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TEACHING HIGHER MATHEMATICS ON A BILINGUAL BASIS: PROBLEMS AND FEATURES

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Changing paradigms of higher education, challenges of globalization necessitate a review of methods and approaches to training future specialists in Ukrainian universities. One of the modern requirements is the training of a specialist who is able to work in a multicultural environment. Bilingual education meets this goal.

The purpose of this work is to highlight the specifics of teaching higher mathematics in English for students of engineering specialties. Some factors affecting the effectiveness of bilingual instruction in engineer education have been analyzed in this paper. These factors play significant roles in promoting the development of bilingual instruction which have been proved in practice. Specific problems that arise for the instructor when teaching in a foreign language are identified, and possible practical ways to overcome them are given. It is shown that these problems do not affect the quality of education provided that the instructor has proper methodological qualifications.

A statistical study was conducted among 1st year students majoring in 141 Power Engineering, Electrical Engineering and Electrical Mechanics. The conducted studies have shown that the factor of learning higher mathematics in a foreign language does not affect the mastery of subject content. This allows expanding the practice of bilingual teaching to professional and general technical disciplines when training future engineers in a technical university.

The results of the study can be the basis for future research: conducting a statistical experiment to identify the influence of bilingual teaching/learning on the formation of bilingual subject competence in mathematics of future engineers; overcoming cognitive costs when learning mathematics in a foreign language.

Keywords: *higher mathematics, foreign language, foreign language education, bilingual teaching/learning model, subject-oriented didactic models, engineering education, academic mobility.*

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ВИКЛАДАННЯ ВИЩОЇ МАТЕМАТИКИ НА БІЛІНГВАЛЬНІЙ ОСНОВІ: ПРОБЛЕМИ ТА ОСОБЛИВОСТІ

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Зміна парадигм вищої освіти, виклики глобалізації зумовлюють необхідність перегляду методів і підходів до підготовки майбутніх фахівців у вищих навчальних закладах України. Однією із сучасних вимог є підготовка фахівця, здатного працювати в полікультурному середовищі. Цій меті відповідає білінгвальна (двомовна) освіта.

Метою даної роботи є висвітлення специфіки навчання вищої математики англійською мовою для студентів інженерних спеціальностей. У статті проаналізовано деякі фактори, що впливають на ефективність білінгвального навчання майбутніх інженерів. Ці чинники відіграють значну роль у сприянні розвитку двомовного навчання, що доведено практикою. Визначено конкретні проблеми, які виникають у викладача під час навчання іноземною мовою, та наведено можливі практичні шляхи їх подолання. Показано, що ці проблеми не впливають на якість навчання за умови належної методичної кваліфікації викладача.

Проведено статистичне дослідження серед студентів 1 курсу спеціальності 141 "Енергетика, електротехніка та електромеханіка". Проведені дослідження показали, що фактор вивчення вищої математики іноземною мовою не впливає на засвоєння змісту предмета. Це дозволяє поширити практику білінгвального викладання на фахові та загальнотехнічні дисципліни при підготовці майбутніх інженерів у технічному університеті.

Результати дослідження можуть стати основою для подальших розвідок: проведення статистичного експерименту з виявлення впливу білінгвального навчання на формування білінгвальної предметної компетентності з математики майбутніх інженерів; подолання когнітивних затрат при вивченні математики іноземною мовою.

Ключові слова: вища математика, іноземна мова, іноземна освіта, модель білінгвального навчання, предметно-орієнтовані дидактичні моделі, інженерна освіта, академічна мобільність.

Introduction of the issue. Ukraine is integrating into the international scientific and educational area, Ukrainian companies are entering the international market. In these conditions, English is becoming not just a lingua franca, but one of the key factors in the fundamental professional education of an engineer. The requirements of the Bologna process provide for expanding the mobility of scientific and pedagogical workers, students and other personnel for mutual enrichment with European experience; increasing the competitiveness of graduates in the domestic, European and world labor markets. Ukrainian universities are faced with the task of harmonizing Ukrainian and foreign educational programs, ensuring the convertibility of domestic higher education. Training personnel who not only possess modern knowledge, but are also able to apply it in practice in the conditions of globalization, including maintaining documentation and communicating in a foreign language, is

becoming increasingly important. Thus, the appeal to bilingual education, in which a foreign language, along with the native language, acts as a tool for learning and self-education, is relevant.

Since the beginning of the 90s bilingual education has been a leading direction of educational policy in many countries of the world. In the process of bilingual learning, a foreign language is a tool for mastering special knowledge. The combination of subject and language components in all links of the educational process is a characteristic feature of bilingual education. Subject-oriented models are gaining relevance. In such models a foreign language is a means of studying a subject (for example, higher mathematics for future engineers).

Current state of the issue.

Researchers on the topic agree that over the past twenty to thirty years, English as a Medium of Instruction (EMI) in higher education has become a global phenomenon. In particular, this is stated by A. Vinke, J. Snippe, W. Jochem [22],

B. Fenton-Smith, P. Humphreys, I. Walkinshaw [9], J. Airy et. al. [1]. The spread of English as a learning tool was triggered by the Bologna Process and the emergence of the European Education Area. F. Maiworm, B. Wächter [14; 23], A. Sandstrom, C. Neghina [19] showed that the spread of EMI leads to an increase in the number of programs taught in English at European universities. Studies by C. Dalton-Puffer [7], P. Mehisto, D. Marsh, M. J. Frigols [15], H. Roquet, C. Pérez-Vidal [18] demonstrate that the integration of language and subject components (CLIL, Content and Language Integrated Learning) in teaching professional disciplines has become widespread in the world. A study conducted in 2013-2014 by the British Council presents information on the spread of EMI in Brazil, Colombia, Uganda, Nigeria, Ethiopia, Zambia; some former countries of the socialist bloc (e.g., Bulgaria, Hungary, the Czech Republic, Slovakia), as well as Azerbaijan, Kazakhstan, Ukraine; J. Dearden [8] provides relevant data. B.A. Goodman [10], R. Bolitho, R. West [5], N. Snizhko [20] considered the issue of implementing bilingual education in Ukrainian universities, in particular, in technical ones. R. Klaassen [13], J. Airy [2] highlighted the problems of teaching physics and mathematics subjects in English for non-English-speaking audiences in the training of engineers. Y. Polyezhayev et.al. [17] considered the issue of using digital technologies in teaching in English at Ukrainian universities.

We observe a complex spectrum of attitudes towards bilingual education policies. A. Balula, S. Vasconcelos, A. Moreira [4], W. Baker, J. Hüttner [3] examined different aspects of EMI; R. Klaassen [13] examined teaching and assessment materials, course plans, syllabi, curricula and other institutional documents. Studies by B.A. Goodman [10] and R. Klaassen [13] reveal the problems that students and teachers face in the EMI process: language analysis, student-instructor interaction, and levels of comprehension. The researchers observed

and discussed some common problems that are commonly associated with the process of teaching subject content in a foreign language (subject instructor's level of language proficiency, students' English language deficiencies, level of acquisition, alternative methodologies, quality of classroom interaction). However, the authors also concluded that contextual factors are important; many researchers caution against adopting a simplistic, single view. There are unique context-dependent variables that influence the language of instruction in different countries and in different specialties. M.L. Pérez-Cañado [16] cautions against directly transferring the implementation of bilingual teaching methods from one country to another, from one specialty to another.

In Ukraine, modern pedagogical studies of bilingual education appeared on the wave of social renewal, the desire for an open society and integration into the world community. Bilingual education in the domestic system of higher education was studied in the works of such scientists as A. Husak, R. Devletov, A. Kovalchuk, N. Mykytenko, F. Moiseeva, S. Sytnyakivska, and others. Issues related to bilingual education of students of non-linguistic specialties were studied. Some issues of bilingual education in technical universities were considered by S.V. Ivanenko [11], S.M. Sytniakivska, M.H. Khlyvniuk [21]. But it should be noted that at the moment a comprehensive concept of bilingual professional education in Ukraine has not been built. Currently, only certain aspects of the problem of bilingual education in higher education have been defined. We also note that the methodological and technological foundations of bilingual teaching of different professional and fundamental disciplines are almost not developed.

Aim of the research is to highlight the specifics of teaching higher mathematics in English for engineering students; to establish the impact of bilingual teaching/learning on the acquisition of subject content.

Research methods. In recent years, the National University Zaporizhzhia

Polytechnic has been teaching a course on higher mathematics in English for students majoring in 141 Power Engineering, Electrical Engineering and Electrical Mechanics (Electrical Engineering Faculty). This course is not duplicated in the native language. In parallel, students learn other fundamental courses and professional courses also in English. Tests, calculations, exams are also carried out in English. Students of English-speaking groups study according to the same curriculum as students of Ukrainian-speaking groups. The only difference is that students of English-speaking groups have additional hours of English compared to students of Ukrainian-speaking groups.

In 2020-2023, 63 students participated in the study (experimental English-speaking groups – 23 students, control Ukrainian-speaking groups – 40 students). The relatively small number of participants in the study is explained by problems related to the pandemic and military actions in Ukraine. The theoretical basis of the research was the concept of bilingual education. At the practical stage of the research, the main method was the natural pedagogical experiment. Within its framework, purposeful pedagogical observation of students' academic achievements during the educational process with given parameters was carried out; emerging difficulties were recorded. Exchange of experience and study and discussion of the results of pedagogical activity took place at methodological seminars.

Results and discussion. Our experience has shown the most common specific problems that instructors of higher mathematics for future engineers face when teaching in English, as well as possible ways to overcome these problems.

The first problem is the initial level of first-year students' English proficiency. They have to listen to lectures in English, communicate in English in practical classes, and use methodological recommendations and manuals written in English. This is a challenge for them, as they did not have such learning experience in high school. Because of this situation,

the instructor may simplify explanations and avoid considering some difficult-to-understand details, although they are very important for understanding the content. This leads to incomplete study of some aspects of the subject. This problem is solved by intensifying the study of English itself in the first year: students of English-speaking groups have additional hours of English compared to students of Ukrainian-speaking groups).

The second problem is obvious: the teaching of a subject in a foreign language takes place at a slower pace. The perception and awareness of information by students is also slower. This takes some time and effort from both the teacher and the students. Therefore, as a rule, in English-speaking groups students have time to process a smaller amount of material than those who learn in their native language within the planned classroom hours for higher mathematics. This can affect the implementation of the curriculum. And here the instructor's experience becomes of great importance: it is necessary to critically approach the selection of material, the sequence of its processing. So, this problem is solved by the instructor's methodical qualification.

Since in Zaporizhzhia Polytechnic the English-language course of higher mathematics is not additional to the Ukrainian-language course, the English-language course is the only course of higher mathematics, the following problem arises. The instructor is faced with the need to duplicate the terminology in his native language. This is necessary in order to have an adequate understanding of the terminology and to use it correctly in a professional context. The instructor must give students the exact equivalent in their native language for each term, and also compile a glossary for each topic. Thus, the problem of adequate mastery of the subject is solved also in the native language.

We see differences in approaches to teaching higher mathematics in Ukraine and abroad. This creates another group of problems. English-language mathematics is more aimed at acquiring practical competencies and skills. It is a well-known

point of view that the main goal of foreign mathematics education is to know-how, and the main goal of domestic mathematics education is to know-why. Ukrainian students enter universities with the knowledge they have acquired at school. They are able to solve non-trivial stereometric problems, systems of equations, operate with trigonometric and logarithmic transformations, and complex numbers. But along with this, first-year Ukrainian students get confused when performing the simplest combinatorial, statistical, and financial calculations, and get lost in graphical information. Moreover, they cannot formalize a task described in terms of a specific life or professional situation. In foreign schools and colleges, the main attention is paid to such skills, this is what is taught in secondary and even primary school. It should also be noted that there are many little things that seem insignificant, but in fact affect the learning process. For example, in English-language mathematics, control, test and examination tasks are presented in a slightly different way than our schoolchildren and students are used to; English-language educational resources use slightly different notations for functions, terms, quantities; standard mathematical formulas have a slightly different appearance. The listed factors do not allow the direct use of only foreign English-language textbooks and manuals. There is a need to create methodological support for the course, which combines the principles of foreign mathematical education and the realities of our school education. We must use English-language methodological manuals (lecture notes, calculation and control works, examples of solving practical tasks, other materials for students' independent work etc.), which contain a list of special terms in English and the native language. Thus, we consider it appropriate to use both original English-language resources and methodological guides created specifically for such courses by our instructors in the

educational process to bridge the aforementioned gap between English-language and domestic higher mathematics. For students majoring in 141 Power Engineering, Electrical Engineering and Electrical Mechanics the instructors of the Department of Mathematics have created a set of methodological manuals (workbooks, calculation tasks with instructions, lecture notes), as well as a trilingual mathematical dictionary.

Regardless the above problems, learning higher mathematics in English has obvious advantages:

- students maintain the language skills and improve their English in the process of learning;

- students master special vocabulary, not only mathematical, but also engineering and technical ones. This gives them the opportunity to read articles and textbooks in English more confidently, and also prepares them for further study abroad, joint master's programs with partner universities, internships in English;

- students can prepare more effectively for exams and tests such as IELTS, TOEIC, TOEFL, GRE. These tests are a necessary condition for continuing their studies or working abroad;

- students can freely use English-language periodicals and literature of a special profile, which is much more available in English than in Ukrainian.

In the course of the study, the question arose whether teaching in a foreign language affects the acquisition of subject content. It was hypothesized that teaching/learning mathematics in English has an insignificant effect on mastering the content of the discipline. For this purpose, data on the assessment in higher mathematics of students of the English-speaking and Ukrainian-speaking groups were studied.

The following Table 1 gives the average score in the first and second semesters of study for each group (scale 0-100 points).

Table 1

Assessment in higher mathematics

	2020-2021 academic year		2021-2022 academic year		2022-2023 academic year	
	1st semester	2nd semester	1st semester	2nd semester	1st semester	2nd semester
English-speaking group	77	73	85	83	60	70
Ukrainian-speaking group	73	73	68	60	71	60

The following Table 2 presents data on two samples: a combined English-speaking group and a combined Ukrainian-speaking group. The null

hypothesis about the equality of the means of two unknown distributed populations (independent samples) was tested.

Table 2

Sample data for applying the Z-test

	Sample size, n	Sample mean, x	Sample variance, D	Significance level, a	Empirical value of the Z-statistic	Critical value of the Z-statistic
Combined English-speaking group (1)	46	71.7826	65.0844	0.05	1.8192	1.96
Combined Ukrainian-speaking group (2)	80	69.3625	28.3810			

We use the Z-test; empirical value of the Z-statistic

$$Z = \frac{|x_1 - x_2|}{\sqrt{\frac{D_1}{n_1} + \frac{D_2}{n_2}}}$$

and critical value of the Z-statistic

$$Z = \Phi^{-1}\left(\frac{1 - \alpha}{2}\right),$$

where $\Phi(t)$ is a Gaussian function, are calculated. Since the empirical value of the criterion is less than the critical value, there is no reason to reject the hypothesis of equality of the means of the two samples. This means that the differences in the scores of the two groups are due to random factors. The data do not contradict the null hypothesis of equality of the means of the two samples. It can be assumed that teaching higher mathematics in English does not affect

the acquisition of the subject content. This result correlates with the conclusions of the study by A. Chin, N. Daysal, S. Imberman [6] on the impact of bilingual programs on learning outcomes. Our study also confirms the results of S. Jianhong et al. [12] on the effectiveness of bilingual instruction for students of engineering and technical specialties.

The research findings were based on a small-scale study with a limited number of participants. However, the general tendency was outlined and the scope of the investigation can be further expanded.

Conclusions and research perspectives. Innovations in teaching and learning are undoubtedly one of the most important factors that determines the success of university education.

Bilingual education of future engineers at technical universities of Ukraine has great prospects in the context of European integration and Ukraine's entry into the international scientific and educational area. The advantages of teaching on a bilingual basis can be a motivating factor not only for students, but also for many instructors to adopt the technology of bilingual teaching of any subjects in a university setting.

The effectiveness of bilingual teaching and, as a consequence, the acquisition of subject content are influenced by a number of factors. The most important of them are the following:

- the initial level of English among first-year students (often low);
- the presence of a parallel course in Ukrainian (usually absent);
- the pace of the lesson (clearly slower, compared to the native language);
- the difference in approaches to teaching mathematics in Ukraine and abroad (manifested in the use of authentic English-language textbooks);
- the availability of appropriate methodological support (insufficient).

The listed factors cause the emergence of specific problems for the instructor:

- the need to simplify the language of explanation, which may affect the correctness of understanding;
- the need to duplicate terminology in Ukrainian;
- working on a smaller amount of material during the scheduled hours, which may affect the implementation of the curriculum;

- the impossibility of using *only* foreign manuals;

- the need to create our own English-language methodological manuals.

The analyzed problems of bilingual teaching/learning mathematics and recommendations for overcoming these problems contribute to a better understanding of the specifics of teaching in a foreign language. And this, in turn, contributes to the involvement of students and greatly facilitates their study of the subject in a foreign language.

Studies conducted among Electrical Engineering students showed that the factor of teaching higher mathematics in English does not affect the mastery of the subject area. Therefore, we believe that bilingual teaching can be used for professional and general technical subjects in the process of training future engineers.

These results can be the basis for future research. We consider it appropriate to conduct a statistical experiment to identify the influence of bilingual teaching/learning on the formation of bilingual subject competence in mathematics of future engineers. The system of communicative qualities of students' mathematical speaking needs more detailed research. This will contribute to further deepening our understanding of the bilingual educational model at a technical university and its potential benefits.

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IMPACT OF MARTIAL LAW ON THE LEVEL OF PROFESSIONAL BURNOUT OF UNIVERSITY TEACHERS: ANALYSIS OF CHALLENGES AND ADAPTATION MECHANISMS

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The article analyses the challenges faced by the academic community under martial law and identifies adaptation mechanisms that help support the professional activity and psychological stability of teachers. In the current conditions of war, the educational sector has undergone significant changes that have affected the organisation of the educational process, the emotional state of teachers and the overall productivity of their work. In particular, teachers of higher education institutions have found themselves in a situation of constant stress due to the danger, the requirement to quickly master new technologies, the need to adapt to distance learning and the aggravation of socio-economic problems.

The study is based on the Maslach Burnout Inventory, which allows assessing the level of professional burnout by three main components: emotional exhaustion, depersonalisation and reduction of personal achievements. A survey of 211 university teachers revealed that 45% of respondents have a high level of emotional exhaustion, 30% face depersonalisation, and 40% experience a decrease in confidence in their own professional abilities. The analysis also showed that women teachers are more likely to experience emotional fatigue, while men are more likely to demonstrate a tendency to professional cynicism.

The article discusses the main adaptation mechanisms that teachers use to overcome stress and professional burnout. These include peer support, development of digital competencies, and the use of stress management techniques such as meditation, exercise, and relaxation practices. At the same time, the authors emphasise that even effective adaptation strategies have limited impact if the crisis situation lasts for a long time.

Particular attention is paid to the development of support programmes for teachers in crisis. A number of measures have been proposed, including the creation of a psychologically safe environment, the organisation of stress management trainings, the introduction of mutual assistance programmes among colleagues, as well as material and technical support. The proposed recommendations are aimed at reducing the level of professional burnout, increasing psychological stability and efficiency of teaching activities.

The study is of practical value for educational institutions, university administrations and government agencies responsible for supporting teachers. The authors emphasise the need to implement a systematic approach to supporting teachers, especially in crisis situations. Further research could include an analysis of the regional peculiarities of the impact of martial law on teacher

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burnout, as well as a study of the long-term dynamics of adaptation and the effectiveness of the proposed support programmes.

Keywords: martial law, professional burnout, higher education institution, distance learning, adaptation, psychological resilience, support program.

ВПЛИВ ВОЄННОГО СТАНУ НА РІВЕНЬ ПРОФЕСІЙНОГО ВИГОРАННЯ ВИКЛАДАЧІВ ЗВО: АНАЛІЗ ВИКЛИКІВ ТА АДАПТАЦІЙНИХ МЕХАНІЗМІВ

С. М. Ситняківська

Стаття присвячена аналізу викликів, з якими стикається академічна спільнота в умовах воєнного стану, та виявленню адаптаційних механізмів, які сприяють підтримці професійної діяльності та психологічної стійкості викладачів. У сучасних умовах війни освітня сфера зазнала значних змін, що вплинули на організацію навчального процесу, емоційний стан педагогів і загальну продуктивність їхньої роботи. Зокрема, викладачі закладів вищої освіти опинилися в ситуації постійного стресу через небезпеку, вимоги до швидкого опанування нових технологій, необхідність адаптації до дистанційного навчання та загострення соціально-економічних проблем.

Дослідження базується на використанні методики Maslach Burnout Inventory, яка дозволяє оцінити рівень професійного вигорання за трьома основними компонентами: емоційна виснаженість, деперсоналізація та редуція особистих досягнень. Анкетування 211 викладачів вітчизняних закладів вищої освіти виявило, що 45% респондентів мають високий рівень емоційного виснаження, 30% стикаються з деперсоналізацією, а 40% відчують зниження впевненості у власних професійних здібностях. Аналіз також показав, що жінки-викладачі частіше стикаються з емоційною втомою, тоді як чоловіки частіше демонструють схильність до професійного цинізму.

У статті розглянуто основні адаптаційні механізми, які викладачі використовують для подолання стресу та професійного вигорання. Серед них – підтримка колег, розвиток цифрових компетенцій, використання технік стрес-менеджменту, таких як медитація, фізичні вправи та релаксаційні практики. Водночас, автори наголошують, що навіть ефективні адаптаційні стратегії мають обмежений вплив, якщо кризова ситуація триває довгостроково.

Особливу увагу приділено розробці програм підтримки викладачів у кризових умовах. Запропоновано низку заходів, які включають створення психологічно безпечного середовища, організацію тренінгів зі стрес-менеджменту, впровадження програм взаємодопомоги серед колег, а також матеріальну та технічну підтримку. Запропоновані рекомендації спрямовані на зниження рівня професійного вигорання, підвищення психологічної стійкості та ефективності викладацької діяльності.

Дослідження має практичну цінність для освітніх установ, адміністрації ЗВО та державних органів, відповідальних за підтримку викладачів. Автори підкреслюють необхідність впровадження системного підходу до підтримки педагогів, особливо у кризових ситуаціях. Подальші дослідження можуть включати аналіз регіональних особливостей впливу воєнного стану на професійне вигорання викладачів, а також вивчення довгострокової динаміки адаптації та ефективності запропонованих програм підтримки.

Ключові слова: військовий стан, професійне вигорання, заклад вищої освіти, дистанційне навчання, адаптація, психологічна стійкість, програма підтримки.

Introduction of the issue. In the context of current global challenges, including military conflicts, the educational sector faces a number of significant challenges. Teachers of higher education institutions (HEIs) are forced not only to ensure the continuity of the educational process, but also to adapt to

new conditions that affect both their professional development and emotional state. The martial law caused by the threat to the country's security leads to dramatic changes in the work of higher education institutions: distance learning, the need to quickly master digital technologies, mobility and security

requirements, as well as emotional pressure due to the instability of the situation.

One of the most common consequences of these challenges is the professional burnout of teachers. Professional burnout is a syndrome that results from chronic stress in the workplace that has not been successfully overcome [1]. It is characterised by three main symptoms: a feeling of exhaustion or fatigue; increased mental distance from work or work-related cynicism; and decreased professional effectiveness.

Constant stress, uncertainty and increasing workloads increase the risk of emotional exhaustion, reduced motivation and effectiveness. However, in response to these difficulties, teachers develop and apply adaptive mechanisms that help them maintain their own performance and psychological resilience.

The study of the impact of martial law on the level of professional burnout of university teachers is relevant and important, as it allows identifying the main challenges faced by the academic community and contributes to the development of effective strategies to support teachers in crisis conditions. This topic involves analysing both the negative aspects of the impact of martial law and the potential resources that help teachers adapt to the new reality.

Current state of the issue. Currently, the topic of the impact of martial law on the level of professional burnout of teachers is to some extent covered in scientific research in various fields, including education, psychology, sociology, and others.

First of all, we should pay attention to the study of the dynamics of professional burnout of Ukrainian teachers during the war in the article "Burnout dynamics among Ukrainian academic staff during the war" by researchers from Berdiansk State Pedagogical University Natalia Tsybulyak, Yana Sychikova, Anastasia Popova, Serhii Kovachov, Olha Hurenko and Liudmyla Shevchenko. This article was published in *Scientific Reports Nature*, one of the world's most respected scientific journals. The cross-sectional

study, which was divided into two waves in July 2022 and January 2023, used the Maslach Burnout Inventory-Human Services (one of the most common tools for assessing the level of professional burnout in social, educational and healthcare workers), which identified three main components of burnout:

Emotional exhaustion is a feeling of overwork and lack of energy to perform work tasks.

Depersonalisation is "professional cynicism", a sense of alienation and indifference to colleagues, and devaluation of their work.

Reduction of personal achievements - doubts about one's own abilities and feelings. The employee feels unfulfilled and believes that his or her work does not matter.

The study found a significant impact of the war on the level and extent of professional burnout among Ukrainian teachers. The most vulnerable to the negative effects were female teachers, who experienced increased emotional fatigue and alienation from their professional activities throughout the war. At the same time, the results of the study show that the duration of hostilities has a stronger impact on the emotional exhaustion of male teachers. In addition, it was found that the duration of a full-scale war has a significant impact on the dynamics of depersonalisation [2].

It is also worth noting the work of Natalia Tsybulyak, PhD in Psychology, Associate Professor of the Department of Applied Psychology and Speech Therapy at Berdiansk State Pedagogical University, and Yana Sychikova, PhD in Engineering, Vice-Rector for Research, who in their article "On the Brink: Migration and Burnout of Ukrainian University Teachers during the War" described the factors that influence the burnout of teachers in Ukrainian higher education institutions during the war.

The deterioration of the security situation has become a key factor in teachers' professional burnout. About 84-87% of respondents felt anxious about their lives, loved ones and the future of the country. The instability of social

protection, insufficient remuneration and economic instability also exacerbated burnout: 55% of teachers abroad and 49% of internal migrants complained about the negative impact of economic conditions.

External migrants faced additional financial difficulties due to high costs abroad, while internal migrants had to adapt to new conditions and suffered from a lack of resources. Almost 50% of them reported uncertainty about their professional future, and 35% lacked the resources to work effectively.

Teachers who were forced to migrate showed higher levels of emotional exhaustion than non-migrants. Internal migrants faced a loss of access to teaching resources and difficulties in re-establishing professional networks. External migrants experienced social isolation, cultural barriers, and loss of professional identity due to the inability to work in their usual format. Anxiety about students, the university and the country, even while abroad, caused emotional pressure and interfered with professional self-realisation [3].

And according to a study by Go Global and Gradus Research, 54% of Ukrainian teachers experience professional burnout, and 70% observe it in their colleagues. More than half of educators (54%) admit that they need psychological help. The workload of teachers has increased significantly: 80% of respondents say their work has become more difficult due to blended learning, air raids and power outages. Only 3% reported a decrease in workload. In offline learning, 85% of teachers face the inability to conduct full lessons due to constant anxiety and technical difficulties, and in online learning, 71% complain about the lack of stable internet.

Among the urgent needs of teachers, psychological and methodological support is a top priority to help them cope with stress and adapt to new working conditions. Material and technical support to ensure comfortable learning conditions, including heating, water supply and necessary equipment, also remains important. Teachers also note

the need for knowledge about working in emergency situations (46%), stress management (37%), identifying signs of stress (29%) and conflict resolution (18%). These results were presented at the press conference "Educational Front. The Impact of War on Educators" [4].

An important aspect is the methods of minimising this problem. At the moment, there are few programmes to support teachers in Ukraine, but some of them are worth noting. The programme "Psychological Support for School Teachers": Implemented by the State Education Quality Service of Ukraine, the programme provides psychosocial and emotional support to teachers, especially in times of war. The programme consists of three blocks: psychological support and safety, pedagogical support and conflict prevention [5]. The exchange programme for Ukrainian teachers "Bridge USA: UAFP/UPRR": A programme that facilitates the exchange of experience between Ukrainian and American teachers for the purpose of joint research, exchange of pedagogical experience and development of training courses [6]. Model teacher training programmes: Approved by the Ministry of Education and Science of Ukraine, these programmes are aimed at raising the professional level of teachers and managers of general secondary education institutions implementing the State Standard of Basic Secondary Education [7].

Aim of the research is to analyse the impact of martial law on the level of professional burnout of higher education institutions (HEIs) teachers, to identify the key challenges faced by the academic community and to identify adaptation mechanisms that help maintain the psychological stability and performance of teachers in crisis conditions.

Research methods: analysis, synthesis, quantitative methods (descriptive statistics), empirical methods (questionnaires, surveys).

Results and discussion. The results of the questionnaire and survey of 211 university teachers were used to generate the results that highlight the level of professional burnout. First of all, it is

worth noting the results of the questionnaire conducted among university teachers using the Maslach Burnout Inventory (MBI) [8], which

revealed that most respondents have a medium or high level of emotional exhaustion (Figure 1).

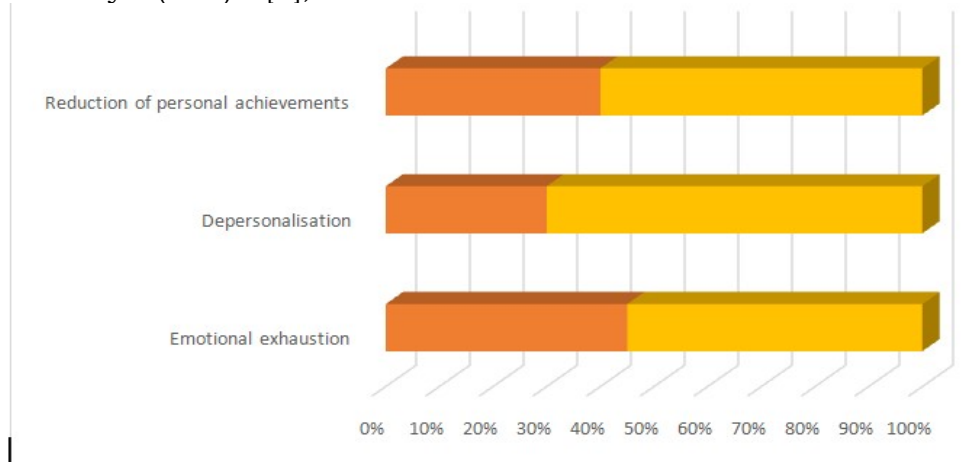


Fig. 1. The level of emotional exhaustion

45% of respondents showed a high level of emotional exhaustion, which indicates a loss of energy and difficulties in performing professional duties. 30% of respondents showed a tendency to professional cynicism (depersonalisation), which was expressed in alienation and indifference to colleagues and students. 40% of teachers felt a decrease in confidence in their professional abilities,

which indicates a reduction in personal achievements.

It is worth noting the influence of gender on professional burnout, as the analysis showed gender differences in the perception of stressful conditions. Female teachers reported emotional exhaustion more often (53%), while the figure for men was 37% (Figure 2).

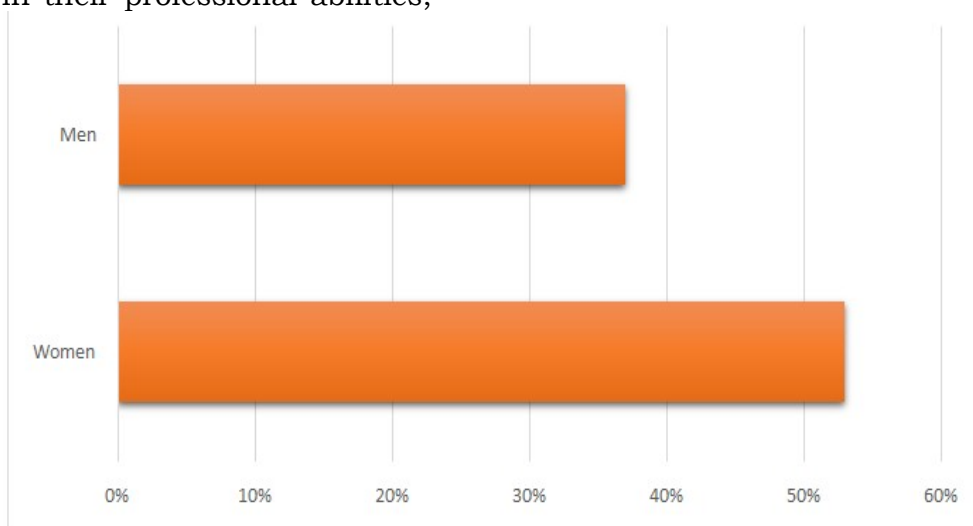


Fig. 2. The influence of gender on professional burnout

Men showed a higher tendency to depersonalise (35% vs. 25% for women),

which may indicate a difference in adaptation strategies (Figure 3.).

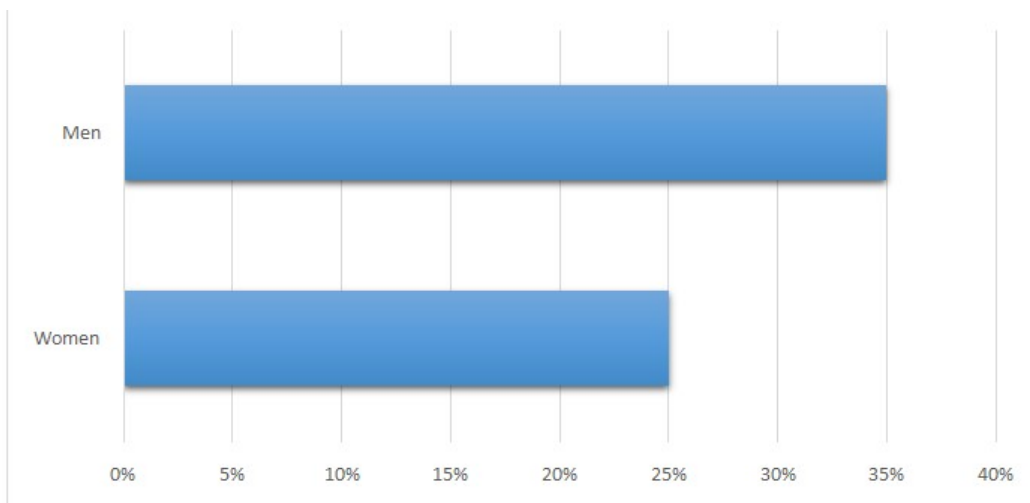


Fig. 3. Men's difference in adaptation strategies

To study the adaptation mechanisms of teachers, a questionnaire was created with questions about the work environment, digital skills, emotional support, stress management, and

personal development. The survey revealed several key strategies for adapting to work under martial law (Figure 4.).

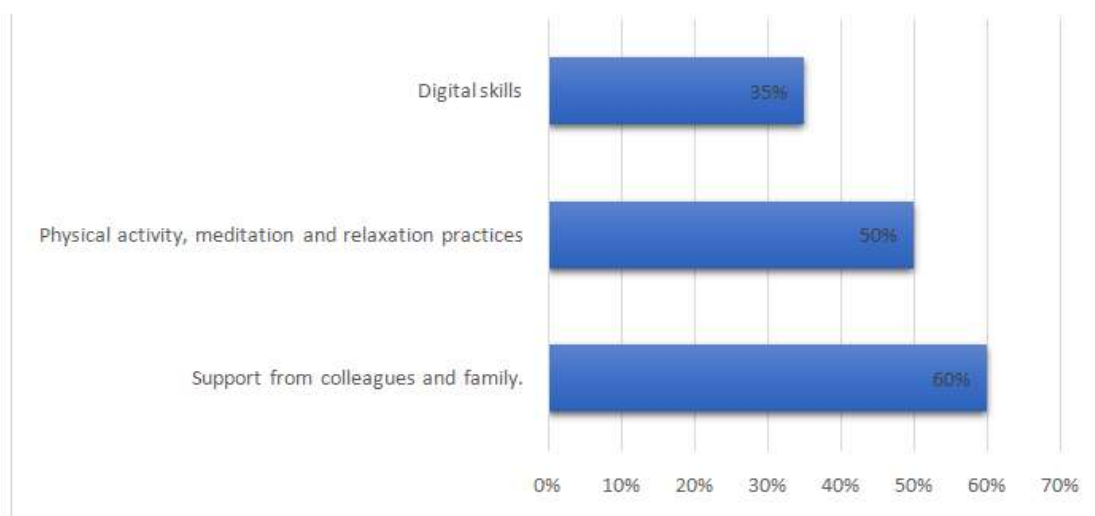


Fig. 4. Work environment, digital skills, emotional support, stress management, personal development

60% of teachers said that the main resource is the support of colleagues and family. 50% use various stress management techniques, including physical activity, meditation and relaxation practices. 35% of respondents improved their digital skills, which allowed them to adapt to the remote work format.

The results of the study confirm that martial law has significantly affected the level of professional burnout of university teachers, increasing emotional exhaustion and depersonalisation. Women were particularly vulnerable due to their greater emotional sensitivity. At the same time, men demonstrate a higher tendency to professional cynicism, which

may be a reaction to prolonged stressful conditions. Adaptation mechanisms, such as peer support, development of digital competencies and stress management techniques, are important resources for overcoming burnout. However, their impact is limited if the crisis situation is ongoing.

The findings of this study are useful for the development of support programmes for teachers aimed at preventing burnout and increasing their psychological resilience.

Therefore, a *recommended support programme* was created to promote the psychological resilience of higher education teachers through the use of internal resources of the institution, including the professional experience of staff, existing infrastructure and organisational capabilities.

Programme objectives:

Creating conditions for emotional recovery and preventing professional burnout.

Development of stress management and emotional regulation skills.

Increasing team cohesion and developing mutual support.

Use of existing HEI resources for education, training and informal events.

The stages of the programme include assessing the needs of the team (conducting surveys or short questionnaires among teachers to identify the main challenges and needs, forming a working group of representatives of the administration, psychologists and initiating teachers); creating conditions for psychological support, for example: a psychological relief room: allocation of a room with a comfortable interior for teachers to relax during the working day, an internal support line: involvement of teachers-psychologists for individual consultations; training

Another important aspect is to regularly evaluate the effectiveness of the programme by surveying teachers to assess their emotional state and satisfaction with working conditions and adjusting programme activities based on the data obtained.

Expected results include: reduced emotional exhaustion and professional burnout, increased team cohesion and mutual trust, improved overall atmosphere in the institution and increased teaching effectiveness, development of new support practices that can be integrated into the institution's workflow on a regular basis.

Conclusions and research perspectives. The study has shown that the professional burnout of higher education teachers is a significant problem in the context of martial law caused by chronic stress, increased professional workload, adaptation requirements and emotional exhaustion. It has been found that the most vulnerable to burnout are teachers who face constant changes in the work environment, such as the transition to blended or distance learning, interruptions in the educational process due to air raids, and insufficient technical support.

Despite the challenges, teachers are demonstrating the ability to adapt by applying a variety of mechanisms, such as psychological support from colleagues, improved digital skills and stress management techniques. However, these efforts require systemic support at the state level, including financial, methodological and technical assistance.

Further research in this area should cover a wider contingent of teachers, in particular from different regions of Ukraine, which will allow to identify regional peculiarities of professional burnout and its factors. It is also important to conduct longitudinal studies that will allow us to trace the dynamics of changes in the condition of teachers over time. Attention should be paid to the implementation and evaluation of the effectiveness of psychological, technical and material support programmes for teachers in crisis. Such programmes may include training in stress management techniques, development of digital competences, as well as individual and group consultations with specialists.

In addition, it is promising to study the impact of adaptation mechanisms on

various aspects of teachers' professional activities, such as productivity, job satisfaction and motivation. This will help to create a holistic support system that

will help to improve the quality of education under martial law and during the period of the country's recovery.

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