem I. 2017.).

The authors of the article developed and substantiated the conceptual-theoretical and concrete-content didactic model of the formation of students' subject-specific thinking, using metacognitive reflexive technologies in the synthesis with information and communication technologies.

One of the types of professional thinking of the teacher is a subject-specific thinking, organically connected with the features of a particular subject and the methodology of its teaching, which allows to solve both narrow professional and generalized problems. The subject-specific thinking of mathematics teacher is a thinking, based on cognitive subject mathematical experience, fixed in specific skills, used for solving not only narrow mathematical problems, but which are the tools for exploring the world as a whole, and also manifested in the individual-personal distinctness of approach to solving emerging professional problems (Razumova O.V. 2008).

The didactic model contains the following components: motivational-targeted, axiological, activity-procedural and reflexive-evaluative. A distinctive feature of the proposed model is its integrity, allowing to cover all types of students' activities: educational, training and research, practical, and scientific-research. The increase in the status of the subject-specific thinking of the future teacher occurs in the process of solving of creative tasks, containing certain problem situations, either having specifically-subjective nature, or being the methodological tasks in the studied subject area (Razumova O.V. 2008).

The considered model is based on personality-oriented and competence-based approaches. The main didactic principles are the following: the principle of scientific character, the principle of visibility, the principle of productivity, the principle of choosing an individual educational trajectory, the principle of flexibility in organization oftraining process. The interaction between the teacher and the students, as well as

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between the students themselves, occurs within the framework of development of creative and technological environment, represented by instrumental and creative components, connected by a commonality of interaction, and ensuring the achievement of the effectiveness of educational process, taking into account the individual characteristics of the students.

In the developed model, the educational process is preceded by the general theoretical and practical training of students, aimed both at actualization of generalized concepts, system knowledge and integrative skills, formed on the basis of the main professional educational disciplines, and at the development of stable positive motivation for the use of modern educational technologies in the learning and future professional activities.

In the proposed model, lecture sessions (lectures-visualizations) are developed by the problem-dialogical type, with the possibility of using dynamic and static frames of computer program complexes (Dockendorff M., Solar H. 2017.). Two methodical principles are implemented in lecture teaching of this type: 1) stimulation of creative, conceptual, systemic, constructive thinking of students as componentsof subject-specific thinking; 2) basing on active listening of students and on partner relations of the teacher and students. Such a lecture is built according to certain rules: 1) the problem situation is formulated, analysis is carried out, the research framework is defined; 2) the problem situation is updated to the level of significance for each student, the grounds (basic knowledge) for the solution of the problem are prepared; 3) mechanisms are developed to achieve results in the studied problem situation. The material of the lecture is divided into several logical parts, each of which is constructed in the following mode: "Provocation - comprehension of the content (listening to the lecture) - reflection." The information, obtained in such a way, is acquired by the students as a personal discovery of knowledge, unknown to them.

The revision of the lecture material is carried out in the practical and laboratory classes, created in the form of discussions, conferences, business games and trainings. The organization of these classes is based on the principles of problematicity, dominant information component and "negative experience". New teaching elements are included in the content of practical classes: tasks of a problem nature, aimed at studying, analyzing and evaluating mistakes, made in concrete real situations; problem tasks,

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permitting student's errors, allowing to discover the pattern of wrong reasoning and to develop the appropriate tactics for further actions. Thus, the formation of new experience is carried out through the creation problematic dialogical situations, which are formed on the basis of emerging contradictions, requiring a definite type of thinking .

Laboratory practicalsin the proposed model of students'training activity have the following basis: 1) heuristic approach and supplementationof creative thinking components; 2) development of the logical, analytical and synthetic thinking of the specialist,due to the strengthening of associations between the varioustopics of the special professional disciplines; 3) acquisition of scientific methods of experimental research by students. The main task of laboratory practicalsis to create a special environment for the student,providing for the development of flexibility, divergence of thinking. One of the results of laboratory practicalsis the development by students of computer learning and teaching (mathematical) complexes, including: training program, study guide, audiovisual didactic materials, pedagogicalprogram products.

Further,it is proposed to include the students in the training-research, and scientific-research activities, differing in the degree of students' independence, creative approach to research of the topic, and scientific theoretical and practical significance.

At this stage, students are involved in solving training tasks of methodological, subject nature, related to the information content and the way of use of program-methodical complexes. The training-research work of the student includes the following structural elements: statement of the problem; search; analysis; data processing; setting a time limit; self-control.

The main forms of organization of scientific-research activities are the following: research in the form of coursework and qualification works; execution of tasks of training and research work during the educational and pedagogical traineeship; participation of students in the work of scientific conferences, research laboratories.

Each work of the student is a project, developed within the framework of a certain scientific discipline by the project method, aimed at systematization, consolidation and expansion of theoretical knowledge, as well as the formation and development of key professional competencies, expressed in the ability to carry out the research

Articulo recibido: 05-11-2017
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independently, and to solve a set of practical and scientific tasks of the chosen specialization, with application of modern educational technologies.

One of the tasks of future teacher is the independent development and formulation of a problem situation already in the school training process, aimed both at developing critical thinking of students, and at forming a culture of communication, the ability to perform various social roles in joint activities. Such work assumes: selection of school material of a problem nature; identification of the level of knowledge, skills, formedness of the main universal educational activities of the students; the establishment of the purpose of training task of a problem nature, such as a contradiction; the choice of the way to organize the process of solving the problem situation, the method and means of solving the training task; revealing the importance of information, obtained in the process of its solution. Thus, the future teacher needs to have both a structurally-systemic, holistic view of the academic discipline material, and specialized means and technologies for construction of this content. Such work requires from the future specialist a great dedication, creativity in the organization of methodological work and a high level of subject-specific thinking.

4. SUMMARY

In the process of experimental approbation of didactic model the following tasks were solved: increasing the level of subject-specific thinking of students, future mathematics teachers; development of creative competence; formation of professional information culture. During the experiment, the level of formation of subject-specific thinking was continuously monitored, including the tools of the model for assessing the quality of training of D. Kirkpatrick (Kirkpatrick D.L., Kirkpatrick J.L. 1998). The development of subject-specific thinking was determined by the following indicators: the student proposes the educational and cognitive problem task, on the basis of his pedagogical experience, the hypothesis for solving the problem; the student expresses his position in solving this problem, and also considers the possible alternatives critically; the student "sees" the effectiveness of use of active training tools in solving the problem, systematizes knowledge and creates its own basis for solving the problem.

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5. CONCLUSION

As a result of the research, it was revealed that metacognitive reflexive technologies, in synthesis with the means of information and communication technologies, increased the level of formation of the subject-specific thinking of the future teacher, as one of the components of professional thinking. It is especially important for the teacher, because, firstly, this is one of the most knowledge-intensive professions, and secondly, only the teacher with a high level of professional thinking can successfully solve the task of formation the thinking of students, with whom he works.

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