

## ANNOTATION

**to dissertation work of Yershat Sapazhanov on «The methodology of the professionally oriented teaching mathematics in military high schools», presented for the degree of Doctor of Philosophy (PhD) in specialty 6D010900-Mathematics.**

**Relevance of the study.** The Law on Education provides for the tasks of further development of the education system "the main task of the education system is to create the necessary conditions for education aimed at the formation and professional improvement of the individual on the basis of national and universal values, achievements of science and practice, the introduction of new learning technologies, the informatization of education, access to international global communication networks». The objectives of the program were justified with an analysis of the state of the education system:

1. Improving the global competitiveness of Kazakhstan's education and science, education and training of the individual on the basis of universal values.

2. Increasing the contribution of science to the socio-economic development of the country.

Education is considered as a powerful engine of economic growth, as one of the most important factors of national security and the well-being of every citizen. The law says that the content and structure of vocational education should undergo qualitative changes, this also applies to higher military educational institutions.

The rapid change in modern technologies has a significant impact on the content of the subjects that students should study, so when teaching mathematics, the student should not only master mathematics, but also learn to responsibly, thoughtfully, creatively apply this knowledge in the study of mathematical disciplines and in future professional activities. The importance of mathematical education for a military specialist is also determined by the professional orientation of teaching mathematics, which is very important in connection with the formation of a new educational paradigm. The study of mathematics also contributes to the development of "intellectual endurance", i.e. develops the ability of a military specialist to keep a complex task in mind for a long time to find ways to solve problems. The development of mathematical methods for solving applied problems for a military specialist implies the formation of elements of mathematical culture.

Modern mathematical education in a military university is characterized by a number of unfavorable trends. Reducing the number of hours devoted to the study of mathematical, natural science and general professional disciplines contradicts the high requirements for the quality of fundamental training of a graduate of a military university. Modern mathematical education in a military university is characterized by a number of unfavorable trends. Reducing the number of hours devoted to the study of mathematical, natural science and general professional disciplines contradicts the high requirements for the quality of fundamental training of a graduate of a military university. The predominance of traditional methods and forms of organization of teaching mathematics at a Military University complicates the activities of teachers to

improve the content component of mathematical disciplines, filling it with elements of a professionally significant nature. The predominance of traditional methods and forms of organization of teaching mathematics at a Military University complicates the activities of teachers to improve the content component of mathematical disciplines, filling it with elements of a professionally significant nature. The reasons why many applicants enter specific military universities are always related to their future professional activities. But the cancellation of the course "Introduction to Mathematics" in higher education institutions, including the military, creates a serious cognitive barrier for first-year students with a low initial level of mathematical training and reduces the motivation to study mathematics and other fundamental disciplines.

In connection with the development of science and technology, there is a *contradiction* between the increased requirements for the quality of professional training of future military specialists and the reduction in the number of hours devoted to the study of mathematical and natural science disciplines; between the traditional content and methods of teaching mathematical disciplines and the need to update the goals, content and methods of professional training of mathematical disciplines in military universities.

One of the most important ways to resolve these contradictions is to strengthen the professional orientation of teaching part of the mathematics course for future military specialists, in our case, "probability theory and additional chapters of mathematics". Thus, the need to overcome the above-mentioned contradictions that are characteristic of higher military education, and the insufficient development of methods for implementing professionally-oriented teaching of mathematical disciplines in higher military schools determined the *relevance* of the study.

**Research problem:** definition of new methodological approaches to the implementation of professionally-oriented mathematics education in military universities.

**Object of research:** the process of professionally-oriented teaching of mathematics in military universities.

**Subject of the study:** progress in the implementation of professionally-oriented training in additional sections of probability theory and mathematics in military universities.

**Purpose of the study:** theoretical justification and development of methods for the implementation of professionally-oriented teaching of mathematics in military universities.

**Scientific research Hypothesis** – if the methodology of teaching mathematics in a military university is developed on the basis of a combination of fundamental and professional orientation, this will improve the quality of mathematical knowledge of students; increase their readiness for further study of general professional and special disciplines, future professional activities; better understand the future profession.

In accordance with the purpose of the study, the following objectives were determined based on the research hypothesis:

1) Theoretically substantiate the essence of professionally-oriented mathematics training for future specialists in military universities.

- 2) To identify the features of professionally-oriented teaching of mathematics to future specialists in military universities.
- 3) To develop a structural and content model of professionally-oriented teaching of mathematics in military universities.
- 4) Develop a methodology for the implementation of professionally-oriented training in probability theory and additional chapters of mathematics.
- 5) To test the effectiveness of the proposed method experimentally and to develop methodological recommendations.

**Theoretical and methodological foundations of the study:** formed the main provisions of higher school didactics (S.I.Archangelsky, Y.K.Babansky, V.I.Zagvyazinsky, A.V.Korzhuev, A.E.Abylkasymova, J.Suleimenov, J.Barbé, M.Bosch, L.Espinoza, etc.), improved the concept of professionally-oriented teaching of mathematics in higher school (V.V.Afanasyev, G.L.Lukankin, A.G.Mordkovich, E.I.Smirnov, A.Nugusova, O.Satybaldiev, E.Smagulov, Van de Walle, A.John, P.Grossman, M.McDonald, etc.), works of scientists-specialists in the field of theory and methods of teaching mathematics (V.A.Gusev, Y.M.Kolyagin, V.L.Matrosov, G.I.Sarantsev, B.Baymukhanov, D.Rakhymbek, A.M.Mubarakov, J.R.Hutchinson, M.Huberman, V.Cherkassky, F.M.Mulier, etc.), concepts of integration of mathematical education (M.I.Zaikin, A.G.Mordkovich, G.I.Sarantsev, S.Seitova, P.Drijvers, O.Skovsmose, etc.), psychological theory of educational activity (P.Y.Galperin, V.V.Davydov, A.N.Leontiev, S.L.Rubinstein, N.F.Talyzin, D.R.Olson, B.A.Nardi, etc.), ideas of developmental learning (D.B.Elkonin, V.V.Davydov, and L.V.Zankov), associative-reflex theory of mental activity (N.A.Menchinskaya, Y.A.Samarin), theory of personality-oriented learning (E.F.Zeer, I.S.Yakimanskaya, M.Derntl, etc.), the concept of formation of mathematical and professional culture of students (A.Kagazbayeva, B.Kaskataeva, S.Llinares, K.Krainer, etc.).

The problems of professional education have been studied by many psychologists and teachers (G.A.Umanov, N.D.Khmel, A.P.Seiteshov, K.Z.Khamidovna, H.Kent, J.Read, etc.).

Solving various problems of teaching mathematics in higher educational institutions, including questions of professional training in mathematics (K.Kabdykayyryly, E.U.Meduov, O.Satybaldiev, R.A.Ilyasova, B.D.Sydykh, R.I.Kadyrbaeva, B.Shankybaev, D.Nelson, M.Burns, etc.).

To solve the tasks set, the following **research methods** were used: study and analysis of philosophical, psychological, pedagogical, scientific and methodological literature on the research problem; analysis of state educational standards and curricula in mathematics, general professional and special disciplines for various specialties in a military university; control and generalization of the experience of teaching mathematical disciplines in a military university; conducting questionnaires and interviews with teachers and cadets; development and testing of methodological; pedagogical experiment and statistical processing of data obtained during the experiment.

**Research base:** The research was conducted at the Military Engineering Institute of Radio Electronics and Communications. The total number of participants at various stages of the research work is 205.

### **The main stages of the study:**

At the first stage (2017-2018), the real state of mathematical education in military universities was analyzed, and the shortcomings of modern teaching practices were identified. The state educational standards and working programs of military universities in mathematical disciplines for several specialties were studied. The theoretical foundations of the concept of professional orientation of training in universities of various directions are studied, the scientific and educational literature on the research problem is studied and analyzed. The purpose, object, subject, tasks, and hypothesis of the study are defined. A ascertaining experiment was conducted.

At the second stage (2018-2019), the theoretical foundations of professionally-oriented teaching of mathematics in military universities, methodological principles and methods of implementing the professional orientation of teaching mathematics to future military specialists were developed, approaches to strengthening the fundamental and professional orientation of teaching mathematics and increasing the cognitive activity of cadets of military universities were identified. The content of professionally-oriented training in probability theory and additional chapters of mathematics has been compiled, a textbook has been developed and prepared. For the first time, methodological materials developed for conducting lectures and practical classes during the teaching of probability theory and additional chapters of mathematics in military universities were tested.

At the third stage (2019-2020), a research experiment was conducted to test the effectiveness of the developed methodology for implementing professionally-oriented training in probability theory and additional chapters of mathematics in a military university.

### **Scientific novelty of the study.**

1. The didactic principles of professionally-oriented teaching of mathematics in military universities are theoretically justified and defined.
2. The features of professionally-oriented teaching of mathematics to future specialists in military universities are revealed.
3. A structural and content model of professionally-oriented mathematics training for future specialists in military universities has been developed.
4. At lectures, practical classes and in independent work of students (on the example of the specialty "Information security systems in military affairs"), a methodology for implementing a set of methodological principles of professional orientation of training has been developed, the main components of which are the study of subject connections of mathematical disciplines and subject connections of fundamental, general professional and special disciplines; adjustment of the content of the mathematical course based on the generalization of educational material within a single idea; development of didactic materials (textbook, collection of professionally-oriented tasks, technical term papers), assessment of the quality of mathematical education. It is established that the level of implementation of the professional orientation of teaching mathematics depends on the level of initial training of students, including the level of secondary special education.
5. Taking into account the changed demands of society and technology, the results of studying the advanced educational function of probability theory and additional

sections of mathematics, which consists in introducing modern achievements of mathematics into the curricula of mathematical disciplines, are experimentally tested and presented.

### **Theoretical significance of the study.**

1. The meaning of the concept of "professionally-oriented teaching of mathematics" in relation to a military university is clarified. The expediency of considering didactic principles (for example, the principle of professionally-oriented training, the principle of the connection of science and theory with practice, etc.) is scientifically justified. The methodological system of teaching mathematics in a military university includes a set of methodological principles for the implementation of the professional orientation of training, reflecting the specifics of the study of mathematical disciplines by future military personnel (fundamental, professionalism, leading idea, continuity, informatization, the principle of an integrated approach, updating of subject connections, etc.).
2. As a result of an analytical review of the course on the modernization of the system of higher military education, literature sources on the problem of research, it is concluded that it is necessary to consider some didactic principles and implement the function of advanced education.
3. The methodological principles and methods of implementing professionally-oriented mathematics training are identified as the most important factors affecting the quality of training of military specialists. They can be used in other military universities because of their versatility..
4. The inter-subject and intra-subject connections of mathematics, general professional and special disciplines were studied, which led to the need to adjust the content of additional sections of probability theory and mathematics, curricula, and to create a professionally-oriented collection of problems.
5. In order to develop students' professional-oriented mathematical knowledge, methods have been developed to organize the educational process.

### **Practical significance of the study:**

The implementation of the methodological recommendations proposed in the study in a military university will strengthen the professional orientation of teaching mathematics; The developed methods and approaches to the formation of the content of the discipline "probability theory and additional chapters of mathematics" are universal and can be used in other military universities, for other military specialties and in relation to other mathematical disciplines; For the specialty "Information Security Systems in Military affairs", an educational and methodological complex has been developed for the discipline "Probability Theory and additional chapters of mathematics", which includes an approach to the representation of discrete and continuous random variables based on the generalization of educational material and is supplemented by additional chapters of probability theory and mathematics studied at the Military University; The developed and published textbook is used in the practice of military universities as a textbook for cadets of higher educational institutions studying in military specialties; The results of the study can be useful for comparing the dependencies between the levels of implementation of the professional orientation

of teaching mathematics for students of military universities, higher technical educational institutions.

**The reliability and validity of the research** results is provided by a deep and comprehensive analysis of the problem under study, based on the fundamental research of philosophers, psychologists, teachers, methodologists; the use of a set of theoretical and practical-experimental methods that are adequate to the goals and objectives of the study; the representativeness of the sample and the positive results of the pedagogical experiment; positive reviews of printed educational materials; extensive testing and implementation of the research results in the educational process of a specific course of mathematics in a military university.

**Results submitted for defense:**

1. Scientific characteristics of professionally-oriented teaching of mathematics in military universities-the definition of its psychological and pedagogical foundations and meanings, the preparation of theoretical foundations.
2. Implementation of professionally-oriented teaching of mathematics in military universities on the basis of a structural and content model, the criteria and indicators of which are defined.
3. Professional orientation of training, based on the adaptation of the conceptual apparatus of the course "probability theory and additional chapters of mathematics" for a military university, identifying and updating intra-subject and inter-subject relationships and thereby contributing to the formation of readiness to use the acquired mathematical knowledge in the study of special disciplines and in future professional activities.
4. It is used as a professional orientation of training in a military engineering university (for example, the course "Probability Theory and additional chapters of mathematics") in lectures and practical classes, in independent work, in SSoST and SSoS, which consists in transforming the goals, content, organizational forms, methods and means of teaching mathematics in a military engineering university.

**Approbation and implementation of research results:** the main principles of the research are reflected in the form of scientific reports at international scientific and practical conferences, in journals recommended by the committee for Control in the field of education and science, in scientific journals based on scopus:

- 1) Әскери жоғары оқу орындарында математиканы кәсіби бағытта оқытудың теориялық ерекшеліктері. Абай атындағы Қазақ ҰПУ-нің Хабаршы «Физика-математика ғылымдары» сериясы, №4 (60), 2017ж 67-72бб
- 2) Болашақ әскери мамандарға математикалық пәндерді кәсіби бағытта оқытудың психологиялық-педагогикалық негіздері. Халықаралық ғылыми-көпшілік журнал: Қазақстанның ғылымы мен өмірі, №3 (58), 2018ж 371-376бб
- 3) Формирование содержания профессионально направленного курса теории вероятностей и математической статистики в военном вузе. Абай атындағы Қазақ ҰПУ-нің Хабаршы «Физика-математика ғылымдары» сериясы, №3 (67), 2019ж 360-363бб
- 4) Factors Affecting Mathematics Achievement in Central Asian Specialized Universities. International Journal of Emerging Technologies in Learning (iJET), 15(19), 143-153.

- 5) Features of formation of the content of a professionally directed course of mathematical disciplines in the military universities. Mathematics, Informatics, and Information and Mathematical Modeling Conference: 3-4 oct 2018 (pp. 96-100). Almaty, Kazakhstan (2018)
- 6) Факторы, влияющие на достижение в математике курсантов Военно-инженерного института радиоэлектроники и связи. Совершенствование подготовки кадров в военно-учебных заведениях Государств-участников СНГ: Место и роль естественно-научных дисциплин в военных вузах. (22 апреля 2019). Алмата-Караганда.
- 7) Comparative analysis of students' anxiety towards mathematics in military institution and nonmilitary university. Тенденции и перспективы развития науки и образования в условиях глобализации: Выпуск 46 (pp. 360-363). Переяслав-Хмельнитский (2019)
- 8) Polynomial Estimates over Exponential Curves in  $C^2$ . USA-Uzbekistan Conference (pp. 93-99). Springer, Cham. (2017 August)
- 9) Kazakh and Russian translation of FSMAS-SF mathematics attitude. International conference on management, economy, education, social science, and technology 2020. 19-20 September 2020 (pp. 51-57). Kuala Lumpur, Malaysia
- 10) Ықтималдықтар теориясы және математикалық статистика элементтері. Жоғары оқу орындарындағы оқытушылары мен жоғары оқу орындарының білімгерлеріне арналған оқу-әдістемелік құралы. (хаттама №18 9.12.2020ж), Қаскелең, 2020 - 132б.
- 11) Becoming a Mathematics Teacher Educator: Perspectives from Kazakhstan and Australia. In International Handbook of Mathematics Teacher Education: Volume 4 (pp. 369-390). Brill Sense. (2020)

**Structure and Scope of the dissertation** consists of an introduction, two chapters, a conclusion, a list of references and an appendix.