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Digital Educational Footprint as a Way to Evaluate the Results of Students' Learning and Cognitive Activity in the Process of Teaching Mathematics

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ABSTRACT

Overcoming the effects of the global economic crisis and focusing on innovative development demanded the modernization of the education system, a key factor in improving various areas of human activity. Digital technologies nowadays are a comprehensive platform for the development of all sectors of the economy, including the field of education. The use of digital technologies in higher education has a didactic potential in organizing the educational and cognitive process, providing new qualitative opportunities through the implementation of the principles of virtualization, mobility, adaptability, instant feedback. Digital education dictates new requirements for subjects of the educational process, for the content of the information and educational space, for the regulation of the interaction of all participants in the educational process, for methods and parameters for evaluating the educational and cognitive activity of students. Thus, the purpose of the article is to study the specificity of evaluating the results of students' educational and cognitive activity in a digital educational environment. The leading method here is the design of students' digital educational footprint, which combines motivational, cognitive and reflective components. As a result of the study, the authors have determined the structural and informative characteristics of the digital educational footprint as a way to assess the results of students' learning and cognitive activity in the process of teaching mathematics; revealed the didactic potential of digital technologies in organizing the process of teaching mathematics; developed a methodological system that allows to evaluate students' digital educational footprint in teaching mathematics in a digital educational environment. Practical use of the research results contributes to the improvement of teaching mathematics in higher educational establishments.

Keywords: digital technologies, educational environment, educational footprint, mathematics education

INTRODUCTION

Currently, mathematical education is the fundamental basis for mastering any activity. It is due to the possibility of using mathematical tools to describe and formalize models of the studied phenomena of any scientific field. One of the priorities in the teaching of mathematics at the university is the implementation of an individual approach. In the era of digitalization, it is possible due to the intensification of the educational process through the use of online services, digital educational technologies, technologies of augmented reality. All these trends determine a qualitatively new approach to the organization of the educational process in higher education. Here special

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Contribution of this paper to the literature

- The authors have developed a unified methodological system, which includes the stages of teaching mathematics at a higher education institution together with various forms of interaction between subjects of the educational process through digital technologies and services.
- The authors have identified the potential of digital technology in evaluating students' digital educational footprint, which includes motivational, cognitive and reflective components.

attention should be paid to the formation of students 'individual educational technologies in the digital educational environment, the recording of the results of activities, ways of evaluating students' knowledge and skills. Many modern researchers study this problem, but some aspects of the organization of the learning process in the digital educational environment need to be concretized, justified, and reasoned. Taking the above mentioned facts into account, we figured out the essential functional characteristics of the key concepts of our research: digital educational environment, digital educational footprint. It should be noted that nowadays the psychological and pedagogical literature describes the following types of environments created and functioning on the basis of information, electronic and digital technologies: "information and educational environment", "adaptive educational environment", "electronic educational environment", "electronic information educational environment", "multimedia educational environment", "virtual educational environment" and others.

We consider the digital educational environment to be the system of interrelated components (content, communication, technology), ensuring the implementation of organizational-stimulating, informative, educational, diagnostic-corrective, and communication-management functions in the interaction of subjects of the learning process for students to master educational programs using digital technologies. Digital educational environment is characterized by structure, multi-channel, multimedia, adaptability, openness, manufacturability and compensatory properties.

The focus of the environment determines the vector of development of the environment, its structure and functions. Structurality implies a well-defined combination of internal components, their interconnectedness. In this aspect, we are interested in studies, which reflect a detailed description of the systemic nature of the environment that performs educational functions. The author emphasizes the importance of the structural property as the main one in the creation and functioning of the educational environment. The effectiveness of the functioning of the content and communication blocks is largely determined by the information content (information richness) and multi-channel (the ability to store, perceive and process some information flows simultaneously). The multimedia property (the use of various information formats), openness (the ability to make changes in content, vary diagnostics and communication; the ability to "go out" into the world educational space) through the Internet makes it possible to realize an adaptive property, expressed in the possibility for students to choose the optimal learning rate, communication between subjects, as well as between subject and environment. Compensation is the optimization of the learning process, its ergonomization, which reduces the time and effort of the student to understand and study the material. In many ways, it is achieved by managing the process of learning through the presented algorithms and training material, implementing the adaptability property (the ability to use modern technologies to create educational content, learning, communication, monitoring and diagnostics), virtuality property (the ability to perform various actions not with real objects, but with their simulations).

Thus, the digital educational environment involves changing the forms of learning and interaction of the subjects of the educational process. Along with such characteristics of information learning environments as chat, webinar, forum and other forms of organization of educational and cognitive activity, digitalization of education has identified new forms of combined learning. Special attention is paid to the digital mitap, hackathon, bootcamp.

New dialogue forms of interaction of subjects of the educational process change the structure of educational and cognitive activity, impose new requirements on how to evaluate its results.

All this actualizes the issue of studying the digital educational footprint that is the complex of psychological and cognitive features of the student. Designing a digital educational system allows not only to evaluate the motivational, cognitive and reflexive components of a student's educational and cognitive activity, but also contributes to the forecasting and management of a student's individual educational trajectory. Understanding and controlling their actions, making an informed choice and predicting the result, subjects learn to build up their activity. This skill is one of the key skills in the digital educational environment.

The main didactic tools are electronic systems, personalized learning environments. It should be emphasized that the strengthening and deepening of the individualization of the educational process is achieved through the didactic potential of the digital educational environment. This is primarily due to its polyfunctionality. In particular, the use of digital technologies in teaching mathematics allows to take into account the individual characteristics of students through the formation and implementation of individual educational trajectories. It provides feedback between the subjects of the educational process, helps to create stimulating situations (situations of success, introduction of elements of competition, etc.), and provides an atmosphere of cooperation and dialogue interaction.

This is due to the fact that the recognition of the priority of the individuality and self-worth of the student, the maximum appeal to his individual experience, the need for self-organization, self-determination and self-development contributes to the formation of a competitive personality. The modern aspect of the issue, implemented through the introduction of information and communication technologies and digital technologies into educational practice, is of great interest. It allows us to consider the process of mathematical preparation of students at the university from the point of the ideas of dialogue, subjectivity and individuality.

LITERATURE REVIEW

The review of scientific, pedagogical and methodical literature allowed us to single out two aspects that are of the greatest interest for our research: social-pedagogical and technical aspects.

In particular, studies of the digital world are presented in Dolan's (2016) work; the phenomenon of digital education, the digital culture of modern society is considered by Mihailidis (2016). Information approach as a knowledgeable paradigm, analysis of information theory, big data, digital traces are explored by Thatcher (2014).

The specifics of the educational process with the introduction of new technologies are presented in the works of Nelson (2007), Dede (2008), Geiger et al. (2016). These studies are interesting as the authors have described in detail the process of the influence of digital technologies on the components of the pedagogical process, the cognitive structures of the personality, his professional development. In addition, it should be noted that this problem is investigated from the point of improving mathematical education.

Questions of the impact of online technology on the professional development of the personality are revealed in Hooley's (2012) work. Ferriter (2011) explores digital footprints in education.

Moreover, questions reflecting the specifics of the students' digital footprint are considered by Stepanenko and Feschenko (2017). The authors analyze and illustrate the methods and mechanisms for assessing the digital footprint of high school students. They emphasize the importance of an integrative approach to the collection and evaluation of data on student learning outcomes. The statements formulated by the authors are the basis for the formation of an individual educational trajectory for each subject in a digital learning environment.

The technological aspect of tracking and evaluating digital footprints is presented by Feshchenko, Goiko and Mozhaeva (2017). In particular, the authors emphasize the importance of social networks in compiling a comprehensive matrix of digital footprint assessment. This is the basis for designing learning individualization models. The main tool in this approach is monitoring. Features of the organization of monitoring in the system of teaching students using information and electronic technologies are reflected in the work of Babanskaya et al. (2017). They emphasize the decisive role of assessing a digital footprint in an educational context - designing an individual educational trajectory. In this connection, Khusainova, Chirkina and Gabdrakhmanova (2015) consider the influence of an individual educational trajectory on the formation of a competitive personality.

At the same time, disclosing the phenomenon of digitalization in the educational environment is impossible without studying issues of building social connections and social interaction. The study of Benson, Morgan and Filippaios (2014) is of particular interest in this aspect. Social interaction through digital tools is investigated by Black and Johnson (2012). This research is valuable as the authors explore the professional aspect - the use of social network employers.

Issues of evaluation and interpretation of digital traces in high school are investigated by Camacho, Minelli and Grosseck (2012).

In the national pedagogical theory and practice we have analyzed issues related to the possibility of interaction (both full-time and virtual), the possibility of visualizing educational material. It has determined the significance of the disclosure of the didactic potential of information, communication and digital technologies in the process of teaching mathematics.

As for the latter aspect, we note that researchers reveal it to a greater degree through the prism of individualization. For example, Krasilnikova (2009) proves the interconnection between the possibility of taking into account individual characteristics and the level of motivation and self-organization of students. This is especially important when studying mathematics, as students with different levels of training and individual-personal characteristics need a different amount of time to perceive and comprehend the information presented in alphanumeric and graphical forms. According to Sokolova and Kabanov (2003), the ability to take into account cognitive styles - styles of perception and processing of information - has a significant impact on the effectiveness of the learning process. This is explained by the fact that the knowledge of the leading channel of perception of information and the adaptation of the training material to the individual and personal characteristics of students allows to ensure the state of their psychological and physical comfort.

In addition, it is proved that the presentation of educational information, taking into account the functional specialization of the cerebral hemispheres, is one of the pedagogical conditions for differentiation and individualization of learning, and, consequently, it leads to its improvement. A close position is presented by Frolov (2009). Exploring the impact of technical means of education on the process of perception of information and its understanding, he comes to the conclusion that new technologies contribute to the intensification of the learning process and also have a significant impact on the formation and assimilation of concepts and reasoning, establishing causal relationships, understanding personal position etc. We believe that this idea is particularly important when organizing mathematical training in high school. Moreover, the influence of information and communication and digital technologies on the process of forming the reflexive position of students is ensured and maintained by the friendliness of the interface. The user-friendliness of the interface is not only convenient navigation for users, but also allows to vary the amount of information provided, its location, font and color design; apply interactive and multimedia objects. This is possible due to the implementation of such properties of information and communication and digital technologies as multimedia, virtuality, openness, adaptability and manufacturability.

It should be emphasized that the use of digital technologies in the process of teaching mathematics contributes to the formation of students' individual educational technology. The problem of formation of individual educational trajectories is reflected by Khutorskoy (2010), Yakimanskaya (2004) and others. Researchers identify different approaches to the definition of the essence of the concept. For example, Khutorskoy (2010) defines it as a personal path to the realization of personal potential. A number of researchers characterize it as a process and result of an individual choice by a student of the content, level and way of getting an education through making a choice. In the psychological and pedagogical work there are two directions of choice - horizontal and vertical. Horizontal direction determines the choice of content, forms of organization of educational activities. The vertical direction provides the choice of the optimal level of education. Osipova and Solovyeva (2013) emphasize that the choice is an action that gives purposefulness to all activities.

This approach actualizes the task of developing a methodical system for teaching mathematics by means of information, communication and digital technologies.

METHODOLOGICAL FRAMEWORK

We identified several stages in the experimental work: theoretical and analytical, activity stage, evaluative-reflexive. Theoretical and analytical stage suggested the separation of the structure of the digital trace; the choice of technology platform, the choice of tools for assessing students' digital educational footprint. Activity stage included implementation of experimental work through the development and testing of a methodological system for teaching mathematics using digital technology. Evaluative-reflexive suggested implementation of the assessment of students' digital educational footprint according to the selected components.

The experimental work was carried out on the basis of the following Russian Universities: Kazan Federal University, Vyatka State University, Financial University under the Government of the Russian Federation, I.M. Sechenov First Moscow Medical University (Sechenov University The research involved 313 people.

For the experimental work we determined the structure of the digital trace. In our study we single out motivational, cognitive and reflexive components in the structure of the digital educational footprint. As a justification for the selection of each of these components in the structure of the digital educational footprint, we point out the following provisions.

Firstly, information-communication and digital technologies for modern students are a key factor in increasing motivation to study the subject. Through the cognitive criterion, it becomes possible to evaluate the "growth" of students' knowledge and skills, the formation of relevant competencies. The reflective component is responsible for the level of self-organization of students in the digital educational environment. This position was justified by the fact that the effectiveness of the educational and cognitive activity of students is interrelated with the level of their self-organization. In the digital educational environment, such skills as semantic planning come to the fore - highlighting goals, sub-goals, and tasks of one's own activities in terms of their semantic significance for the individual, streamlining them in order of importance; current control of the order of the tasks to be solved, taking into account the pace, rhythm, time spent on the implementation of all tasks and goals; probabilistic forecasting - the correlation of immediate and remote tasks in the time perspective of the day, week, month, etc. To assess the mathematical preparation of students, we built a system of criteria, which included motivational, cognitive-activity and reflexive criteria.

We determined low, medium and high level of students' mathematical training for each criterion. Low level of the motivational criterion is characterized by: weak motivation and lack of interest in the study of mathematical and natural sciences, lack of awareness of the importance of the studied disciplines for future professional activities. For the cognitive-activity criterion it is: formal knowledge of formulas, definitions, laws, methods for solving problems of algorithms, ability to evaluate, prove, use mathematical knowledge in solving applied problems. For the reflexive criterion low level means the following: a student knows, but does not always use in practice the methods of performing control and assessment activities; low self-esteem, lack of confidence in the use of mathematical and scientific knowledge, learning management skills.

Middle level of the motivational criterion is characterized by: sustained motivation and interest in mathematical preparation, awareness of the importance of the studied disciplines for future professional activities. For the cognitive-activity criterion it is: having theoretical knowledge in the field of mathematics, being able to identify the natural scientific essence of the problem. choose a method for solving the problem and analyze the result obtained, make calculations for carrying out evidence and proving scientific statements. For the reflexive criterion middle level means the following: a student knows and uses in practice the methods of control and appraisal activities; appreciates his skills higher, he is more confident in the use of theoretical knowledge in solving applied problems; has desire to manage the learning process and expand knowledge, has skills of self-control and self-improvement.

High level of the motivational criterion is characterized by: strong motivation to study mathematical disciplines; confidence in understanding the importance of mathematical training for future professional activities. For the cognitive-activity criterion it is: a confident theoretical knowledge in the field of mathematics, knowledge how to choose a solution and justify its use, knowledge of the mathematical language to describe the phenomena of the world and processes associated with future professional activities; methods of mathematical analysis and modeling of physical phenomena and chemical processes, skills to predict the possible effects. For the reflexive criterion high level means the following: a student knows and always uses in practice the methods of control and appraisal activities; has high self-esteem of his own skills; possesses confidence when using theoretical knowledge in solving applied problems, has the skills of planning, organizing and correcting educational and cognitive activity.

At the next stage we have chosen the technological basis for creating a digital educational environment. The choice of technological basis was carried out by analyzing the capabilities of support systems for distance and e-learning. In this aspect, the works of Anisimov (2009), Belous (2008), Jirmann (2007) are of particular importance for our research. According to Belous (2008), Moodle, the modular object-oriented dynamic learning environment has the greatest potential for organizing e-learning. This system is superior to ANGEL LearningInc, ATutor, Blackboard, Desire2Learn Suit (D2L), LRN, LON-CAPA, Moodle, Sakai, TeleTOP VLE, WebTutor systems by the following parameters: technical and software, administration, productivity tools, organization and support students' activities, communication and support courses, cost. The priority use of the Moodle environment in the organization of independent work, the activation of the subjective position of students is emphasized by Anisimov, Jirmann (Anisimov, 2009; Belous, 2008, Jirmann, 2007). Due to its functional characteristics, the Moodle system has been introduced and is actively used in such educational organizations as the World Technological University, Kazan National Research Technological University, Omsk Polytechnic University, the Russian State Technological University named after K.E. Tsiolkovsky, St. Petersburg State University of Information Technologies, Mechanics and Optics, Siberian State University of Communications, Tomsk State University and others. The theoretical generalization of these studies, as well as the study of the experience of using the Moodle system in the educational practice of universities, made it possible to identify a number of factors that ensure its widespread adoption and use in education. Firstly, it is free distribution and open source code of the system, which allows to use Moodle in accordance with the specifics of the educational organization and making the necessary adjustments and additions. Secondly, the considered technological "platform" is a dynamically and effectively developing software environment. This ensures its continuous improvement and compliance with the modern characteristics of distance and e-learning. Thirdly, a fairly simple installation and requirements for the technical and system software, make it possible to avoid difficulties in setting up and administering the system. Fourth, the functional diversity of Moodle and its modular structure contributes to the integrated management and monitoring of the learning process. In many ways, it is achieved through a wide range of options for the presentation of educational material, the organization of interaction between subjects of the learning process and the assessment system. In particular, the following components can be implemented in the Moodle system: "chat", "forum", "lecture", "glossary", "blog", "workbook", "survey", "resource", "task", "test", "Profile", "wiki". The specified functionality of the Moodle tools allows to create interactive educational material, include external information and multimedia educational resources, web services, use programmable tasks with control questions, etc. These features and capabilities of the modular object-oriented dynamic learning environment Moodle were taken into account when developing the content of the electronic didactic environment.

In addition to the technological basis, we also analyzed tools able to evaluate the digital educational footprint: Edpuzzle, Edulastic, Flipgrid, Google Ciassroom, Google Forms, Formative, InsertLearning, Mentimeter, Nearpod, Pear Deck, Plickers, Poll Everywhere, Seesaw, Socrative.

When choosing the tools and technological basis, we considered stages of working with a digital educational footprint: data collection and decoding, data structuring and analysis, aggregation and data visualization. The key principles were: the principle of safety, validation and verification.

RESULTS

Designing a Methodological System for Teaching Mathematics, Taking into Account the Didactic Potential of Information and Communication Technologies

The principles of consistency, adaptability, manageability and integrativity were the basis for designing a methodical system for teaching mathematics through digital technologies. The methodical system of teaching mathematics includes interrelated components (target, content, technology), which determine the logic of interaction between the subjects of the educational process. At the first stage, we determined the theoretical foundations of designing a methodical system, taking into account the specifics of students' mathematical training and the didactic potential of digital educational technologies. At the second stage, we developed the content of the methodical system. At the third stage, technological tools were developed taking into account its didactic potential, including expanding the forms and structure of interaction between the subjects of the educational process in order to assess the results of the evaluation of students' learning and cognitive activity.

We structured the stages of interaction according to the form of organization of educational and cognitive activity. It should be noted that the logic of passing the stages for the majority of students is not consistent due to their individual and personal characteristics, and it may be cyclical. In particular, for the implementation of the fourth stage, it is necessary to refer to the first and third stages. This return is necessary in order to update the already existing methods of solving problems and to consider the theoretical issues that have caused the students the greatest difficulties. The most difficult and key sixth stage requires the assimilation and systematization of the information received, therefore, it actualizes the transition from the fourth to the third, second and first stages. The fifth stage can be accessed immediately after the first in order to obtain the necessary information for the formation of individual educational trajectories.

The possibility of choice and the non-linear nature of the presentation of educational material provide the opportunity to study the course taking into account the individual-personal characteristics of students. Therefore, it contributes to the formation of the students' reflexive position. "Looping" of the sequence of the stages from the sixth to the first occurs on the basis of the logic of studying the selected subject lines of the discipline. The presented stages assume the use of individual, pair and collective forms of education.

The considered technological basis, the specifics of its substantive content, the phased structure of the organization of educational and cognitive activity of students and possible interaction schemes within it are fundamental ideas in developing a methodological system for teaching mathematicians of information and communication and digital technologies.

The Content of the Digital Environment in The Process of Learning Math

The developed method is represented by three modules: informational, design and reflexive. The modules were designed taking into account the structure of students' educational and cognitive activity.

The information module is aimed to inform students about the specifics of organizing their own activities and planning time. The specified module contains tasks aimed to develop the skills of self-organization of students. The design module includes practice-oriented tasks which solutions require the use of both a mathematical apparatus and knowledge of professional disciplines. This block is aimed at the development of logical and reflective thinking of students. The reflexive block provides the formation and adjustment of the students' reflective position; it aimed at self-analysis and self-development of the individual.

The developed method assumes full-time and virtual interaction of the subjects of the educational process. Through the use of information and communication technologies, we conducted such webinars in the framework of the information module as: "Information crystals" (Effective methods of processing information), "Secrets of time management" (information module of the methodology); in the framework of the design module: "I want to be an engineer - let them teach me!", "Kaleidoscope of scientific discoveries"; in the framework of the reflexive module: "Dull Mathematics"; "The engineer of the third millennium - the engineer of the future, what is he?".

In addition to the theoretical part, students were offered a system of practical tasks, the discussion of which took place in the framework of organized chats ("Mathematics for the engineer: myth and reality"), round tables "The legacy of the past" (about great inventions, discoveries and scientists) with the help of didactic techniques (blue sky, constellation - Engineer, tree of desires; five fingers; "fish-born" "thick" and "subtle questions"). It should be emphasized that the specificity of these methods, techniques and forms of education was determined by the specifics of the direction of training students.

We paid special attention to the system of tasks aimed to assess the cognitive component of the student's educational and cognitive activity. One of the most frequently visited modules among students was the module "Entertaining modeling". It is aimed to develop the skills of using the mathematical apparatus for modeling various processes of animate and inanimate nature. This stage had mainly research tasks for the development of students' analytical skills: analysis of information in order to identify the natural scientific nature of problems; methods of correct expression and a reasoned rationale for their point of view; forecast of possible consequences; formation of ideas about mathematics as a "tool" for describing the phenomena of the world around us and processes related to future professional activity.

At this stage, we had such online classes as "Living Differential Equations", "Mathematical Architecture", "Constellation of Natural Science", "Short Circuit". "Living Differential Equations" lesson was of particular interest for students. The aim of this lesson was to create conditions for the formation of analytical and research abilities, skills to simulate the processes of animate and inanimate nature and to interpret data. In the system of training future engineers, this topic has one of the key positions. This is due to the fact that, having arisen from problems of an applied nature, differential equations after further development of the theory were reflected in many sciences. Therefore, the study of this topic contributes to the implementation of interdisciplinary connections. Secondly, a student develops modeling skills in the process of studying the fundamentals of the theory of differential equations. The review of pedagogical and methodical research contributed to the definition of the cognitive, corrective and interpretative series of functions of mathematical modeling when studying the course of differential equations.

For a qualitative analysis of the results, we used the following techniques to evaluate the digital educational footprint. The method of "entangled logical chains" allowed to trace causal relationships or a chronological chain of events, to focus on the variability of the development of certain situations. The value of admission lies in the awareness by students of the importance of cause-effect relationships. The reception "cross discussion" was used in organizing the work of students in small groups. During the class, students were offered a binary question, during its discussion they had to express thoughtful arguments (counter-arguments) and also demonstrate the ability to listen to their opponents. The reception "thick and thin questions" was applied at the final stage of the lesson in order to summarize and organize feedback with the students. They were asked to answer the "subtle" questions on their own ("Who?", "What?", "When?", "Do you agree?", etc.). "Fat" questions ("give an explanation ...", "why do you think ...", "what is the difference ...", "suppose what happens if ...", etc.) were discussed together. Students noted that the use of this technique contributes to the concentration of attention, development of thinking, more effective learning of the material, and identification of the methodological potential of the disciplines studied.

Results of Approbation of the Methodology for Forming the Reflexive Position of Students in the Process of Teaching Mathematics

The results of experimental work on the evaluation of digital educational footprint allow us to create a database that includes the results of educational and cognitive activity of students in the digital educational environment for each of the components: motivational, cognitive, reflexive.

It should be noted that in the course of testing the methodology of teaching mathematics in the digital environment, we received a qualitative increase in each of the studied indicators. Thus, for example, the number of students with a low level in terms of the total index of all three criteria studied decreased from 34.5 to 22.3%. Students with low levels of self-organization demonstrate an unconscious choice of profession, weak motivation to work, lack of systematicity and consistency in the organization of educational and cognitive activity, low self-esteem in achieving the goal, lack of skills to exercise reflection; have difficulty solving practical and research problems. The students of the second group are characterized by a conscious choice of profession, formed by the skills of planning activities and analyzing its results, stable motivation to obtain new knowledge; successfully solve practical problems that require the use of mathematical tools. Students with a high level are characterized by adequate choice of profession, high motivation, strong will, sufficiently high adequate self-esteem, sense of purpose, organization, high performance, self-confidence, reflexion skills; the predominance of research-type activities, the lack of difficulty in solving applied and research problems.

DISCUSSIONS

Today in pedagogical science, as well as in domestic and foreign educational practices, a variety of works try to solve a number of problems existing in the organization and implementation of mathematical training at a higher educational institution. We have considered one of the aspects of the process of mathematical preparation, namely: changing the approach to the implementation of the evaluation of educational and cognitive activity of students in the digital educational environment. We consider information and communication technologies and digital technologies as the leading didactic tool. Analysis of the scientific and methodological literature, as well as our own teaching experience allows us to highlight the significant pedagogical potential of the considered technologies. However, it should be noted that in spite of the positive impact of information and communication technologies and digital technologies on the preparation process as a whole, there are certain difficulties.

Key difficulties are: the development of teaching materials, the level of computer and information literacy of teachers and students, "closing social contacts", "the gap between knowledge and cognitive experience", the illusion of free personal goal setting and choice, virtual dependence, reliability of software and hardware, its functionality, ensuring objectivity in the system of knowledge assessment, etc. The above aspects make it possible to formulate promising lines of improvement developed method, in particular, details of the methods, techniques, forms of organization of learning and cognitive activity of students, taking into account the levels of differentiation and "initial" amount of knowledge of students. We believe that this, in turn, will increase the efficiency of the developed methodology and its results.

CONCLUSION

We developed and introduced into educational practice methodological approaches, based on the didactic possibilities of technologies while analyzing various points of view on the problem of forming the reflexive position of students by means of information and communication technologies. The conducted approbation contributed to the concretization of the methodological system of teaching mathematics at university, supplemented by such forms of work as a webinar, a virtual tour, chat, etc.

The implementation of the ideas of individualization of education is ensured by recognizing the priority of each student's individuality and self-worth, maximally turning to his individual experience, the need for self-organization, self-determination and self-development, designing the general conceptual provisions of the theory of activity on the pedagogical field; analysis of the results of training in the form of an integrative system of actions.

Our study has a predictive value, as it creates real prerequisites for further scientific research in studying the specifics of introducing information and communication and digital technologies into educational practice, taking into account the development of information and technological characteristics of modern society, flexibility and changing guidelines of federal state educational standards, and technological areas of production.

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