

The use of digital technologies in the teaching of mathematical disciplines to generate student interest in research activities

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Abstract — The development of digital technologies in education helps to optimize certain types of independent work of students, including research. Since the conduction of research work involves the use of not only classroom time for conducting classes, but also extra-curricular activities, it is proposed to use digital technologies to conduct extracurricular activities of students in the study of mathematical disciplines in order to develop and increase the scientific potential of students and increase their interest in research work. The research demonstrated examples of the positive results of using digital technologies in the teaching of mathematical disciplines.

Keywords — innovations, digital education, research work of students, educational process optimization

I. INTRODUCTION

Some researches of students' attitudes to scientific work in Russia [13] suggest, that the percentage of students, who are ready to write scientific or research work is sometimes unusually low.

It is worth noting, that most often first-year students do not know how to write scientific works. However, senior students also do not have sufficient knowledge, and sometimes, do not feel the need to write such works [13.]

Nevertheless, the writing of higher qualification works by students implies their knowledge in research activities. However, most of the written diplomas cannot be attributed to full-fledged scientific work, which is associated with the lack of experience in such work during most of the students studying at a higher educational institution. Also, the increased demand for writing diploma works to order suggests, that students sometimes simply avoid research work, which is provided by standards and is an obligatory part of higher education.

When we talk about higher education, we imply, that one of its most important qualities is the systematization of knowledge and the ability to conduct active independent work using various learning methods, including interactive methods and methods, based on digital technologies. Thus, there is a need to look differently at the content of professional education and the forms of independent work of students.

The teacher should not only form theoretical knowledge and some practical skills in students, but also develop his

skills of independent work, his own initiative, and allow to use his creative and scientific potential.

In this context, it can be said that the correct form of independent work of the student is necessary.

II. PROBLEMS

The problem of the unwillingness to write works of this kind and the unwillingness to engage in scientific activity exists. It would seem, that this problem is not so obvious: since higher education institutions should graduate specialists, not scientific workers or researchers. However, when we talk about the graduation of specialists from a higher educational institution, we imply, that the graduate's knowledge is at a high level and he is well aware of the current state of the field, in which he received his diploma, and is also familiar with innovations in his and related fields. With the modern dissemination of information and the digitalization of society, a student (who will later become a graduate-specialist) can mostly obtain this knowledge thanks to scientific work, which is impossible without studying conference materials, scientific articles on a specific topic, conducting his own research work, etc.

The formation of students' interest in the studied disciplines, including additional independent work, is possible due to different sources. For example, one of the relevant direction in this area is the socio-cultural marketing approach [12]. As a motivation for students, a material incentive, establishing contacts on extracurricular issues between teaching staff and students, increase in the practical significance of student work, and moral incentives can be applied. However, before "turning on" these motivators, it is necessary to interest younger students and make their participation in research activities voluntary. To make this happen, it is necessary to familiarize them with scientific articles, with the main objects, that are used in scientific activity and identify "weak" and "strong" points, when working with a specific group in a particular discipline, so that the work on filling the lack of experience with scientific literature, with the study of scientific concepts, practicing writing scientific texts was carried out purposefully, on a schedule, in connection with the studied discipline, and most importantly, with the interest of students and their voluntary participation.

To optimize certain types of independent work of students in a university with the aim of showing high activity by students, it is necessary to increase student activity not only in class time, but also in extracurricular time, which is associated with a number of difficulties [9]. However, these difficulties can be overcome using digital technologies in the educational process during extracurricular activities, the result of which we propose to consider further.

The fulfillment of coursework and laboratory work, writing control works, tests, homework is that part of the work in which the student can prove himself, but is not a full-fledged basis for further research activities. However, the conduction of research activities by students ensures, that they are professionals in their field after leaving the walls of a higher educational institution and have a good idea of the current state of science and technology and also of innovation in the fields of knowledge, in which they receive a diploma.

Criterion of estimation follows the students from the school bench and is not a strong motivator, but rather, is perceived as the everyday life of the school, and then student life. In particular, it concerns the disciplines of natural science and technology cycle.

When we talk about higher education, we imply, that one of its most important qualities is the systematization of knowledge and the ability to conduct active independent work using various learning methods, including interactive methods and methods, based on digital technologies. Thus, there is a need to look differently at the content of professional education and the forms of independent work of students.

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III. METHODOLOGY

To solve the problem of students' interest in the learning process, various technologies of the digital community are used, including gamification and the use of Internet technologies, e-learning and others.

Gamification is given a lot of attention in the context of how the latest technologies can help the modern education system. To the question of whether it is possible to use games as a tool to increase the effectiveness of learning, many researchers give positive answers [5], [6].

Gamification is the use of game elements and game design methods in non-game contexts; application of approaches, specific to computer games of non-gaming processes in order to attract users, increase their involvement in solving applied problems, or use products and services by consumers.

There is data, presented at various conferences and in articles, that the positive experience in the development of digital pedagogy as an educational system, such as learning

using e-learning platforms or computer games to engage students in the educational process takes place [1], [7].

It is obvious, that the modern education system should use the positive tendency of introducing E-learning into the learning process. [8]

E-learning is already becoming a fundamental part of student learning and an integral aspect of studying higher education [2], and also show a positive tendency in the application in students practice [3], [4].

In recent years, more and more models and forms of the educational process in universities with the use of digital technologies is proposed, such as an integration model, in which the material of mass online courses is used as additional, in the implementation of classes in a traditional format, or as an integration model, involving the transformation of the learning process with a partial transfer to the electronic environment. [10]

It is noted, that for generation Z (born since 2003) and generation Y (born since 1983 to 2002), among other features, a reduced focus of attention on one information flow is characteristic — the desire to receive multiple flows of information at the same time, the desire to receive information in an interactive format [11]. Thus, the learning process should take into account these features, typical to the students of these generations. Undoubtedly, the use of digital technologies helps to avoid problems in obtaining and processing information from students of these generations.

The massive use of online courses like Coursera or MOOC, the use of LMS and LCMS systems is the most discussed recently. However, each teacher, being one of the key figures in the educational process, can model the educational process, using digital technologies, himself, without being outside the framework of the educational program, but at the same time, change his professional practice, using digital competencies.

IV. RESULTS OF THE RESEARCH

A test research to determine the level of competence in the main aspects of research activity was conducted among second-year students, studying mathematical disciplines, in particular, students, studying the discipline "Game theory", which is one of the classical mathematical disciplines with the capability to solve applied problems either in the economic field, or in many others. The sample consisted of two groups with a total amount of 51 people.

Initially, students were offered to find scientific articles, that rely on the theory of the studied discipline, using electronic services, and evaluate the capabilities of applications and solve real applied problems, using the basic studied concepts. It was recommended to get acquainted with articles of not only domestic, but also foreign authors, including english-language articles and magazines.

It is worth noting, that the main part of the students were able to find a large number of applications of game theory and suggest areas, where this theory can be applied. However, over 80% of the entire sample used articles of no scientific

importance, or related to popular science instead of scientific articles. Also, second-year students did not think about participating in scientific conferences yet. Thus, it was revealed, that students are poorly oriented in the study of scientific literature and do not know the features of scientific articles, the differences between scientific articles and popular science, the structure of writing a scientific article, are not familiarized with the search sources of scientific publications. This situation is typical for young students, since the first year of study usually spent on adaptation to the university environment and students still do not have time to do scientific work at the proper level.

In order to familiarize students with scientific articles, with the main objects that are used in research and to identify "weak" and "strong" points, so that the work on filling the lack of experience in working with scientific literature, with the study of scientific concepts, with working out the writing of scientific texts was carried out purposefully, on a schedule, in connection with the studied discipline and, most importantly, with the interest of students and their voluntary participation, it was proposed to use tools for creating, editing and publishing content and learning objects (such as Google Drive, Google Docs, etc.)

Students were asked to complete several assignments, that were aimed at developing skills and obtaining primary experience in research work.

The assignment, aimed at familiarization with the structure of a scientific article, the main aspects of writing a scientific article, the search for scientific works, consisted of creating a common electronic document with the possibility of joint editing and discussion, consisted in answering the questions:

- a) What is a research?
 - b) What is the difference between research work and design work? It is necessary to establish and write out the differences.
 - c) What is the difference between a scientific article and a popular science article? Specify the structure features of a scientific article
- etc.

As annexes to the document, scientific articles, found by students, were used.

During the entire time the of fulfillment of the assignment, the group had the possibility to jointly edit the document, using Internet services and receive tips from the teacher, since access to the document was open.

The assignment, aimed at working out the writing of a scientific work, in particular, familiarization with the basic principles of copyright ethics and testing for anti-plagiarism, consisted of writing an essay on topics, related to mathematical disciplines. Students, who did not pass an anti-plagiarism test, wrote an essay again, until they reached the threshold of 80% of the originality of the text.

For example, in one of the groups, the students included the following to the first spot in the list of features of a

scientific article: a scientific article is intended for scientists and specialists; the presence of complicated scientific terminology and phraseology, set terminological expressions; a text, in which conclusions follow from the content, they are consistent, the text is divided into separate semantic segments, that reflect the movement of thought from particular to general or from general to particular; absence of advertising; reviews are presented; correct statement of scientific information and facts of analytical-synthetic data processing, explanation of scientific idea, etc.

It is worth noting, that the group work in the online environment attracted a large number of participants and almost all group students took part in the fulfillment of assignments, despite the fact, that these assignments were fulfilled by students without giving grades, on a voluntary basis, as an annexes to common homework.

At the end of the course, students were asked to take a survey, on the basis of which it is possible to judge the success of this work, since according to the presented below survey, students began to better orientate in scientific work and some of the respondents assume their participation in scientific conferences in the future.

As a result of the survey, almost 84% of students answered, that they were more freely oriented in scientific work, selecting a list of references, etc. after the work.

Almost 73% of respondents consider, that they became well-versed in the basic concepts, studied in the course, including thanks to collaboration with the use of tools for creating, editing learning objects.

60% of students noticed, that they worked with scientific articles previously, only 40% said, that they did such work for the first time. However, less than 10% of students had ideas about the basic concepts of research work and important aspects of scientific publications prior to the work. After working with the use of digital technologies, 67% of students confirmed, that they easily orient in the concepts of "research work", "design work", "scientific article" and the main characteristics of scientific articles. Also, 73% of students noted, that they can now easily distinguish a scientific article from a popular science article, which only 10% could do before.

70% of respondents answered positively to the question, if they would like to attend conferences, in the natural sciences profile, in profiles, related to mathematical methods in economics. At the same time, 58% of students answered positively to the question, whether they would like to make a report at the conference. However, this percentage can be considered quite high and suggests, that the initial motivation by second-year students for participating in the conference is present and it is important for the teacher to develop it for further working and high-quality writing of diplomas and theses of reports, scientific articles.

V. CONCLUSION

It can be said, that the development of digital technologies allows to use Internet resources in the educational process,

achieving the goal of not only increasing the effectiveness of learning, but also of forming the necessary competencies by students, which are provided by the modern educational program. The effectiveness is achieved thanks to the use of interactive-online space and the interaction between students and teachers through Internet services. Thus, it can be said, that the use of digital resources helps to provide not only a continuous and dynamic learning process, but also allows to provide an individually-oriented learning process.

The above research shows, that the use of digital technologies in the learning process of representatives of generations Y and Z gives a positive result in optimizing certain types of students' independent work, aimed at increasing interest in research work and acquiring the skills, necessary for scientific work.

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