Quality Assurance of Mathematical Education of the Future Specialist in the Field of Radio Engineering

Dmitry Miskov, Sergey Grodzenskiy, Vyacheslav Muraviev, Irina Vlasova, Alexey Korotkikh, Alexander Novikov, Irina Baranova, Maxim Nazarenko

Abstract:. The modern pace of changes in the life of society and the change of technology is so high that it becomes difficult for universities to produce engineers fully ready to work in the specialty. The solution to this problem is seen in the training of such a specialist, who is able to independently adjust to future activities and adapt to it, have knowledge that does not become obsolete over time, help to navigate in a new environment and are, in fact, universal. The priorities of the new educational paradigm are: fundamental, which involves the orientation to identify the deep intrinsic relationships between the various processes of the surrounding world; integrity - involving the introduction of the formation of single cycles of the fundamental disciplines, United by a common objective function-oriented interdisciplinary connections; orientation to the development of the individual.

Index Terms*: *About four key words or phrases in alphabetical order, separated by commas.

I. INTRODUCTION

The use of the fundamental principle of mathematical education should not be reduced to a simple increase in each of the fundamental disciplines, and contribute to the creation of interrelated fundamental training courses in each of the disciplines. Let us consider the example of mathematics; its role in solving the problems of purposeful management of nature and society is growing at a pace that requires a deeper mathematization of all Sciences [1-9]. It is impossible to create new and improve existing technological processes [10-19] without a preliminary mathematical study and identification of functional dependencies between the objects under study. The resulting mathematical models are so diverse that their study requires constant expansion of the content of the University course of higher mathematics. But educational standards do not imply an increase in the time of studying the discipline "mathematics", so there are a number of questions concerning the methods of teaching this fundamental discipline.

II. RESEARCH METHOD

In order to ensure the qualitative assimilation of the increasing volume of material for the same time of study at the University, it is necessary to restructure not only the course of mathematics, but also other General professional and special disciplines that use the mathematical apparatus and ensure the consolidation of mathematical knowledge. This concept allows us to consider the following main tasks of mathematical education of future engineers.

1. Teaching mathematics should ensure that all students acquire sufficient knowledge to achieve the goals of mathematical education and the formation of the human potential of society, prepared to work in a market economy.

2. The content of mathematical education of future engineers should be a system of knowledge-concepts, statements, techniques and methods of reasoning, the systematization of which allows to solve modern problems of mathematical education, which have a humanitarian character and is aimed at the intellectual development of the individual, which consists in the formation of students ' ability to assimilate new knowledge, to The methodical system of teaching mathematics should be restructured to the priority of the developing function of education in relation to education and provide: mastering a set of knowledge and skills necessary for the study at the present level of natural Sciences and Humanities, General and special disciplines, and for professional activities. The logic of the deductive method of organization of scientific knowledge should be replaced by the logic of the cognitive process: from concrete examples through their analysis to theoretical generalizations and further to wide practice and applications.

III. RESULTS AND ANALYSIS

Improving the system of higher education and global mathematization of Sciences entail an increase in the requirements for mathematical knowledge of graduates, however, we must admit, mathematics is one of the most unattractive disciplines for students and increasing the level of mathematical knowledge is associated with significant pedagogical difficulties. These problems are compounded by the fact that at present the thesis that computer mathematics with its rapid and very impressive development can replace traditional mathematics and is sufficient for the vast majority of the population sounds more and more insistent. However, every computer program has its limits of applicability and, therefore, even at the level of using powerful computing tools, it is necessary to

Revised Manuscript Received on July 09, 2019.
Dmitry Miskov, Sergey Grodzenskiy, Vyacheslav Muraviev, Irina Vlasova, Alexey Korotkikh, AlexanderNovikov, Irina Baranova, Maxim Nazarenko,78, Vernadskogo pr., Moscow, 119454 Russia, Email: miskov@mirea.ru

conduct a preliminary analysis of the interpretation of the problem, which can only be based on mathematical, physical, chemical, economic and other laws. That is why a specialist in any field of activity should have a fundamental training.

Mathematical knowledge and skills should be closely related to the formulation of questions, understanding of the processes taking place in areas not related to the actual mathematics as a discipline. After all, one of the driving forces of the development of mathematics is "external", when the problems of the environment, social life should be solved with the use of mathematics. Therefore, in the process of teaching it is necessary to focus the transfer of knowledge and their assimilation to the maximum extent on the application. At the same time, teachers of mathematics need to study and update the needs of modern technology in mathematical methods and the potential applications of mathematical science. It should be indispensable and the fact that, teaching students, teachers should show not only the possibility of mathematical methods, but also the limitations of each of them individually, ie, the need for the development of mathematics as a science.

Without a systematic display of the possibilities of mathematics in a particular field of activity, it is difficult to convince students of the need to study mathematics. Students of engineering universities have chosen their specialty other Sciences, whose interests lie outside of mathematics, so its teaching should be built so that future engineers constantly feel its importance for a deep understanding of their specialty. The desire to do without mathematics brings up a false idea among students that in modern engineering research it is possible to engage in approximate reasoning, almost complete disregard for mathematical methods. In this regard, General professional and special departments should systematically use the existing mathematical knowledge of students, which will allow them to study the relevant courses at the modern scientific and engineering levels, and at the senior courses should include the study of courses to discuss the problems of engineering, organization and Economics of production using mathematical models and different approaches to solving applied problems. This is especially important in cases where the solution of applied mathematical problems formed a false idea of exclusively their physical orientation, the limited need for mathematical methods for these professionals. The current mathematization of various Sciences poses problems not only of new content, but also of a completely new structure, requiring a new mathematical apparatus to solve them. Therefore, one of the tasks of teaching mathematics - finding a match (learning function) between the specialty in which the training is carried out, and those mathematical knowledge that the specialist must master.

There is an obvious contradiction between the development of mathematics (as a science) and the methodology of its teaching not to mathematicians. Modern mathematics seeks to maximize the generality of theories, and the process of understanding such theories is to identify their viability in specific objects. Therefore, one of the tasks of the teacher-to find typical and simple examples, while thinking deeply about the method of their impact on students. It will be more effective if these examples are used repeatedly both in one course and in different courses and are accompanied by counterexamples.

In our opinion, it is also impossible to intensify the process of teaching mathematics by increasing the generality of presentation, as this often leads to misunderstanding. In order for a future engineer to master the mathematical method, it is necessary to work with specific examples. It is no secret that for engineers mathematics always remains a device, a language of description of certain facts, and not an entity that interests them in itself. Therefore, the basis of mathematics as an academic subject should be meaningful, specific reasoning, revealing its meaning. The pedagogical problem of justification should be to make the mathematical statement convincing and understandable to the student.

Mandatory elements of the professional culture of any modern engineer can introduce in the curriculum at the expense of the maximum critical selection of traditional material, replacement shares of the abstract, formal reasoning is a substantive, focused on intuition and therefore faster leading to the goal. To solve the problem of real applications it is necessary to look for simple, but often encountered in practice problems and demonstrate the effect of the application of the studied mathematical methods. In this case, the problems should be taught, not formally illustrate the theory.

The task of the course of mathematics in technical universities has always been and remains twofold: to master the methods of mathematics as an instrument of knowledge and to accustom the future engineer to the practice of mathematical calculations. This problem is solved effectively if both goals are organically soldered, if each thought of the theory is closely linked with the practical calculations adjacent to it. Otherwise, the theory remains a dogma for students, and practice - poorly understood, devoid of theoretical Foundation recipe. The absence of a "bridge" between these two components is most likely if mathematics is taught by some, and its application is shown by others. It seems controversial and existing (yet) rigid division of lectures and practical classes, contributing to the violation of the organic unity between the theoretical and practical aspects of learning. Practical actions clarify and deepen the process of understanding, and the theoretical understanding of practical actions accelerates the assimilation, makes it conscious, so teaching at least those sections, which are more dependent on a full understanding of the course, it is advisable to carry out on a lecture-practical basis, including along with the theory of the developed system of exercises.

The connection between theory and practice can be carried out, including in the teaching process methodically selected tasks focused on a deep understanding of the course. To illustrate mathematical concepts and methods is much more difficult than mathematical models in the course of special disciplines, where the General formula is used to solve a specific engineering problem. At the lessons of

mathematics it is necessary to show the universality of mathematical formulas for solving various engineering and economic problems. This requires a different form of presentation of illustrative material. As experience shows, this is most effectively carried out on tasks focused on mathematical models of General professional disciplines. Their teaching should be organized in such a way that students develop common principles for solving heterogeneous technical problems, the ability to separate the stage of formation of a mathematical model from pure mathematics; ultimately, this leads to their meaningful use in the calculation of computers and modern tools.

To bring the educational process closer to the needs of practice, to prepare such a specialist, the adaptation of which after graduation will be minimal-long, perhaps due to the inclusion in the curriculum of complex disciplines with fundamental components.

The presence of complex disciplines, prospects for their preservation and further development pose a number of methodological problems for teachers.

1. When teaching fundamental disciplines, it is necessary to show their universal character. Students should be informed that in the course of further study at the University some provisions of this course will be specified in the courses of complex disciplines. It is logical to Orient students to the methodologically correct perception of various literary sources (textbooks, manuals), where references to the fundamental provisions can be applied.

2. Teachers engaged in the educational process in complex disciplines should be competent in all sections of these disciplines. From an organizational and methodological point of view, this is achieved by various means: independent study of monographic, educational and other literature, attendance of leading teachers, consultations with them and

3. When conducting classes in complex disciplines, teachers should proceed from the same conceptual provisions as the departments that provide teaching in the relevant fundamental disciplines, despite the possible rejection of the concept of the second by the first. It is necessary for correct, uniform perception of educational material by students.

4. In preparation for the teaching of complex disciplines can be a serious problem - the participation of two or more departments in the teaching of the same discipline. To implement this takes a lot of effort (coordination of the program, the search for qualified teachers, the distribution of workload between departments, etc.), but they will be justified if the students will get the knowledge on the subject of the course, which in the conditions of market economy is absolutely essential to the specialist in radio engineering.

IV. CONCLUSION

In our view, the fundamentalization of education should not be limited to traditional plans for the organization of the educational process.

Mathematics as a discipline forms mathematical thinking, involves the ability to isolate from reality the relevant abstractions and work with them. However, if these abstractions are presented to the student at the beginning of training at the University, their effectiveness is questionable. This circumstance, in particular, we explain the weak mathematical training of engineers. Mathematics as a fundamental discipline may be necessary not in the first, but in the last year, when the student is more or less specifically acquainted with the reality in which he works, and is ripe to create appropriate mathematical objects that allow to move away from the randomness of this particular reality, revealing something invariant in it. It may seem ridiculous to carry out fundamental training at the end of training. But in science (in contrast to education) these "changes" took place. Thus, the applied aspects of set theory developed earlier than the fundamental substantiation of the theory itself.

Summing up the discussion of mathematical education of future engineers can not agree with the fact that the purpose of higher education in mathematics — to lay the Foundation for future studies. After completing the mathematics course, the student must endure the feeling of a deep connection of mathematical theory and methods with practical problems and make sure of the need for mathematical knowledge to solve them. Questions of fundamentalization of education should be viewed through the prism of specialization-to look for the fundamental aspects of special disciplines. At the same time, the educational process should focus not on the object, but on the professional activity of the graduate.

Conflict of Interest

The authors declare no conflict of interest.

REFERENCES

[1] T.A. Demenkova et al, “Mobile Applications For Tasks Of Distance Learning” Rossiyskiy tekhnologicheskiy zhurnal (Russian Technological Journal). 2018. 6(1): 6-19. (in Russ.)

[2] A.A. Filippov et al, “Algorithm of End-to-End Integrated Quality Management” Proceedings of the 2018 International Conference “Quality Management, Transport and Information Security, Information Technologies”, IT and QM and IS, 2018, 8525039, p. 44-46. DOI: 10.1109/ITMQIS.2018.8525039

[3] S.V. Kruchinin et al, “Main Self-Educational Platforms in Russia and Skills that Can Be Develop Via Them” Proceedings of the 2018 International Conference “Quality Management, Transport and Information Security, Information Technologies”, IT and QM and IS, 2018, 8525032, p. 669-671. DOI: 10.1109/ITMQIS.2018.8525032

[4] S.V. Kruchinin et al, “Simultaneous Development of E-Learning in Russia and Information Society” Proceedings of the 2018 International Conference “Quality Management, Transport and Information Security, Information Technologies”, IT and QM and IS, 2018, 8524994, p. 666-668. DOI: 10.1109/ITMQIS.2018.8524994

[5] S.V. Kruchinin et al, “Key Ways of Information Technologies for Self-Education Development. Pros and Cons” Proceedings of the 2018 International Conference “Quality Management, Transport and Information Security, Information Technologies”, IT and QM and IS, 2018, 8544901, p. 663-665. DOI: 10.1109/ITMQIS.2018.8524901

[6] E.V. Bagrova et al, “Usage of Information Technologies in Self-Education in Russia” Proceedings of the 2018 International Conference “Quality Management, Transport and Information Security, Information Technologies”, IT and QM and IS, 2018, 8524940, p. 565-567. DOI: 10.1109/ITMQIS.2018.8524940

[7] E.V. Bagrova et al, Additional Education in Russia. Ways of Development” Proceedings of the 2018 International Conference “Quality Management, Transport and Information Security, Information Technologies”, IT and QM and IS, 2018, 8524999, p. 561-564. DOI: 10.1109/ITMQIS.2018.8524999

[8] E.V. Bagrova et al, “Quantity Measures of Quality in Higher Education in Russia. How Information Technologies Can Help?” Proceedings of the 2018 International Conference

"Quality Management, Transport and Information Security, Information Technologies", IT and QM and IS, 2018, 8525044, p. 557-560. DOI: 10.1109/ITMQIS.2018.8525044

[9] M.A. Nazarenko, "Some properties of rational approximations of degree (k,1) in the Hardy space H2(D)" Mathematical Notes. 1998. 64(1-2). P. 213-219.

[10] E.S. Djevello et al, "Specifics of Management Quality Implementation to Information Systems and Products" Proceedings of the 2018 International Conference "Quality Management, Transport and Information Security, Information Technologies", IT and QM and IS, 2018, 8524995, p. 40-43. DOI: 10.1109/ITMQIS.2018.8524995

[11] M.A. Nazarenko, "Mobile Operating Systems and Integrated Apps Quality Management System" Proceedings of the 2018 International Conference "Quality Management, Transport and Information Security, Information Technologies", IT and QM and IS, 2018, 8525022, p. 63-65. DOI: 10.1109/ITMQIS.2018.8525022

[12] V.V. Muraviev et al, "Company Life Cycle and Quality Standardization" Proceedings of the 2018 International Conference "Quality Management, Transport and Information Security, Information Technologies", IT and QM and IS, 2018, 8525064, p. 59-62. DOI: 10.1109/ITMQIS.2018.8525064

[13] M.A. Nazarenko, T.V. Khronusova "Big Data in Modern Higher Education. Benefits and Criticism" Proceedings of the 2017 International Conference "Quality Management, Transport and Information Security, Information Technologies", IT and QM and IS, 2017, 8084914, p. 676-679. DOI: 10.1109/ITMQIS.2017.8085914

[14] M.S. Kostin et al, "Counterreengineering of electronic devices" Rossiyskiy tekhnologicheskiy zhurnal (Russian Technological Journal). 2019; 7(1): 57-79. (in Russ.). DOI: 10.32362/2500-316X-2019-7-1-57-79

[15] M.A. Nazarenko et al, "Main directions of higher education regionalization process as an integral part of social partnership in society (The problems of inclusive education)" International Journal of Engineering and Technology (UAE). 2018. Volume 7, Issue 4.36. P. 1135-1138. DOI: 10.14419/ijet.v7i4.36.25052

[16] Y.Y. Cheremukhina et al, "The process of working with claims in the quality management system of an enterprise of the radio-electronic industry" International Journal of Engineering and Technology (UAE). 2018. Volume 7, Issue 4.36. P. 67-68. DOI: 10.14419/ijet.v7i4.36.23313

[17] M.A. Nazarenko et al, "Model end-to-end integrated quality management" International Journal of Engineering and Technology (UAE). 2018. Volume 7, Issue 4.36. P. 60-63.

[18] M.A. Nazarenko et al, "Antivirus software and industrial cyber security system certification in Russia" Rossiyskiy tekhnologicheskiy zhurnal (Russian Technological Journal). 2019; 7(1): 48-56. (in Russ.). DOI: 10.32362/2500-316X-2019-7-1-48-56

[19] A.I. Gorobets et al, "Technical and economical analysis of efficiency of electronic means' quality management" International Journal of Engineering and Technology (UAE). 2018. Volume 7, Issue 4.20. P. 629-630. DOI: 10.14419/ijet.v7i2.8.10548