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On some topical problems of organization of mathematical training for English-speaking academic groups of FCST

We consider some questions of teacher's work on Faculty of Computer Science and Technology with Ukrainian and foreign students of FCST studying in English, organization and implementation of the educational process in different forms: offline, online and blended learning. We study peculiarities of planning and giving lectures, practical trainings and consultations in multinational academic groups. Our aim is to form different students' skills significant for their future work in Information Technology.

Globalization processes acceleration has led to the intensification of teaching in English at universities all over the world, in particular in Ukraine. General problems of the development of this process in Ukraine were investigated by R. Bolitho & R. West in [1] and O. Kvasova, C. Westbrook & K. Westbrook in [2]. This area of education is relevant and promotes further improvement of professional skills of the university graduates.

Since English is one of the official languages of the International Civil Aviation Organization (ICAO), the opportunity to receive a professional education in English is very important for future aviation professionals. The program "Higher Education in Foreign Languages" began to work at National Aviation University since 1999. The authors joined the program shortly after it began. Research on teaching mathematics in English to Ukrainian and foreign students of NAU has been conducted by the authors as part of this program since 2006.

Some of general problems of teacher's work with English-speaking students of technical and IT specialties were considered by O. W. Karupu T. A. Oleshko & V. V. Pakhnenko [3, 4], T. I. Dovhodko [5], N. V. Ichanska & L. G. Nalyvaiko [6]. Some issues of teaching to discipline "Higher Mathematics" in English were considered by O. W. Karupu T. A. Oleshko & V. V. Pakhnenko [7–9], S. I Fedak, L. A. Romaniuk & S. A. Fedak [10], A. P. Rybalko & K. V. Stiepanova [11], N. V. Snizhko [12–14].

We present analysis of some results of our experience of teaching in English Ukrainian and foreign students studying on Faculty of Computer Science and Technology to mathematical disciplines offline, online and in mixed form.

Any specialist must have specific professional features and competencies. These characteristics of future specialists should preferably be formed in the process of studying both special and general scientific disciplines. It is especially important for future specialists of all profiles in the field of information technology not only to know the basic theoretical foundations of mathematics, but also to have the skills to apply them.

We study the specific questions that arise during the teaching of 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 try to link the theoretical constructions to the corresponding problems as much as possible so that students see the use of mathematics. We discuss general issues of planning and conducting lectures and practical trainings for 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 peculiarities of linguistic and organizational grounding of students from different countries, who study at NAU, and provide our recommendations for working with them.

On mathematical training English-speaking students teachers have to solve many problems of methodical, didactic and organizational nature related to the specifics of teaching mathematical disciplines in English. Problems related to the specifics of teaching mathematical disciplines to Ukrainian and foreign students in multinational groups were considered by the authors in [15–17]. 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. We study specifics of organization of educational process and application of problem-based learning in the process of formation of students' intellectual skills important for future work in field of IT. Methods of problem-based learning in the teaching process were considered by O. P. Tomaschuk, V. K. Repeta V. K. & O. L. Leshchynskyi in [18] and by authors in [15–17].

It is crucial for IT specialists to develop skills in organizing both self-control and mutual control over the accuracy of actions, understanding their importance, and being psychologically prepared to apply them in professional practice. The development of self-control skills in mathematics is traditionally fostered through solving problems using various methods. To further ensure the correctness of calculations, students can be encouraged to utilize Computer Algebra Systems (CAS). We find it valuable not only to discuss the unique features of each method but also to emphasize that applying these different methods enables students to independently verify the accuracy of their work. For instance, self-control in calculating determinants is typically developed by solving problems through multiple approaches. Moreover, the ability to recognize problem types is equally important when students are learning methods for determining the convergence of series.

The modeling of the professional activities of future IT specialists has been addressed by authors in [17, 19]. Teamwork skills within multinational teams can be effectively developed through practical training sessions [15–17].

For instance, a major challenge in teaching mathematical analysis is the insufficient proficiency of many foreign and Ukrainian students in differentiation and integration techniques. To help students master this topic, we implement a model of professional activity [15, 18] for future IT specialists. During practical training, we divide the academic group into smaller teams consisting of a performer, a controller, and an expert. Alternatively, the group can be split into two or three subgroups to work on similar tasks collaboratively. This approach not only strengthens mathematical skills but also fosters teamwork within multinational teams, encourages self-regulation, and builds psychological resilience to external supervision. Several aspects of modeling the professional activities of future IT specialists are further explored in [17] and [19].

The joint education of foreign and Ukrainian students offers them the

opportunity to communicate in English with peers who have received language training in different countries, while also enhancing their ability to collaborate in international teams. Alongside mathematical competencies and teamwork skills, students cultivate habits of self-discipline and resilience to external oversight. We find it beneficial to use a variety of supplementary materials, and tailoring these resources for students of different specializations proves to be effective. Notably, for students specializing in Computer Engineering, Software Engineering, and Cybersecurity, providing reference materials such as algorithm flowcharts is particularly helpful. It is also crucial to equip students with strategies for using Computer Algebra Systems (CAS) and online resources. Additionally, proper attention must be given to the nuances of mathematical terminology usage. At NAU distance learning is conducted in Google Workspace using Google Classroom and Google Meet. The work of student teams implemented with the help of Google Jamboard was generally quite effective (see [9] and [23, 24]). Different aspects of application of information technologies to mathematical education were considered by V. I. Trofymenko, I. P. Kudzinovska & V. V. Pakhnenko [20], I. P. Kudzinovska & V. K. Repeta [21], A. O. Pashko & H. Y. Holubov [22], O. W. Karupu, T. A. Oleshko, V. V. Pakhnenko & A. O. Pashko [23, 24].

In recent years teachers faced difficulties connected with introduction of distance and blended learning that has appeared very hard for students studying in English. Especially difficult is to organize effective practical classes for the first-year students. Many students had problems with the Internet and even with telephone communications, which increased the requirements for materials in Google Classroom and led to the need for additional consultations in Google Meet. At NAU distance learning is conducted in Google Workspace using Google Classroom and Google Meet. The work of student teams implemented with the help of Google Jamboard was generally quite effective (see [9] and [23, 24]).

The analysis of our approach to teaching mathematics in English to multinational academic groups in the FCST provides an opportunity to develop recommendations for teachers. In our view, instructing mathematical disciplines in English for both Ukrainian and international students in these diverse academic groups necessitates adjustments to conventional teaching methods.

For students who are non-native English speakers, it is crucial to consistently focus on mathematical terminology and notation. We provide students with guidance on using internet resources and Computer Algebra Systems. Connecting the material to real-world problems is essential for enhancing students' comprehension of the subject. The collaborative training of both foreign and Ukrainian future IT specialists fosters the development of teamwork skills in multinational environments.

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