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SELF-EDUCATIONAL ACTIVITY FORMATION OF UNIVERSITY STUDENTS IN TEACHING MATHEMATICS IN DIGITAL ENVIRONMENT

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Abstract

The success of students' professional activities depends on the formation of their readiness for self-education. The high dynamism of the modern world, the growing needs of the economy, the ongoing changes in labor markets and marketing lead to the reduction of adaptation periods of the graduates of higher education to work, and increase the requirements for their mobility and competitiveness. Modern pedagogy considers the formation of self-education skills and abilities as the highest stage of learning and one of the necessary conditions for lifelong learning, which is based on self-learning. Self-education is characterized by active cognitive needs and interests, effective internal motivation of a person to satisfy them, the manifestation of significant will efforts, high degree of consciousness and organization. The paper discloses the conditions for the formation of self-educational activity in the process of teaching mathematics in a digital educational environment. In the context of digitalization of the educational system, scientific and methodological work presents a particular value. A feature of the digital educational environment is the ability of students and teachers to access educational multimedia resources, structured educational and methodological materials at any time and from any device with the Internet access, as well as continuous communication with a teacher, on-line or off-line guidance and individual "navigation" while completing a task. The main goal of the educational process in mathematics is not only the assimilation of knowledge, but also the mastery of methods of this assimilation, development of cognitive needs and the creative potential of students.

Keywords: Self-education, digital educational environment, personal and professional growth of a student

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1. Introduction

The function of education in the 21st century is to support a person throughout his life. This meets the need for people to be able to adapt to rapidly changing conditions in everyday life and in the professional sphere, to maintain the desire for knowledge regardless of age, i.e. education of the 21st century seems creative and innovative. Creative education focuses on qualitative changes of subjects, implements their needs in self-realization and creativity, serves as a source of further development and self-improvement of the society. Therefore, the reorientation of modern education to creativity will allow considering the needs of modern civilization and the requirements of the future. The high dynamism of the modern world, the growing needs of the economy, the ongoing changes in labor markets and marketing lead to the reduction of adaptation periods of the graduates of higher education to work and increase the requirements for their mobility and competitiveness.

The main task of education in these conditions is not only to provide students with considerable knowledge, but also to teach them to constantly improve their educational and professional level, to use various sources of information, and to obtain new facts when searching for it both within professional field and in related fields. This, in turn, reveals the need to analyze the process of developing the professional competence of future specialists.

2. Problem Statement

The problem of student personality development deserves special attention. The development of a specialist in a certain field of professional activity requires the transfer of a student from object to subject position, i.e. to the position of active professional self-development being the result of refusal from training as a transfer of knowledge in the form of specific patterns and the transfer of focus from assimilation of knowledge to its independent acquisition thus ensuring the readiness for self-education. Modern pedagogy considers the formation of self-education skills and abilities as the highest stage of learning and one of the necessary conditions for lifelong learning, which is based on self-learning.

3. Research Questions

It is known that Russian fundamental education was created on the basis of the cognitive information paradigm, the core of which was the classical type of scientific rationality developed in the 17–18th centuries. When designing and implementing the educational process, the main attention was paid to the assimilation of knowledge, which was caused by stable understanding of the need to transfer a student the maximum knowledge, skills and abilities accumulated by mankind, and the orientation of teachers to subject programs and fixed measurable results. It was believed that the assimilation of knowledge itself has developing potential – it is in the process of training that skills and abilities necessary in the upcoming professional activity should be formed. In this case, the purpose of training reflected the social order for the quality of knowledge, skills and abilities, i.e. the information support of a person, but not its development, which was achieved occasionally in the course of ongoing educational activities (Artyukhina, 2014). The subject was considered as a kind of projection of science and practice,

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the educational material – as scientific and technological knowledge subjected to didactic processing. The existing paradigm of education required disciplinary training and defined the isolated blocks of academic disciplines. The long-standing practice of implementing the cognitive paradigm in Russia has formed a state higher education in form, fundamental and academic in its content. Modern higher educational institutions increase their socializing potential every year thus expanding prospects for a dialogue with other related areas (economics, politics, culture), acting as a determining resource in assimilating ways towards a successful society and achieving life well-being for students. This was greatly facilitated by the transition to a person-oriented paradigm of higher education, which ensures the creation of conditions for the most full-fledged social development of a future specialist as a subject of social relations and professional activity (Artyukhina et al., 2018). This means placing a student at the center of the educational process with his needs, motives, aspirations, taking into account the patterns of development, age, individual personality; searching and updating the content, forms, methods of educational activity; establishing subject-subject relations between students and teachers in their academic and educational activities by including them into a polysubjective dialogue; designing the subject-oriented content of educational activity, ensuring the possibility of students' effective development and transformation of the surrounding world, as well as building their life path as future specialists. These aspects serve to achieve the main goal of person-oriented higher education – to provide humane conditions for personal and professional development of a specialist in a chosen professional activity and to ensure full disclosure of his potential. From the point of view of a personally oriented paradigm all substantive, procedural and technological components of education should be aimed at the versatile development of a student, shaping his image of a changing world, thus giving him the opportunity to realize his uniqueness through reflection and creativity. All this, in turn, requires a review of all components of the content of education and their organizational and pedagogical composition with a focused orientation on preparation for self-development, self-education and lifelong learning.

Self-education means specially organized, self-regulatory, systematic cognitive activity aimed at achieving certain personal or socially significant educational objectives: satisfying cognitive interests, general cultural and professional needs and improving qualifications. Self-education is a system of mental and worldview self-cultivation entailing strong-willed and moral self-improvement, but not setting them as the major objective (Sanina et al., 2019). The author notes two aspects in self-education. On the one hand, self-education should be understood as "specially organized, independent, systematic cognitive activity aimed at achieving certain personal or socially significant educational objectives". On the other hand, all human life is a source of continuous self-development and self-education. In this context, these concepts act as synonyms (Sanina et al., 2019). The content of self-education is multifaceted. Among its components, Eisenberg (1986) includes "a free choice of a range of problems, independent work with sources of information, a flexible amount of knowledge limited by the degree of interest to a chosen subject" (p. 56). Self-education is characterized by active cognitive needs and interests, effective internal motivation of a person to satisfy them, considerable will for this, high degree of consciousness and organization.

In the context of digitalization of the educational system, scientific and methodological work presents a particular value. A feature of the digital educational environment is the ability of students and teachers to access educational multimedia resources, structured educational and methodological materials

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at any time and from any device with the Internet access, as well as continuous communication with a teacher, on-line or off-line guidance and individual "navigation" while completing a task. The information educational environment makes training more flexible, increases the efficiency and significance of independent work. (Sanina et al., 2018). Students' feedback with a teacher is increasing. A significant advantage of distance learning is the possibility of subtler individualization of the learning process, since it is now determined by a student himself, who works independently and can repeatedly turn to the texts of lectures, tasks and appeal for help of a teacher. The features of the audiovisual presentation of educational materials can increase the motivation of students and facilitate the mastery of the discipline content through more concentrated and visible presentation and a convenient form of working with them. Nevertheless, in distance learning in mathematics, solutions require such problems as the formation of strict self-organization and self-discipline on the part of students; the need to change the course content when students find insufficient mastery of the material (the amount of this work can increase with the increase in the number of simultaneously trained students in a group); the need to control the assimilation of all concepts, theorems and formulas; significant time costs associated with the technical work on typing mathematical texts and introducing educational materials into the environment, checking the tasks where a student is supposed to give a complete solution, and organizing feedback with a student (limiting the ways of quickly expressing his own thoughts (including question-answer format) for both a student and a teacher); the difficulty of math text reading and listening skills; the difficulty of controlling the independence of tasks without creating a fairly wide bank of intermediate and final exercises. However, higher efficiency of distance work with students while studying mathematics can be achieved by distributing educational material into fragments commensurate with students' ability to study theoretical material and tasks for one independent lesson lasting 1–1.5 hours; highlighting the most significant information in a text; giving examples of solving typical tasks and similar tests; providing materials of the next unit only after assimilating the previous one; complying with strictly defined deadlines for students to pass test works for each unit. The use of remote educational technologies as elements of the digital educational environment in the educational process will foster self-education of students, stimulate their motivation for research and improve the quality of education.

4. Purpose of the Study

The purpose of the study is to theoretically justify and experimentally test the methodology for the formation of self-educational activities of university students in teaching mathematics in a digital educational environment.

5. Research Methods

The experiment showed that personal characteristics of students' professional development include such personal qualities as social integration, lack of anxiety and high level of motivation for continuous self-education in achieving the objective of professional development. The control (CG) and experimental (EG) groups were determined to carry out the educational experiment.

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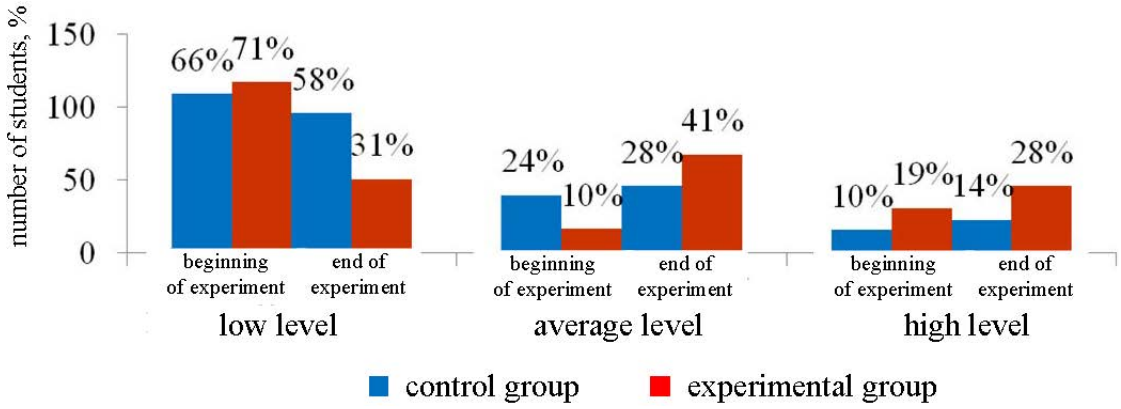

Figure 1. Results of the experiment in the teaching environment.

The experiment showed a significant increase in motivation and interest of students to mathematical disciplines in the process of interactive training in mathematics (Figure 1).

The degree of development of the cognitive component was determined by the following quantitative indicators: a knowledge-information criterion to determine the level of mathematical competence (at the initial stage, a diagnosis of the initial educational level of mathematics was developed in the context of the tasks of the unified state examination in mathematics, testing and assessment materials for mathematical disciplines were developed and adapted to test the formation of the mathematical competence at the stage of control diagnostics (see Table 1).

Table 1. Math competence level at the beginning and end of the experiment

Level	Quantitative characteristics	Initial diagnostics			
		CG (frequency)	EG (frequency)	$\chi^2_{\text{эмп}}$	$\chi^2_{\text{кр}}$(α=0.05)
Low	3–15 points	40	41		
Average	16–30 points	17	13	2.15	
High	31–45 points	7	10		
Level	Quantitative characteristics	Control diagnostics			
		CG (frequency)	EG (frequency)	$\chi^2_{\text{эмп}}$	5.99
Low	3–15 points	30	20		
Average	16–30 points	20	25	7.32	
High	31–45 points	14	19		

Statistical processing showed that at the initial diagnostics $\chi^2_{\text{эмп}} = 2{,}15 < 5{,}99 = \chi^2_{\text{кр}}$ (for significance level α = 0.05), the null hypothesis is accepted (the distribution of students in control and experimental groups by levels of mathematical competence differs slightly from each other at the initial diagnosis (before training)). The level of mathematical competence during the control diagnostics after interactive training in mathematics in the experimental group and in the group with traditional training has significant differences, $\chi\chi^2_{\text{эмп}} = 19{,}4 > 5{,}99 = \chi^2_{\text{кр}}$ (for significance level α = 0.05), the null hypothesis is refuted at a high level of significance (the difference between students in control and experimental groups by levels of mathematical competence was significant at the control diagnostics (after training)).

The experiment showed a significant increase in the formation of mathematical competence.

6. Findings

Self-education of university students can be successfully and effectively implemented in teaching mathematics in a digital educational environment with a set of the following pedagogical conditions:

1. Implementation of variable learning technology, which contributes to increasing the level of students' knowledge by students choosing a conscious, personally significant individual educational trajectory themselves.

2. Consideration of personal needs and motives of students to create a comfortable psychological environment, an atmosphere of cooperation.

3. Combination and variation of individual, paired and group activities of students, allowing to take into account individual inclinations, abilities and interests of students, to study material with different completeness and depth, as well as to implement training at different rates.

4. Application of techniques that contribute to the development of reflexive skills of students, help students evaluate their choice, their activities from different perspectives and according to different criteria, formulate the obtained results, determine the objectives of further work, and adjust their subsequent actions.

7. Conclusion

The student's personality can be successfully developed due to certain pedagogical conditions, which include interactive technologies for teaching and educating a new generation in a digital educational environment. The changes in the modern system of education determine new educational outcomes. First of all, it is urgent to develop self-education skills of students. The main objective of the educational process is not only the assimilation of knowledge, but also the mastery of the methods of its assimilation, development of cognitive needs and the creative potential of students.

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