UDC 629.735.018.7.015.3.025.1

O. V. Karupu, PhD, T. A. Oleshko, PhD, V. V. Pakhnenko, PhD
(National Aviation University, Ukraine)

On some aspects of modeling of professional activity of future aviation engineer in teaching of mathematical disciplines in multinational groups

We consider general issues of planning and giving lectures and practical trainings to English-speaking foreign and Ukrainian students studying on technical specialties in National Aviation University. We study specifics of organization of educational process, contributing to the formation of students' intellectual skills, which are important for future work in aviation.

A specialist of any profile employed in aviation must have specific professional features and competencies. These characteristics of future aviators should preferably be formed in the process of studying both special and general scientific disciplines. This is especially important in teacher's work with students of technical specialties.

Some of these issues were considered by O. V. Karupu & T. A. Oleshko [1], L.V. Androshchuk & V.I. Trofymenko. [2], V.I Trofymenko [3], O. V. Karupu, T. A. Oleshko & V. V. Pakhnenko [4].

The organization of the teaching process in multinational academic groups has a specific nature and is interesting for investigation. We consider some features of this process in the teaching of higher mathematics and other mathematical disciplines in the framework of the Project of Education in English.

We present the results of our experience of teaching in English to foreign and Ukrainian students in National Aviation University. Foreign students in National Aviation University may choose to study in English, Russian or Ukrainian. In English-speaking groups foreign applicants may study without a preparatory course of Ukrainian or Russian. As English is one of the official languages of ICAO (International Civil Aviation Organization), this trend of education is urgent and favors the further improvement of professional skills of the university graduates. Beside this, foreign applicants may study without a preparatory course of Ukrainian or Russian.

Therefore we study the specific problems of methodical, didactic and organizational nature which arise while teaching mathematical disciplines in English-speaking groups on technical specialties.

Some of these problems arise as a result of different approach to teaching mathematics in secondary schools in Ukraine and countries native for our students. These include, first of all, a very low level of knowledge on trigonometry and stereometry, which is detected in many students. Other essential problems are insufficient skills of foreign students in the techniques of differentiation and integration, their inadequate skills in solving practical problems of a technical application.

Beside this, we study specifics of organization of educational process, contributing to the formation of students' intellectual skills, which are important for

future work in aviation. We try to link the theoretical constructions to the aviation problem as much as possible so that students see the use of linear algebra in the industry. Assimilation of the new section will be better if at the beginning of the lecture give examples explaining the emergence of matrices and determinants and their application. Then students have an interest to the considered topic.

We study the specific issues that arise while teaching the discipline "Higher Mathematic" and other mathematical disciplines to students who are not native speakers and therefore studied mathematics in their native languages in secondary school. We will discuss general issues of planning and giving lectures and practical trainings to such students, namely, the need for stating out and clarification of mathematical terminology, teaching them to read formulas, appealing their attention to semantic inconsistencies of mathematical terms in different languages. In addition, we analyze the specific features of linguistic and organizational grounding of students from different countries, who study at NAU, and give our recommendations for dealing with them.

Some of these issues were considered by O. V. Karupu & T. A. Oleshko [1], O. V. Karupu, T. A. Oleshko & V. V. Pakhnenko [4]–[6].

It is important for aviation specialists to have skills in organizing self-control and mutual control over the correctness of actions, an understanding of their necessity, and also psychological readiness to apply them in professional practice.

For example, for students of all specialties it is necessary to have sufficient skills in operating with vectors, determinants and matrices. It is also necessary to be able to apply these skills in solving systems of linear algebraic equations and in solving problems of analytic geometry.

In the study of linear and vector algebra, students generally learn well the elements of vector algebra and they effectively use theoretical knowledge to solve problems. But assimilation of elements of linear algebra for many students is more difficult. We note that most students work well with determinants and matrices. However, they often make mistakes due to lack of attention and inaccuracy in calculations. Some of these issues were considered by O. V. Karupu, T. A. Oleshko & V. V. Pakhnenko [7], [8].

The development of self-control skills in the process of calculating determinants is traditionally achieved by solving the problem applying different methods. For calculating determinants of the third order teacher usually proposes students to calculate the determinant by the rule of triangles, the method of reducing the determinant to a triangular form, and expanding the determinant by elements of a row or a column. For calculating determinants of the forth order teacher usually proposes students to calculate the determinant by the method of reducing the determinant to a triangular form, and expanding the determinant by elements of a row or a column. In addition, to control the correctness of calculations in this case, you can invite students to use CAS.

We consider it useful not only to discuss the specifics of each method, but also to point out that the application of all these methods allows the student to independently monitor the correctness of his calculations.

The development of self-control skills in the process of calculating determinants is traditionally achieved by solving the problem in different methods. The development of self-control skills in the process of solving systems of linear algebraic equations is also traditionally achieved by solving the problem applying different methods.

Team work skills in a multinational team may be well developed in practical training in differentiation and integration technique.

A significant problem encountered in teaching mathematical analysis is the lack of skills of many foreign and Ukrainian students in differentiation and integration techniques and the lack of desire to master these skills.

In many countries, besides the known methods of integration with the change of variable and of integration by parts, the third method is also studied: integration by formula, which consists in the fact that students substitute their values of parameters in the formulas given in the textbook and immediately receive the result. Most students have mastered this method most, and as a result, the study of the first two methods causes considerable difficulties.

The definite integral often is introduced in schools as an increment of the antiderivative. In this connection, the understanding of a definite integral as the limit of integral sums is complicated.

In many textbooks intended for technical universities and popular among students, the presentation of the material is carried out in the following order: derivative, antiderivative, definite integral and its properties, the basic formula of integral calculus, applications of definite integral, integration technique. This creates the illusion that the last question is less important.

It should also be noted that foreign students are more willing to use CAS and have certain level of skills in the application of these systems. In addition, there are quite a lot of problems related to learning and mastering by foreign students of differential and integral calculus, since this section is quite difficult to perceive, especially in technical universities.

In order to eliminate this problem, we practice the following modeling of the professional activity of future aviation engineers: we divide the academic group on practical training into subgroups consisting of a performer, a controller and an expert. It is also possible to divide the group into two or three subgroups and suggest to students similar work in teams.

These teams may be constant or may randomly change with each new task or new practical training. As a result, in addition to mathematical skills, the skills of teamwork in a multinational team are formed, a habit of self-control and psychological resistance to external control are developed.

It is useful for students to use given by teacher algorithm for the process of recognition of types of standard mathematical problems. In particular, this concerns the algorithmization of the process of recognition of equations of straight lines, planes, curves and surfaces. A critical need for the vast majority of foreign students is the availability of supporting materials. We also note that students studying in technical specialties better perceive auxiliary materials in the form of tables and students who are studying in all specialties of the field of knowledge 12 "Information Technologies", better perceive the supporting materials in the form of flowcharts of the corresponding

algorithms. It is very useful for all students to have lectures in a multimedia lecture room using various technical means for visualizing considered objects and to have practical classes in a computer class using the computer mathematics system. It is also useful for the students to study mathematical material in reference to its connection with the aviation problem.

Note that detailed algorithmization of the process of recognition of types of problems is very important also when students are taught to methods for investigation the convergence of number series. These issues were considered by O. V. Karupu, T. A. Oleshko & V. V. Pakhnenko [9].

In the study of ordinary differential equations the assimilation of material by foreign students is relatively good. This is especially true for linear differential equations with constant coefficients, which is due to the presence of simple algorithms and the absence of the need for integration.

Considerable attention should also be paid to the development of skills of recognition of the basic types of differential equations, which are integrated in quadratures (while emphasizing, that the list of considered equations does not exhaust all their diversity and in the future, if necessary, one can use reference books). We note that with a clear presentation by the teacher of the algorithm of recognition of the simplest types of differential equations, a significant part of students master these skills sufficiently well. These issues were considered by O. V. Karupu, T. A. Oleshko & V. V. Pakhnenko [10].

Team work skills in a multinational team are also well developed when performing calculations on mathematical statistics.

Some of these issues were considered by O. V. Karupu, T. A. Oleshko & V. V. Pakhnenko [11],[12].

The joint study of foreign and Ukrainian students has, generally, positive features. At the same time, Ukrainian students get the opportunity to communicate in English with foreign students who have received language training in other countries. This will greatly facilitate the professional communication of English to our graduates who will work in a specific international English-speaking environment, where most participants are not native English speakers. For foreign students, the main benefit of learning in such groups is faster adaptation in Ukraine and the development of a friendly attitude towards our country, language and people. Moreover, joint training of foreign and Ukrainian students contributes to the development of the skills of cooperation among participants in international teams.

Thus, in addition to the mathematical skills and skills of working together in international teams, students studying mathematics by this method, develop a habit of self-control and psychological stability to external control.

References

1. Karupu, O. V., Oleshko, T. A. On some problems of teaching mathematics in English. 12 International Scientific Conf. M.Kravchuk. – 2008, v.2. – 2008. – P. 217.

2. Андрощук Л.В., Трофименко В. І. Методологія викладання та професійна спрямованість задач з вищої математики в сучасних умовах. Вища

освіта України у контексті інтеграції до європейського освітнього простору. ІО Міжн. наук.-практ. конф. – 2015. – С.141–151.

3. Трофименко В. І. Деякі складові формування професійної компетентності майбутніх фахівців авіаційної галузі у навчанні математики. Сучасні інформаційні технології та інноваційні методики навчання у підготовці фахівців: методологія, теорія, досвід, проблеми. – 2010, 26. – С. 524–529.

4. Карупу О. В., Олешко Т.А., Пахненко В.В. Про деякі особливості викладання математичних дисциплін англомовним студентам. Вісник Чернігівського національного педагогічного університету. Серія: Педагогічні науки. – 2011, № 83. – С.76–79.

5. Карупу О. В., Олешко Т.А., Пахненко В.В. Деякі особливості викладання математичних дисциплін іноземним студентам. Східно-Європейський журнал передових технологій. – 2012, №2/2 (56) . – С. 11–14.

6. Карупу О. В., Олешко Т.А., Пахненко В.В. Аналіз практики викладання вищої математики українським та іноземним студентам в Національному авіаційному університеті. Science and Education a New Dimension. Pedagogy and Psychology. – 2013, Is. 5. – P. 88–92.

7. Карупу О. В., Олешко Т.А., Пахненко В.В. Про викладання деяких питань лінійної алгебри англомовним студентам в Національному авіаційному університеті. Вісник Черкаського університету. Серія: Педагогічні науки. – 2017, № 11. 2017 – С. 26–33.

8. Карупу О. В., Олешко Т.А., Пахненко В.В. Про деякі особливості викладання аналітичної геометрії англомовним студентам. Вісник Чернігівського національного педагогічного університету. Серія: Педагогічні науки. – 2016, Вип. 140. – С. 17–21.

9. Карупу О. В., Олешко Т.А., Пахненко В.В. Про деякі особливості викладання математичного аналізу англомовним студентам НАУ. Вісник Черкаського університету. Серія: Педагогічні науки. – 2015, № 20 (353). – С. 26–31.

10. Карупу О. В., Олешко Т.А., Пахненко В.В. Аналіз практики викладання звичайних диференціальних рівнянь англомовним студентам технічних спеціальностей в Національному авіаційному університеті // Фізико-математична освіта. – 2017. – № 4(14). – С. 33–36.

11. Karupu, O. V., Oleshko, T. A. & Pakhnenko, V. V. On some problems of teaching to probability theory applications. Education and Science and their Role in Social and Industrial Progress of Society. Humboldt Kolleg: International conference. – 2014. – P. 20–21.

12. Карупу О. В., Олешко Т.А., Пахненко В.В. Аналіз практики викладання теорії ймовірностей та математичної статистики англомовним студентам в Національному авіаційному університеті. Science and Education a New Dimension: Pedagogy and Psychology. – 2017, Vol. V (52), Issue 113. – P. 34–37.