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COMPARATIVE CHARACTERISTICS OF THE TEACHING OF MATHEMATICS IN THE DEPARTMENTS OF ECONOMICS IN UKRAINIAN AND GERMAN UNIVERSITIES

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Abstract. The article considers one of the most important and pressing problems of modern university education in Ukraine: its competitiveness in the market of world educational services. There are given the main statistical data on the situation in the educational space of the world's leading countries. It is also taken into account for comparison and determination of the state of the outlined problem the result of our own pedagogical experience, and for answering of the actually: "Does the level of education in modern Ukrainian universities correspond to the level of material which offered by popular and leading universities of the world?"

In this way of searching process was given analysis of the teaching of mathematical disciplines at the faculties of economics at Kharkiv National University V. Karazin and International University of Applied Science (Germany). It has been chosen as a comparison for conducting more independent research from any conditions only the fundamental disciplines ("Higher Mathematics", "Probability Theory", "Mathematical Statistics", etc.). Purpose of the article is comparison the study process into two universities of Germany and Ukraine (higher mathematic subjects) and to consider the better and worse parts of it.

It is shown that the trend of globalization observe, is spreading in modern higher education

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too. And the development of university education and its popularization is one of the important facts that can solve a lot of problems that many countries face today, including a sufficient number of developed countries. In this way attraction young talented people not only to study, but also to work for the country and to build a family solves a demographic question. The popularization of higher education promotes investment in the state, and it works in both forms (individual payment and corporation investment). Education stimulates the development of science, raises the image of country through its culture, language and more.

There is the usual competition between countries on this way. Unfortunately lives the opinion that the modern university education of Ukraine is infinitely backward. And it (an education) doesn't competitive in comparison with its foreign counterparts. Such kind of thinking lives deeply in the domestic society. Really, there are some problems in this direction and it depends more of the materials and technical statement of the universities as it will be shown in the article. But the situation is mostly different if it is going about teaching fundamental courses. It was taken the teaching of mathematics at the faculties of economics of Ukraine and Germany universities as an example of comparative analysis. And it is possible to determine that some of domestic courses doesn't lose but on some of ways are is better according to teaching methods and their own structure than the corresponding courses at German universities.

Key words: higher education; mathematics; subject; profession; specialist; university; training course.

Analysis of recent articles and publications. Modern higher education contains many functions. The modern university is not just a place where students learn. They are entire complexes with laboratories, research centers, and libraries. Many developed countries are looking on education as a matter of national importance.

Firstly, it allows not only to develop own economy due to internal resources of the country, but also to attract new working force from outside and to make the own country more popular in the world market.

Secondly, modern higher education is, first of all, a huge business project, the investment of money and resources in which brings tangible benefits. If we take the U.S. educational services market as an example, in recent years the funds provided for the development of secondary school and higher education system are account for 27-28% of the total government spending of the country's general budget as a whole.

And, for example, real investments for higher education have increased by more than 2.5 times during the last 25 years. There are more than 30 universities in the U.S. today that are entirely financed by high-tech corporations today. The annual budget of each of them is more than 130 million dollars. At the same time, many corporations, they put a money into educational system, achieve a return of 25-30 dollars for every dollar invested in the development of education (Topchiy, 2011; Demidov, 2011; Dergay, 2011; Shklyar, 2011).

According to the latest research conducted by UNESCO, by 2025 the total number of students in the world is projected to increase from the current 97 million to about 260 million. The number of foreign students by that time will increase from the

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current 2 million to 5-7 million. Two-thirds of them will obviously come from Asia, especially from India and China (Lokshyna, 2021; Dzhurylo, 2021; Hlushko, 2021). Given that educating foreigners is a profitable business, the competition between of exporting countries in this market will inevitably intensify.

The emergence of new players in the market will have a great impact on the competition. If we talk about the Ukrainian market of educational services, it is not competitive enough. For example, about 80% of foreign students come from developing African republics. More than 60% of foreign students who study in Ukraine are trained in medicine, other specialties are represented rather poorly (for example about 1% finance, 2% -3% architecture, engineering). In addition, an additional pressure on modern higher education in Ukraine is the factor that most of the talented youth seeks to go to study abroad, motivating it by poor preparation at Ukrainian universities. But if we analyze the problem deeper, the level of preparation is not the determining factor of such a choice (The exporting education as a global business, 2006; Business & Finance, 2020).

The aim of the article is to consider the problem of modern education, and to find out what is the reason for such a sharp decline in the popularity of education in universities in Ukraine.

Research methods. First of all, let's conduct a statistical analysis of the problem. So, let's look at the number of modern students who go to study in other countries. So, for example, for the last 8 years the number of students who study in Poland has tripled (more than 60% of all foreign students are Ukrainians). And at the beginning of January 2021, only 622 citizens of Poland studied at universities in Ukraine. With such an approach, about 70% of Ukrainian universities in the future can lose their status of state-financed organizations. At the same time, more than 55% of Poles also do not aspire to study in their country, and if possible choose to study in more developed Western countries. And students from Germany and France, for example, tend to continue their studies in the United States (Roche, 2020; Bell, 2020; Galvao, 2020; Golumbic, 2020; Kloetzer, 2020; Knoben, 2020; Laakso, 2020; Lorke, 2020; Mannion, 2020; Massetti, 2020; Mauchline, 2020; Pata, 2020; Ruck, 2020; Tarabara, 2020; Winter, 2020).

Thus, the analysis of the literature suggests that the problem is not in the level of education itself, but in the opportunity to get a foreign education degree, and as a consequence without any problems to stay and work in better conditions. Thus, only 7% of Ukrainian students who studied abroad plan to return home. As a rule, this is the initial factor in the choice of a place of study. Often the problem of this non-competitive situation is interpreted as a consequence of the large number of universities in Ukraine,

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and as a consequence of the relaxation of the educational process (Matsko, 2019)

Let's analyze the statistics further. The number of universities in Ukraine is 140 for an approximate population of 43 million people; in Great Britain 137 for a population of 69 million people, in Germany 376 for 83 million people, in Russia 700 universities of various forms of ownership for 145 million people. And in the same Poland there are 457 higher educational institutions for a population of 38 million people.

Thus, in other countries too, the number of universities in relation to the population is quite large. And it would be incorrect to say that the reduction of universities will lead to an improvement in the quality of their teaching, an increase the competition between them through increasing of the number of students who will apply for studying. On the contrary, other countries are increasing the number of educational institutions, attracting the most talented young people from all over the world. And the lack of competitiveness as a consequence of a large number of universities is an absolutely incorrect statement. Consider another factor.

The so-called low level of training. Is it so? Is it really true that the level of education in modern universities in Ukraine is much lower than in its foreign counterparts? For further analysis, it is necessary to clearly define the criteria according to which further evaluation will be carried out.

It is not entirely reasonable and appropriate to compare the teaching of humanities disciplines such as history, literature, and law. Because their level of teaching and content depends on the country. It would be incorrect to compare the teaching of history or law, for example, in Ukraine and in Germany. In addition, it is difficult to compare the teaching of specialized disciplines. Since the system of higher education is tailored to the country and there are areas that are quite strongly developed in one country and poorly developed in another due to some industrial and economic characteristics.

Thus, the best comparison is the choice of teaching fundamental disciplines in majors that are more or less standard regardless of the country where the university is located. In recent years there have been major shifts in the ratio between the main areas of professional specialization in the training of future specialists. Technical specialties, engineering and natural sciences come first, this is due to the growing role of enterprises in the development of the latest high-tech industries and other sectors of the economy.

Besides, business education, which includes economic schools, business schools, economic faculties, MBA programs, plays an important role, which can also be explained by the increasing international distribution of labor, trans nationalization

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of capital. And a big role in such training belongs to mathematics.

Let us compare the content of the courses of mathematical disciplines at the Faculty of Economics of V. N. Karazin Kharkiv National University and at the German University International University of Applied Science. Let us note that this educational institution is private, offers a wide range of economic specialties and has branches in many lands (states in Germany), but in any case it is accredited by the state. And thus the similarity in the presentation of the material should be identical for any university of the chosen direction of study.

Language of teaching is English, which implies its better accessibility for international students, i.e. we can talk about the international orientation of the university. Thus, two universities with an international focus were chosen for comparison, which makes the comparison quite equivalent.

The first thing it would be nice to point out an attention that the original German school exam Abitur for the possibility of higher education by Germans themselves in Germany is fundamentally different from the Ukrainian external independent testing.

Firstly, it covers only the level of knowledge of gymnasium classes, which from the point of view of a Ukrainian student makes it more difficult. Second, the level of assignments has a more applied orientation: it does not contain just equations and examples. There is a certain problem, and to it you need to make a mathematical model, and solve it. The level of mathematics teaching in the gymnasium classes itself is quite high. Now let's return to the Business Mathematic course offered by the University of Applied Science. The content of the Business Mathematic course itself does not differ from the mathematics course at the V. N. Karazin Kharkiv National University at the Economics Department in a strong way, rather the opposite.

Some topics are covered weakly and not completely, there is a lot of repetition of elementary school material, which is studied in the middle school, and in its middle classes. Here are some excerpts from the lecture material of the course.

The course itself begins with solving quadratic equations, and defining the type of numbers, which should be studied in school, regardless of the country of study. Further, elements of probability theory and mathematical statistics are presented only as a module of the course, and the explanation of the material is quite condensed. Without knowing the material at all, it is difficult to understand what we are talking about in general.

Here, for example, is how Bernoulli's theorem is treated in the lecture. Note that this is only part of the lecture, and only one slide of the presentation corresponds to this topic (fig.1).

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Fig. 1 Bernoulli's Theorem

But for an economist in any field of training, the discipline of "Probability Theory and Mathematical Statistics" itself is extremely important, and as a rule, it is taken as a separate course. On the other hand, a large amount of time is devoted to the repetition of elementary material, which is studied in middle school. The slides below illustrate the repetition of material on the topic of functions, function shifts (fig.2)

Fig.2. Function Shifts

Particularly surprising was the part of the lecture, which is devoted to finding the roots of polynomials and their decomposition into multipliers (division of a polynomial by a polynomial). The lecturer clearly stated that one of the roots of the polynomial must be guessed in order to do the division. And nowhere is the rule to find the whole roots of the polynomial, if they exist (fig.3).

Fig. 3. Polynomial Division Scheme

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So, tasks are given for students after each lecture. And after the lesson for finding the roots of the polynomial, the root of the polynomial is already given in the corresponding task as a hint, although it is not difficult to find it by polynomials of this type (Fig. 4)

Fig. 4. Homework for Polynomial Division Scheme

The absence of such words as "theorem", "consequence", and the like is also striking. The absence of at least some elementary proofs of uncomplicated mathematical assertions, and no connection of any kind between those or other assertions, are present anywhere.

The level of content of the course can be different, but it is still a course of mathematical discipline, and a strong scientific style of presentation must be presented.

Besides, mathematics primarily teaches analysis, searching of relationships between events, causes and effects, which is the key to success in almost any profession. And such statements as "Let's guess the root of a polynomial" in the presence of the theorem on finding the integer roots of a polynomial, if they exist in a university mathematics course, sound strange, to say the least.

Results of the study. It should be noted mathematical courses are taught at economic faculties are more complete, more mathematically organized in the system of higher education in Ukraine. And as result it would be incorrect to say that the system of higher education in Ukraine hopelessly lags behind its foreign counterparts.

Of course, we cannot ignore the fact that there are sufficient difficulties, which are primarily associated with the material and technical support of universities. But this factor cannot be considered as only the fault of the university, it is a matter of national importance. In addition, evidence of a growing number of international exchanges among teachers, graduate students of universities are evidence of the competitiveness of universities in the global market of educational services. Therefore, on the basis of a brief comparison we can draw the following conclusions.   Thus, the problem of modern higher education in Ukraine, is not a problem of poor quality of teaching as

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education itself.

If we talk about the teaching of basic sciences, and it is reasonable to compare them, as a criterion of compliance of Ukrainian and foreign education, the quality of their teaching is not catastrophically low, but the tendency to decline exists. And the reasons for this is not the structure of the educational process in higher education institutions, but primarily the mismatch between the needs of university graduates and the realities that modern Ukraine can offer them.

The modern successful applicant, or a bachelor's graduate chooses education abroad not because it is better, but because the diploma of a foreign university gives the opportunity to work without problems and stay in the chosen country, thereby avoiding the difficulties in the adaptation and recognition of foreign (Ukrainian) education.

There is a certain natural selection at the first stages of university entrance: the best and financially capable students go to study abroad, and there is a clear tendency for the initially weaker students to enroll at universities of Ukraine. And this way isn't determined by the level of the university (level of education), in which case the university must lower both the bar of requirements and the bar of the presentation of the material.

As for the attractiveness of modern Ukrainian universities in the eyes of foreign students, the picture is virtually the same. Most of foreign students do not plan to return to their home country, but dream of the more affluent and attractive countries of Western Europe. So those who can afford such studies do so initially. And those who study here (in Ukraine) also see Ukraine as a transit country just to get a diploma.

Conclusions. The analysis carried out in this article allows us to assert that the main problem of Ukrainian higher education cannot be solved by the universities themselves. Its solution lies in the economic model of our society, the creation of jobs with adequate wages, the presence of prospects for development, achievement of goals and material well-being. It is the presence of these factors will give primacy in the choice of place of study at Ukrainian universities for both domestic and foreign students.

REFERENCES

1. Lokshyna, O., Dzhurylo, A., Hlushko, O., & Shparyk, O. (2021). Secondary education reform priorities under globalisation: the case of Ukraine in comparison with China, Germany and Poland. Second International Conference on History, Theory and Methodology of Learning. *Section History of Learning and Education*. Retrieved from: https://www.shs-conferences.org/articles/shsconf/abs/2021/15/shsconf_ichtml2021_01004/shsconf_ichtml2021_01004.html

2. Matsko, O. (2019). *Where going to study Ukrainians*. Retrieved from http://www.dsnews.ua/society/na-moskvu-kuda-uezzhayut-uchitsya-ukraintsy-30012019220000

_____

3. Roche, J., Bell, L., Galvao, C., Golumbic, Y., Kloetzer, L., Knoben, N., Laakso, M., Lorke, J., Mannion, G., Massetti, L., Mauchline, A., Pata, K., Ruck, A., Tarabara, P., & Winter, S. (2020). *Citizen Science, Education and Learning: Challenges and Opportunities. Frontiers in Sociology. Sociological Theory.* URL: https://www.frontiersin.org/articles/10.3389/fsoc.2020.613814/full

4. Topchiy, N., Demidov, S., Dergay, N., & Shklyar, S. (2011). *Comparative characteristics of the educational systems of Ukraine and the USA.* pp. 203–205. URL: https://moluch.ru/conf/ped/archive/17/135/

5. *The exporting education as a global business. World and National Economy* (2006). URL: https://mirec.mgimo.ru/2006/2006-01/eksport-obrazovania-kak-globalnyj-biznes

6. *Ukraine's Income From Foreign Students During the Period of Study Is More Than $ 3 Billion – Ministry of Education. Business & Finance* (2020). URL: https://ipress.ua/ru/news/dohod_ukrayni_ot_ynostrannih_studentov_za_peryod_obuchenyya_sostavlyaet_bolee_3_mlrd__mynobrazovanyya_315927.html

ПОРІВНЯЛЬНА ХАРАКТЕРИСТИКА ВИКЛАДАННЯ МАТЕМАТИКИ НА ФАКУЛЬТЕТАХ ЕКОНОМІКИ УНІВЕРСИТЕТІВ УКРАЇНИ ТА НІМЕЧЧИНИ

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Анотація. У статті розглянута одна із найактуальніших проблем сучасної вищої освіти України: її конкурентоспроможність на ринку світових освітніх послуг. Наведено основні статистичні дані, щодо ситуації яка відбувається у навчальному просторі провідних країн

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Comparative Characteristics of the Teaching of Mathematics in the Departments of Economics in Ukrainian and German Universities

світу, враховано також результат власного педагогічного досвіду для відповіді на одне із актуальних питань: «Чи відповідає рівень навчання у сучасних українських університетах рівню матеріалу, що пропонують провідні західні університети?» Для цього був проведеним порівняльний аналіз викладання математичних дисциплін на економічних факультетах у Харківському національному університеті ім. В.Н. Каразіна, та International University of Applied Science (Німеччина).

У якості порівняння та для проведення більш незалежного від впливу зовнішніх умов оцінювання було обрано саме фундаментальні дисципліни математичного циклу: «Вища математика», «Теорія ймовірностей», «Математична статистика», та інші. Показано, що тенденція глобалізації, що спостерігається у всьому світі є розповсюдженою і на сучасну вищу освіту. Саме розвиток університетської освіти та її популяризація може вирішити численні проблеми із якими стикаються сьогодні багато країн світу, у тому числі достатня кількість розвинених країн.

Дійсно, існують певні проблеми у цьому напрямку, та як було показано у статті, це стосується більш матеріально-технічного забезпечення університетів. Однак, якщо мова відбувається про викладання фундаментальних курсів, то ситуація є іншою. На прикладі проведеного порівняльного аналізу викладання математичних кусів на економічних факультетах України та Німеччини можна визначити, що не тільки вітчизняні курси не програють, а й навпаки за методикою викладання, та власною структурою є більш кращими ніж відповідні курси у німецькому університеті.

Ключові слова: вища освіта; математика; предмет; спеціаліст; фах; університет; навчальний курс.

СПИСОК ВИКОРИСТАНИХ ДЖЕРЕЛ

1. Lokshyna, O., Dzhurylo, A., Hlushko, O., & Shparyk, O. (2021). Secondary education reform priorities under globalisation: the case of Ukraine in comparison with China, Germany and Poland. *Second International Conference on History, Theory and Methodology of Learning. Section History of Learning and Education.* URL: https://www.shs-conferences.org/articles/shsconf/abs/2021/15/shsconf_ichtml2021_01004/shsconf_ichtml2021_01004.html

2. Matsko, O. (2019). *Куда уезжают учиться украинцы.* Взято з http://www.dsnews.ua/society/na-moskvu-kuda-uezzhayut-uchitsya-ukraintsy-30012019220000

3. Roche, J., Bell, L., Galvao, C., Golumbic, Y., Kloetzer, L., Knoben, N., Laakso, M., Lorke, J., Mannion, G., Massetti, L., Mauchline, A., Pata, K., Ruck, A., Tarabara, P., & Winter, S. (2020). Citizen Science, Education and Learning: Challenges and Opportunities. *Frontiers in Sociology. Sociological Theory.* URL: https://www.frontiersin.org/articles/10.3389/fsoc.2020.613814/full

4. Topchiy, N., Demidov, S., Dergay, N., & Shklyar, S. (2011). Comparative characteristics of the educational systems of Ukraine and the USA. *Сравнительная характеристика систем образования» Украины и США. Problems and prospects of the development of education: materials of the Intern. scientific conf.*, 203–205. URL: https://moluch.ru/conf/ped/archive/17/135/

5. *Экспорт образования как глобальный бизнес. Мировое и национальное хозяйство. (2006).* URL: https://mirec.mgimo.ru/2006/2006-01/eksport-obrazovania-kak-globalnyj-biznes

6. *Доход Украины от иностранных студентов за период обучения составляет более $ 3 млрд- Минобразования. Бизнес & Финансы (2020).* URL: https://ipress.ua/ru/news/dohod_ukrayni_ot_ynostrannih_studentov_za_peryod_obuchenyya_sostavlyaet_bolee_3_mlrd__mynobrazovanyya_315927.html

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