PROVISION OF MATHEMATICAL PREREQUISITES TO STUDENTS IN HUMANITIES AT THE FEDERAL UNIVERSITY OF YAKUTIA

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INTRODUCTION

Changes in the system of Russian higher education, in line with the principles of the Bologna Agreement, began in 2003. Since 2010, two-cycle training has been introduced in higher educational institutions; this is a bachelor’s and master’s degrees.

Teaching mathematics to students in humanitarian classes has a continuous continuation and in the higher level of education, according to the requirements of the first Federal State Educational Standard (FSES) of 1995 and the second 2000 generations, the discipline of mathematics is included in the humanitarian areas and specialties as a general educational discipline.

In the concept of natural science education for humanities, adopted in 2000, one of the main tasks is to be acquainted with the exclusive role of mathematical models as a universal means of describing relationships in various fields of knowledge, which determines the ability of mathematics to act as a language of science.

In the FSES of Higher Education (HE) (FSES, 2016) in undergraduate education and pedagogical sciences, it is presented that graduates must master the ability to use natural science and mathematical knowledge to navigate in the modern information space (general cultural competence (GCC-3)).

The content of mathematical education at all levels of education is becoming obsolete, in humanitarian specialties, it is strongly divorced from life situations, and there is no continuity between the levels of education. The needs of future humanitarian specialists in mathematical knowledge are not sufficiently taken into account. All this suggests that when teaching mathematics to students of humanities in mathematics, it is necessary to teach them to use the acquired mathematical knowledge in their professional activities.

In the course of researching the problem, we solved the following tasks: we conducted a survey (2017-2018, 2018-2019 academic years) among students of the Faculty of Philology (FP) and the Institute of Foreign Philology and Regional Studies (IFPRS) in M.K. Ammosov North-Eastern Federal University, Yakutsk, to identify the need to study mathematics by students of humanities and specialties; studied and analyzed curricula, work programs in mathematics (intended for teaching mathematics in humanitarian areas and specialties); substantiated the pedagogical condition aimed at the formation of general cultural competences, focused on the use of knowledge of mathematical methods in professional activities.

LITERATURE REVIEW

From year to year, university professors note the factors that cause difficulties in the study of mathematics by students of humanitarian areas and specialties: low mathematical training of high school graduates; inconsistency of the content of textbooks in mathematics, the characteristics of students - humanities; there is no connection between mathematics
programs for students of humanitarian classes and students of humanitarian fields and specialties (ZIYAUTDINOVA, 2015).

The mathematical education of students in the humanities abroad can be found in the works by Ami Mamolo (2018), Peter L. S Mofokeng, Andile Mji (MOFOKENG, ANDILE, 2010), Teresa Ayala-Perez, Jorge Joo-Nagata (2019) and others. For example, Mamolo (2018) researches teaching mathematics concerning issues of social importance. Peter L. S Mofokeng, Andile Mji (MOFOKENG, 2019), studied the question of the readiness of teachers to use information and communication technologies in schools for teaching mathematics. Maria Kukhta, Olga Homushku, Larisa Kutsenko, write that the relationship between the humanities and natural sciences contributes to the development of the concept of "symbolic thinking" in students (KUKHTA, 2015).

Teresa Ayala-Perez, Jorge Joo-Nagata (AYALA-PEREZ, 2019), studied the development of the digital culture of students of pedagogical specialties, a humanitarian university. Noteworthy is the work by F.-J. Garcia-Marco (2017), the author examines the integration of communicative competence in the information literacy program, because communicative competence is basic. Cohen, R., Kelly, A. M. focused their research on mathematics and general academic factors that influenced the learning outcomes of community college students (COHEN, KELLY, 2019). We find a problematic approach to the process of teaching students mathematics in the works by Masitoh, Fitiyani (2018); Santos-Trigo (2020). Herawaty, Widada (2017) studied the linear influence of cognitive conflict on the ability to understand mathematical concepts using a contextual learning model.

Based on the theory of self-directed learning, Sun, Xie, Anderman (2018) examined the relationship between academic achievement and the three key constructs of self-regulation in two undergraduate courses in mathematics. Worsley, D. analyzed the practice of teaching mathematics, based on which interdisciplinary projects for teaching humanities students were created (WORSLEY, 2002). Richland, Stigler, Holyoak (2012) considered psychological and educational research, which hypothesized that school improvement should be based on the long-term ability to transfer and use mathematical skills as a meaningful system in human life. In his work Smithies, J. showed new critical and methodological approaches to digital humanities, where the dependence of people and complex socio-technological systems is investigated (SMITHIES, 2017). The level of academic achievement, as well as the mathematical abilities of adolescents and adults, was investigated by Barroso, Ganley, McGraw, Geer, Hart, Daucourt (2021).

Of the domestic scientists involved in the study of teaching mathematics to humanities, A.A. Solovyova (2017) and E.P. Perminov (2020) reflect the most effective approaches in the works. The studies by A.A. Solovyova reflect the organization of independent work of humanities students using the project method (SOLOVYOVA, 2017). In his research, E.A. Perminov showed the use of a meta subject approach in teaching mathematics, determining the invariant basis of the content of teaching humanities students at a university (PERMINOV, 2020). An interesting and timely vision, in the context of a pandemic and the synergy of digital technologies, can be found in the article by a group of authors E.Z. Vlasova, E.A. Barakhsanova et al., education of teachers in a higher educational institution (VLASOVA et al., 2020).

The formation of general cultural competence of students in the humanities and specialties in the study of mathematics cannot be realized without the creation of favorable pedagogical conditions and the application of appropriate pedagogical approaches when working with students. In connection with the introduction of a new generation of the Federal State Education Standards (FSES) of higher professional education, the category "competence" has become the main one. Competence is the sum of knowledge, skills, and abilities that help a person to solve certain problems. The term "general cultural competencies" is the basis for more specific, subject-oriented, professional competencies, the formation of which is carried out in the study of each discipline. The formation of general cultural competencies provides any person with a comfortable stay in a social environment. Successful socialization is the ability to establish connections between the knowledge gained and the real situation.

Leading scientists - researchers: A.N. Leontiev, A.V. Khutorsky, I.A. Zimnyaya et al., note that the formation of general cultural competence is facilitated by a personality-oriented approach in
education; this paradigm involves the recognition of the individual uniqueness of each student. Thus, working on the formation of the general cultural competence of future teachers of humanitarian disciplines, we attempted to enrich the content of the subject area “Mathematics” of humanitarian areas and specialties with an educational and methodological complex aimed at the formation of general cultural competence. For the implementation of the educational-methodological complex in the educational process, the most productive pedagogical approaches turned out to be personality-oriented, information-communication, and competence-based. The educational-methodical complex included the textbook “Elements of the theory of probability and statistics”; tasks for laboratory work, the author’s site “Elements of the theory of probability and statistics.”

For successful training and achievement of the goal of the discipline A.V. Ivanova and A.G. Skryabina in their textbook “Elements of the theory of probability and statistics” (IVANOVA, 2019) compiled “Mathematics”. The purpose of the tutorial is to form students’ basic combinatorial and probabilistic ideas about the world around them and their explanatory mathematical laws. All the proposed tasks have methodological support; there are many tasks with regional content.

In the course of the educational process, students were offered four laboratory works, which were supplied with instructions. In the course of laboratory work, students improved their knowledge of the tools of the Excel package, for example, they learned to draw up formulas for finding data values and build charts, graphs using information and communication technologies. Website (https://webquestgeom.jimdo.com/) was widely used. Which contains a web-quest on the topic “Elements of Probability Theory and Statistics”. This site was mainly used to test the knowledge of students in this section.

Therefore, as a pedagogical condition, it was proposed to enrich the content of the subject areas “Mathematics” of humanitarian areas and specialties with an educational and methodological complex aimed at the formation of general cultural competencies. The formation of general cultural competencies of students in the humanities and specialties is impossible without the use of personality-oriented, information-communication, and competence-based approaches in teaching.

Analyzing modern pedagogical sources, we put forward the following concepts of student-centered learning: the humanistic principle of interaction between the teacher and students (SCHERBINA, 2018); strategy and tactics of forming the personality of a specialist (GORBUNOVA, 2018); motivation of students (NIKOLAEV, 2019); preparation for future teaching activities (USHATIKOVA, 2018). The use of this approach in the educational process is due to the effectiveness in the development of the professional interests of students.

With the development of information and communication technologies (ICT), inevitably, the use of information and communication technologies in the educational process, as one of the most rational approaches, for mobile elimination of problems arising in the educational process. The function of a modern teacher with the requirements of the new FSES for learning outcomes has increased significantly, with the need to form and develop cognitive independence, research skills of students. New educational standards impose special requirements on the preparedness of the teacher in the field of knowledge and use of information and communication technologies, thereby; their functions are significantly expanded and complicated. One of the interesting facts is the interaction with educational content in an informational educational environment (BELYAKOVA, 2019).

The competency-based approach to the higher education system began to be introduced only in 2011, with the introduction of the new FSES for higher vocational education. The requirements for a modern qualified specialist consist of professional and personal qualities, i.e., possess qualifications, creativity, initiative, the ability to lead teamwork, etc. Therefore, the quality of modern vocational education is closely related to the formation of competence, in connection with which there is a renewal, modernization of domestic vocational education. In this context, the competence-based approach in the educational process is the creation of favorable conditions and support for students in training, which can ensure the most effective self-education of students and the formation of their professional competence. Many university
teachers use this approach widely in teaching (BOZHKO, 2018; GUBAR, 2019; DARBASOVA, 2019; MAKSIMOVA et al., 2018).

Summarizing the conducted studies of the peculiarities of the formation of general cultural competencies of students in the humanities and specialties, with the substantiation of the pedagogical condition based on personality-oriented, information-communicative, and competence-based approaches, we present the following conclusions:

- A pedagogical condition that hypothetically contributes to the formation of general cultural competencies of students in the humanities and specialties - enrichment of the content of the subject area “Mathematics” for humanitarian areas and specialties with an educational and methodological complex aimed at the formation of general cultural competencies;
- Methodological approaches are described: personality-oriented, information-communication, and competence-based approaches in teaching focused on the formation of general cultural competencies of students.

MATERIALS AND METHODS

The methodological basis of the research is personality-oriented, information-communication, and competence-based approaches in teaching mathematics to students. Theoretical and empirical methods were used (observation of students in the study of mathematics, a survey of students, conversation with teachers), a pedagogical experiment, analysis of the results.

For the study, students in the direction of training were selected 44.03.05 Pedagogical education (with two training profiles), profile: Foreign language (German) and additional education - 32 students; 44.03.05 Pedagogical education (with two training profiles), profile: Russian and foreign languages - 24 students. In total, covering 56 students, for the 2017-2018 academic year. These two groups constituted one control group.

For the experimental group, students were selected in the same areas of training, only for the 2018-2019 academic year, were in the direction of training 44.03.05 Pedagogical education (with two training profiles), profile: Foreign language (German) and additional education, amounted to 27 students; 44.03.05 Pedagogical education (with two training profiles), profile: Russian and foreign languages - 31 students. In total, there are 58 students in the experimental group.

The level of proficiency in mathematics of students at the beginning of the academic year showed approximately the same knowledge.

Purpose of the study: the formation of general cultural competencies aimed at the formation and use of mathematical methods in professional activities.

Based on the passport and the program of general cultural competencies, the following components were selected as indicators of its formation: motivation for studying the discipline and the quality of its assimilation.

To identify general cultural competencies aimed at using mathematical methods in the professional activity of students in the humanities and specialties, the following methods were used:

- Assessment of the motivation for studying the discipline and the quality of knowledge in mathematics;
- Analysis of the obtained results.

To diagnose the educational motivation of students, we used the methodology for diagnosing the orientation of the motivation for studying the subject proposed by the doctor of psychological sciences T.D. Dubovitskaya (2002). We chose that method because the questions proposed in it are closest to the indicators for assessing the formation of general cultural competencies. The methodology for diagnosing the educational motivation of students consists of 20 judgments and the answer options offered to them. Answers are recorded in the form of pluses and minuses on a special form; verification is carried out per the key.

To identify the quality of knowledge in mathematics, verification, control, laboratory work in mathematics were carried out to check the quality of mastering the material in mathematics.
RESULTS
The experiment was carried out in the 2017-2018 and 2018-2019 academic years, with students of the Faculty of Philology (FP) and the Institute of Foreign Philology and Regional Studies (IFPRS) in M.K. Ammosov NEFU. At the beginning of each academic year, in all groups, work was carried out to identify the level of formation of general cultural competencies of students; for this, tests in mathematics and diagnostic measures were carried out to identify the motivation for students’ substantive activity. The results on indicators of the formation of general cultural competencies are shown in the tables below.

So, there are only 20 questions in the methodology for diagnosing the orientation of motivation for studying the subject, therefore, if there are 24 students, then a total of 480 questions are obtained, and accordingly, with 32 students - 640 questions, in the 2017-2018 academic year. Accordingly, in the 2018-2019 academic year: 31 people - 620 questions and 27 people - 540 questions. Among all the answers, it was needed to identify a match with the key that gives one point. The results of the ascertaining (beginning of the experiment) and control (end of the experiment) stages to identify the motivation for studying the discipline are given in Tables 1 and 2.

Table 1 - Results of motivation for studying the discipline at the beginning and end of the experiment, in % for the 2017-2018 academic year, control groups.

| Number of students | At the beginning of the experiment | At the end of the experiment |
|--------------------|-----------------------------------|-------------------------------|
|                    | Matched responses                  | Mismatched responses           | Matched responses | Mismatched responses |
| FP (24 people)     | 118-25% 362-75%                   | 130-27% 350-73%               |
| IFPRS (32 people)  | 166-26% 474-74%                   | 192-30% 448-70%               |

Source: Search data.

Table 2 - The results of motivation for studying the discipline at the beginning and end of the experiment, in % for the 2018-2019 academic year, for experimental groups.

| Number of students | At the beginning of the experiment | At the end of the experiment |
|--------------------|-----------------------------------|-------------------------------|
|                    | Matched responses                  | Mismatched responses           | Matched responses | Mismatched responses |
| FP (31 people)     | 151-24.4% 469-75.6%               | 254-41% 366-59%               |
| IFPRS (27 people)  | 142-26.3% 398-73.7%               | 233-43.1% 307-56.9%           |

Source: Search data.

Table 1 shows that the number of coincident answers did not increase significantly compared to the initial data, which means that the number of students with intrinsic motivation to study the subject remained at the same level, i.e. the students are not very interested, they are interested in mathematics and may not apply the knowledge gained in the future in their professional activities. Moreover, Table 2 shows a significant increase in the coincident answers, the number of students with intrinsic motivation to study the subject has increased significantly, which means that it shows a positive trend in the formation of general cultural competence. As determined by T.D. Dubovitskaya (2002), internal motives are associated with the student’s conscious cognitive need, obtained from the cognitive process, which coincides with the purpose of their activity. External motivation for educational activity is associated with fleeting manifestations of interest in the discipline, getting a good grade, for the sake of a scholarship, etc.

The quality of students' mathematical education was checked using the proposed laboratory, independent, control works, and passing an exam in the subject. Table 3 summarizes the data on verification work.

Table 3 - Generalized data of verification work by groups at the beginning and end of the experiment, in % (positive ratings), 2017-2018 academic year, control groups.

| Number of students | Start of the experiment | End of the experiment |
|--------------------|-------------------------|-----------------------|
| FP (24 people)     | 71% (17)                | 83% (20)              |
| IFPRS (32 people)  | 71.8% (23)              | 81% (26)              |

Source: Search data.
Table 4 - Generalized data of verification work by groups at the beginning and end of the experiment, in % (positive ratings), 2018-2019 academic year, and experimental groups.

| Number of students | Start of the experiment | End of the experiment |
|--------------------|-------------------------|-----------------------|
| FP (31 people)     | 67.7% (21)              | 93.5% (29)            |
| IFPRS (27 people)  | 66.7% (18)              | 92.6% (25)            |

Source: Search data.

Table 3 shows that the number of students who wrote test papers for positive grades (“3”, “4”, and “5”) increased by three people, both among the students of FP and IFPRS. We see a significant increase in positive ratings for the 2018-2019 academic year (Table 4), the difference in the group of students of FP was 8 (25.8%) people and, accordingly, in the students of IFPRS - 7 (25.9%) people. The results of the test work allow us to conclude that the use of a textbook, laboratory work, the use of an educational site in teaching mathematics to students in the humanities and specialties, the widespread use of personality-oriented, information-communicative, and competency-based approaches in teaching gave positive results.

DISCUSSION

The experiment took place for two academic years; the first academic year was devoted to the ascertaining stage, the second academic year - to the formative and control stages. Students of the 2017-2018 academic year were assigned to the control group, students of the 2018-2019 academic year - the experimental group. According to the curriculum, the discipline “Mathematics” in these areas belongs to the basic, optional, compulsory discipline. Where, according to the curriculum, 108 hours are allocated in the first semester of the first year, where 36 hours are allocated for independent work, the form of control is an exam.

The work program provides for the study of elements of higher mathematics, which are usually given to first-year students, is linear algebra, analytical geometry on a plane and in space, the basics of mathematical analysis, elements of probability theory, and mathematical statistics. Due to the variability, the choice of the studied sections by the teacher himself, we had the right to reduce the hours by adding these hours to study another section. In this regard, in the 2018-2019 academic year, we devoted enough time to study material about the concepts of randomness and stochasticity, which determine the course of all-natural processes that we meet in everyday life, to show the beauty and practical significance of mathematics in everyday life.

So, training in the 2017-2018 academic year was held in the traditional form, i.e. tried to keep pace with all the sections that were presented in the working program. At the beginning and end of the experiment, among the students, a survey was conducted, diagnostics of educational motivation in the discipline, test work to identify the level of formation of general cultural competencies focused on the use of knowledge of mathematical methods in professional activity. In the 2018-2019 academic year, when teaching mathematics, we adjusted the work program, used modern teaching technologies when conducting classes, paid special attention to the use of information and communication technologies, conducting integrated classes, widely used a compiled manual, a developed educational website and carried out laboratory work, after the class, we carried out reflection.

Thus, the formative stage was devoted to the implementation of the pedagogical condition - the enrichment of the content of the subject area “Mathematics” for humanitarian areas and specialties with an educational and methodological complex aimed at the formation of general cultural competencies, conducting control activities to diagnose educational motivation for the discipline and testing: laboratory and control work in mathematics.

CONCLUSION

Formation of general cultural competencies of students in humanitarian areas and specialties requires the creation of favorable pedagogical conditions that meet the needs and capabilities of students, in the implementation of which it is necessary to use the systemic unity of personality-oriented, information-communication, and competence-based approaches in the educational and educational process. However, the need for a constant increase in the level of general cultural and professional competencies, especially for a mathematics teacher teaching
students in the humanities and specialties, is a problem that deserves due attention.

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Provision of mathematical prerequisites to students in humanities at the Federal University of Yakutia

Provisão de pré-requisitos matemáticos para estudantes de ciências humanas na Universidade Federal de Yakutia

Provisión de requisitos matemáticos a los estudiantes de humanidades de la Universidad Federal de Yakutia

Resumo
O objetivo da pesquisa é revelar os problemas de estudo da matemática por estudantes das ciências humanas e especialidades, utilizando o exemplo de alunos da Faculdade de Filologia e do Instituto de Filologia Estrangeira e Estudos Regionais da Universidade Federal do Nordeste Ammosov e descrever a experiência de ensino de matemática, contribuindo para a formação de competências culturais gerais voltadas para o uso de métodos matemáticos em atividades profissionais. Um estudo sociológico foi realizado na forma de uma pesquisa escrita de alunos e conversas com professores da Faculdade de Filologia e do Instituto de Filologia Estrangeira e Estudos Regionais, abrangendo 114 alunos e 4 professores. Com base nos resultados do estudo, os autores resumiram a possibilidade de disseminação dessa experiência, utilizando o complexo educacional e metodológico proposto em outras áreas humanitárias e especialidades.

Abstract
The purpose of the research is to reveal the problems of studying mathematics by students of the humanities and specialities, using the example of students of the Faculty of Philology and the Institute of Foreign Philology and Regional Studies of the Ammosov North-Eastern Federal University and describe the experience of teaching mathematics, contributing to the formation of general cultural competencies focused on the use of mathematical methods in professional activities. A sociological study was carried out in the form of a written survey of students and conversations with teachers of the Faculty of Philology and the Institute of Foreign Philology and Regional Studies, covering 114 students and 4 teachers. Based on the results of the study, the authors summed up the possibility of spreading this experience, using the proposed educational and methodological complex in other humanitarian areas and specialities.

Resumen
El propósito de la investigación es revelar los problemas del estudio de las matemáticas por los estudiantes de las humanidades y especialidades, utilizando el ejemplo de los estudiantes de la Facultad de Filología y el Instituto de Filología Extranjera y Estudios Regionales de la Universidad Federal ammosov noreste y describir la experiencia de la enseñanza de las matemáticas, contribuyendo a la formación de competencias culturales generales centradas en el uso de métodos matemáticos en las actividades profesionales. Se realizó un estudio sociológico en forma de encuesta escrita a estudiantes y conversaciones con profesores de la Facultad de Filología y del Instituto de Filología Extranjera y Estudios Regionales, abarcando a 114 estudiantes y 4 profesores. A partir de los resultados del estudio, los autores resumieron la posibilidad de difundir esta experiencia, utilizando el complejo educativo y metodológico propuesto en otras áreas y especialidades humanitarias.

Palavras-chave: Direção humanitária. Especialidade humanitária. Competência. Condição pedagógica. Abordagens.

Keywords: Humanitarian direction. Humanitarian specialty. Competence. Pedagogical condition. Approaches.

Palabras-clave: Dirección humanitaria. Especialidad humanitaria. Competencia. Condición pedagógica. Enfoques.