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## **BILINGUAL APPROACH TO FOREIGN STUDENTS MATH TEACHING IN THE KHARKIV NATIONAL UNIVERSITY NAMED AFTER V.N. KARAZIN**

**Abstract.** The article discusses the peculiarities of teaching mathematics for foreign students who use English as a language intermediary in bilingual education at the preparatory department of the Kharkiv National University named after V.N. Karazin. It is noted that the key feature of educational material on mathematics, as information, is its network structure, formed by semantic-logical links. There are options for the distribution of decisions of control tasks. The process of preliminary assessment of foreign students, the training program and the logic of its creation are analyzed. The process of organizing bilingual education of foreign students at the faculty and its coordination between teachers is described. A statistical analysis of the composition of students, the initial level of their training is presented and the most effective training strategy is justified using the capabilities of university teachers. The process of creating a program for the discipline "Mathematics" is considered, taking into account the fact that students have a different initial level of knowledge in mathematics. It was noted that the use of a bilingual approach to learning and interdisciplinary cooperation allows foreign students to better understand the content of the discipline; get more opportunities to clarify difficult moments; expand opportunities for joint work on developing collaborative solutions; Feel comfortable when working with a mathematical device. It was concluded that interdisciplinary interaction in the learning process, in which students receive both professional development and improvement of their foreign language skills, deserves a positive assessment and can be recommended for use in the development of the educational environment.

**Keywords:** bilingual education; mathematics; English for special purposes; foreign students; teacher.

### **Formulation of the problem**

In recent years, to increase the efficiency of teaching foreign students, approach based on bilingual education increasingly used. This approach is the subject of discussion in the professional society of different higher education institutions teachers of preparatory faculties. This approach is closely linked and coordinated with the interdisciplinary approach to teaching disciplines and subject-integrated learning, which contributes to a deeper learning of academic disciplines and contributes to increasing the chances of high-quality education of foreign students in tertiary education institutions both in and out of the host country and especially when it comes to learning English for special purposes. Particular attention is also required to study in English for further study in higher education in European countries. The language of specialty is also the most important aspect of teaching Ukrainian as a foreign language in non-philological institutions of higher education [1].

The teaching of a specialty language is multifaceted. In the first place, it is impossible without working on a special terminology [2]. Such work is based on linguistic analysis of different levels units: terminological phrases, words, elements-terms. The basis for the analysis of different levels units is development of a minimum list of terms of a separate discipline. Solving this problem requires the development of a dictionary on the preparation subject. To ensure better preparation, the dictionary should be developed for most native for students languages.

The training and preparation of foreign students at the initial stage of their preparation has obvious signs of bilingual education [3]. This paper describes the experience of bilingual education in math at the preparatory faculty of foreign students at the Karazin Kharkiv National University. The educational process

and the assessment of the academic achievements of foreign students are carried out by teachers of special disciplines, in this case, math, in close cooperation with the teachers of the Ukrainian language as a foreign language.

### **Analysis of recent research and publications**

The question of bilingual education is widely presented in the methodological literature. Along with the term "bilingual education", the words "bilingualism", "linguistic immersion" or even "bilingual linguistic immersion" are used. The attention of researchers attracted university programs for foreign students studying in a specialty in terms of language immersion, most often it is about English and people who study it. (ELL, English Language Learners) Today, the "theory of languages for special purposes" continues its development (languages for special purposes), the formation of which preceded the work of T. Saviro [2, P. 295-301]. Bilingual education of math for foreign students involves the simultaneous use of English and the Ukrainian in the context of math and continues to be the subject of pedagogical research.

The most popular topic of research is the weight of each of the partner languages. Some researchers argue that students show higher results on one of the partner languages that they use more [3-6]. Of course, the teaching of discipline studied in the bilingual regime, should take into account the characteristics of basic student training and the possible individualization of the training program. As a rule, one of the language partners is English. The share of the use of this language depends on how proficient it is in the student's region of residence [7]. In the practice of the department the most frequent ratio of languages is 50/50, although it can reach up to 70 percent or more. The choice of a learning model and the need to use the English language component depends on the characteristics of the student

contingent over the years of the recruitment. In some cases, when the proportion of English-speaking students is low, studies are conducted exclusively in the language of the host country. Although recent years more and more demand is learning exclusively in English.

A number of instructors in our country and abroad note the low level of preparations in math, growing number of immigrants who also have problems with the language of the country of residence (English in this case), since at home they communicate exclusively in native language. Researchers come to the conclusion that math is much less than other disciplines, depends on the language of communication. More important are the methods of studying mathematics in the country of origin students (English school, Chinese school, school of French colonies) [8-9]. However, bilingual education for foreign students in math consistently contributes to the mastering of their mathematical sections in solving practical, achievable and individually oriented tasks [10-14].

Bilingual education attracts the attention of researchers first of all because it allows to better organize the study of profile disciplines and compensates for the lack of knowledge of one language at the expense of the second, which in the end gives students a wide choice of sources of information and learning methods.

Unfortunately, the students' knowledge of English, Ukrainian and mathematics is not homogeneous. Some students have sufficient English language proficiency, but their knowledge of mathematics is not sufficient. The other part of the students have a good knowledge of the language of the host country, but either poorly trained in math or do not speak English. There are those who are well trained in math, but do not know either English or Ukrainian.

Thus, the issue of the formation of a methodology for teaching math to provide the necessary competences for students for further study in institutions of higher education of Ukraine remains unresolved. Open, also, remains the issue of creating an educational environment for the organization of high-quality training in math.

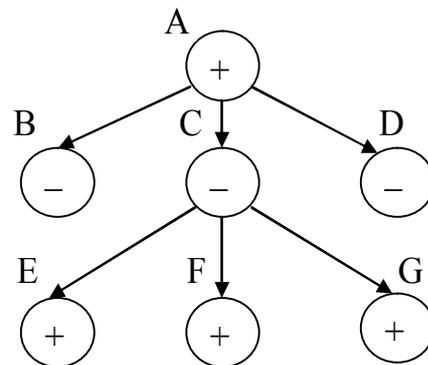
Therefore, **the purpose of the article** is to develop a methodology for studying mathematics by foreign students on the basis of a bilingual approach using modern educational environments.

**Presenting main material**

Practical experience shows that it is math causes the greatest studying difficulties with students.

A key feature of educational material in mathematics, as information, is its network structure, formed by semantic-logical links.

Fig. 1 shows the distribution options for the solutions of control tasks where +/- – True / incorrect solution of the control task; A, B, C, D, E, F, G – control tasks.



**Fig. 1.** Options for the distribution of solutions control tasks

In fig. 1 control task A is more complex, complex in relation to control tasks B, C and D. In other words, the solution to task A is based on the ability to successfully solve problems B, C and D, confirmed by the established relationships between them. The distribution of the solutions of control tasks in the case of  $A \rightarrow B, C, D$  clearly illustrates the contradiction that arises when the more complex problem is solved “correctly”, but the tasks on which the solution of the more complex ones is based are solved “incorrectly”.

At the same time, the level of mathematical preparation of entrants from different countries is extremely heterogeneous, first of all, due to differences in the content of programs of national secondary schools.

On the first practical lesson in math, diagnostic testing is usually performed to determine the initial level of mathematical preparation of students. The results of such testing, where those who are tested can get as many as 12 points, are presented in Table 1 and, in our opinion, are characteristic.

*Table 1 – Level of mathematical preparation of foreign students*

Marks	Number of students (people)	%
10-12	8	15%
7-9	9	17%
4-6	11	21%
0-3	24 (13) *	47% (25%) *
Together:	52	100%

Note: \* – in brackets given number of students with zero initial level of training.

The need to equalize this imbalance in order for foreign students to develop syllabus curricula together with Ukrainian first year students, explains the emergence of preparatory faculties in higher educational institutions of Ukraine that host foreign students.

The given statistical data is the basis for the choice of methodical techniques and teaching technologies in the described educational process. [5, P. 52-56].

Principles of selecting the content of practical classes in math at the preparatory faculty for foreign students are conditioned by the need to eliminate a significant difference in the initial level of training in mathematics, to reduce the gap between the strong and weak students, to introduce the students to the problems of increased complexity.

The first section of the course begins with the introduction of basic mathematical terms: figures and numbers, mathematical signs, arithmetic operations, specifies the notion of natural, integer, rational and real numbers. Then introduced the concepts that are necessary for the study of physics, chemistry, namely: percentages, proportions, trigonometric functions.

The second section is devoted to numerical and algebraic expressions, identical transformations of rational and irrational expressions, solving equations and inequalities. Typically, the initial level of listeners allows you to process such a large amount of didactic units in a rather short time.

In the next section, the concept of function is introduced without exact mathematical definition. The following basic concepts are considered such as zeros of functions, signs of fidelity, growth / decrease and extremums of a function, the largest and smallest function of a function on the interval, elementary functions and their graphs.

The tasks performed in this section do not foresee the use of the derivative, the definition corresponds to the level of secondary school.

The final sections of the course are most important for the study of university courses in higher math. This is differential and integral calculus, which are key to the first year of the university regardless of the direction of preparation.

It is important to prepare listeners for the perception of a large amount of oral information during the lecture, to teach them not only to solve, but also to correctly explain the decision of tasks in practical classes [7, P. 158-166]

When working on streamlining the mathematical terminology database both in Ukrainian and in English, the teacher of mathematics should eliminate the difference in the level of training, while it is especially important to give the features of teaching mathematics at the national school of science and to help weaker students to prepare for the first year of undergraduate studies.

The problem of inadequate language proficiency in learning is greatly hampering the learning process. The bilingual approach allows solving emerging terminological problems, achieving better understanding and accelerating the achievement of the desired level of training of non-homogeneous according to the level of

training and the countries of origin of the groups of listeners.

For foreign students who do not have the subject matter competence, the Ukrainian language is part of the educational process – the main means of acquiring a specialty. Since in the hierarchy of motives for studying foreign students the Ukrainian language is dominated by educational and professional activities, it is absolutely obvious that the language of the specialty becomes the dominant language, which becomes the language of teaching a foreign student at a university, enabling him to study subjects in the specialty, passing tests and examinations.

From the foregoing, it follows that along with the general (ethnic) language, foreign students must learn a language for special purposes that corresponds to their professional interests. At the same time, studying the language in the amount necessary for understanding the artistic text (20% of the academic time) occurs simultaneously with the study of journalistic and scientific language (80% of the academic time). [2, P. 295-301]

Let's return to the teaching experience of the Ukrainian language, which have mathematical character at the preparatory faculty and is a typical example of learning a foreign language for further education. The purpose of this initial course is to create a terminology base that would allow continuing to undergraduate studies in higher mathematics and special disciplines with a sufficient share of the practical solution of mathematical problems and the application of mathematical methods during the study of computer science. During this training students must learn:

- read and understand the symbolic record of mathematical expressions in Ukrainian;
- to understand oral and written information of mathematical subjects;
- to remove the main and secondary information from mathematical audio texts, to be able to write it down symbolically and to interpret it orally;
- to participate in dialogues with a teacher and fellow students, as well as make small monologues on mathematical topics;
- voice their actions during mathematical calculations, solving problems, describe changes in the process of obtaining intermediate results.

It should be noted that part of the graduates of the preparatory faculty enter into other universities, but nevertheless most of them become students of numerous faculties of the Karazin university. Those of you who speak English well become students of specialties taught in English. The programs of studying these specialties include the natural and mathematical disciplines that are taught in English. However, in the case of lexical difficulties, the bilingual approach is used, and the Ukrainian language is used as the partner language, which increases the efficiency of mastering the disciplines.

The process of studying the language of a specialty precludes a combination of occupations in the specialty, and is of a preventive nature, with the ultimate goal of forming foreign students fluent competence, sufficient

for reading texts of textbooks on professional disciplines, listening to lectures of teachers, participating in seminars, performing tasks on special subjects in oral and written form.

The situation is complicated by the fact that the formation of the subject competence is divided. For the linguistic competence "responsible" teacher-philologist, and for the subject – the teacher "subject". This distinction has already become traditional, and much effort is spent on the coordination of teaching activities of teachers, the establishment of interpersonal relations, imitation.

Every teacher of math, who uses the bilingual approach, knows the great role of English in learning foreigners math. This is precisely the area where interdisciplinary cooperation and even team work is needed, which has recently become more popular in the work of specialists in professional linguistic education. The department implements the approach of developing bilingual textbooks, and in some cases three or more – linguistic approach. Where individual elements of the text and individual concepts are translated and presented in the native language of foreign students.

However, for many math teachers, the combination of teaching math with a bilingual approach is a problem, since not all of them have English at the right level. In order to provide training for foreign students at the university, courses for the study of English and advanced training courses for teachers were created. Also, at the Faculty of Foreign Students Preparation, inter-departmental and methodical meetings are held where the approaches to bilingual training of students are discussed and agreed upon.

### Conclusions

Application of a bilingual approach to learning and interdisciplinary cooperation allows foreign students:

- better understand the content of the discipline;
- get more opportunities to refine the difficult moments;

- to expand the opportunities for teamwork to develop collaborative solutions;

- feel comfortable when working with a mathematical device.

Among the benefits of bilingual education should be academic successes of students; more confident use in learning activities and for personal communication of English; the best prospects for career growth; possibility to participate in international events; participation in professionally-oriented testing for obtaining international certificates. At the further stages of learning, the free use of the math apparatus in English will allow students to more effectively analyze specific business situations and make decisions verified by calculations.

The study does not leave doubt that bilingual education is a product of close cooperation between teachers of basic disciplines of the university, in particular mathematicians, and teachers of Ukrainian and foreign languages. As practical experience shows, in the study of foreign math students, the teacher feels the difficulties of both educational and corporate discipline, namely:

- the presence of a language barrier;
- the difference between educational systems and the organization of educational activities;
- difference in methodology of teaching math.

Thus, the use of the bilingual approach to the organization of the educational process in the study of math provides a harmonization between content-integrated learning, and the personal abilities of foreign students. Bilingual education turned out to be the most suitable and effective method for preparing foreign students with different levels of math and different communication languages. Interdisciplinary interaction in the learning process in which students receive both professional development and improve their knowledge of a foreign language deserves a positive assessment and can be recommended for use in the development of the educational environment.

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#### Білінгвальний підхід до іноземнонавчання іноземних студентів у Харківському національному університеті імені В. Н. Каразіна

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**Анотація.** У статті розглядаються особливості викладання математики для іноземних студентів, які використовують англійську мову в якості мовного посередника у двомовній освіті на підготовчому факультеті Харківського національного університету імені Василя Назаровича Каразіна. Відзначено, що ключовою особливістю навчального матеріалу з математики, як інформації, є його мережева структура, утворена семантико-логічними зв'язками. Наведено варіанти розподілу рішень контрольних завдань. Аналізується процес попередньої оцінки іноземних студентів, програма навчання і логіка її створення. Описано процес організації двомовного навчання іноземних студентів на факультеті і його координації між викладачами. Представлений статистичний аналіз складу студентів, початкового рівня їх підготовки і обґрунтована найбільш ефективна стратегія навчання з використанням можливостей викладачів університету. Розглядається процес створення програми з дисципліни «Математика» з урахуванням того, що у студентів різний початковий рівень знань з математики. Відзначено, що застосування двомовного підходу до навчання і міждисциплінарної співпраці дозволяє іноземним студентам краще зрозуміти зміст дисципліни; отримати більше можливостей для уточнення складних моментів; розширити можливості для спільної роботи по розробці спільних рішень; відчувати себе комфортно при роботі з математичним апаратом. Зроблено висновки, що міждисциплінарний взаємодія в процесі навчання, в якому студенти отримують як розвиток, так і вдосконалення своїх знань іноземної мови, заслуговує на позитивну оцінку і може бути рекомендовано для використання в розвитку освітнього середовища.

**Ключові слова:** двомовна освіта; математика; англійська мова для спеціальних цілей; іноземні студенти; викладач.

#### Билингуальный подход к иностранному обучению иностранных студентов в Харьковском национальном университете имени В. Н. Каразина

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**Аннотация.** В статье рассматриваются особенности преподавания математики для иностранных студентов, использующих английский язык в качестве языкового посредника в двуязычном образовании на подготовительном факультете Харьковского национального университета имени Василия Назаровича Каразина. Отмечено, что ключевой особенностью учебного материала по математике, как информации, является его сетевая структура, образованная семантико-логическими связями. Приведены варианты распределения решений контрольных заданий. Анализируется процесс предварительной оценки иностранных студентов, программа обучения и логика ее создания. Описан процесс организации двуязычного обучения иностранных студентов на факультете и его координации между преподавателями. Представлен статистический анализ состава студентов, начального уровня их подготовки и обоснована наиболее эффективная стратегия обучения с использованием возможностей преподавателей университета. Рассматривается процесс создания программы по дисциплине «Математика» с учетом того, что у студентов разный начальный уровень знаний по математике. Отмечено, что применение двуязычного подхода к обучению и междисциплинарному сотрудничеству позволяет иностранным студентам лучше понять содержание дисциплины; получить больше возможностей для уточнения сложных моментов; расширить возможности для совместной работы по разработке совместных решений; чувствовать себя комфортно при работе с математическим аппаратом. Сделаны выводы, что междисциплинарное взаимодействие в процессе обучения, в котором студенты получают как профессиональное развитие, так и совершенствование своих знаний иностранного языка, заслуживает положительной оценки и может быть рекомендовано для использования в развитии образовательной среды.

**Ключевые слова:** двуязычное образование; математика; английский язык для специальных целей; иностранные студенты; преподаватель.