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DYNAMICS OF INTEREST IN HIGHER EDUCATION BEFORE AND DURING ONGOING WAR: GOOGLE TRENDS ANALYSIS

Abstract

This paper explores how the war in Ukraine changed the interest in higher education of Ukrainians who stayed on the territory of Ukraine and emigrated to other countries. The methodology is based on Google Trends Analysis and peak approach with Google Trends Scale of Internet user inquiries about higher education from June 20, 2021 to June 20, 2023 with a middle point on February 24, 2022. Dynamics of changes in the queries of Internet users by keywords regarding studied higher education are: 1) exclusively from the territory of Ukraine; 2) from the territory of Poland, Slovakia, Germany, the Czech Republic, Great Britain, Spain, Italy, Bulgaria, Romania, Moldova, Austria, i.e., top-10 countries by number of registered Ukrainian refugees according to the UN Refugee Agency.

The key results are: 1) increased interest of Internet users in higher education after beginning of the full-scale war: Poland – 22.9%, Romania – 28.9%, Ukraine – 31.2%, Hungary – 32.4%, Slovakia – 35.8%, Moldova – 49.0% of average number of «university» inquiries; 2) increased requests for professional education (42.2%), distance education (25.6%), distance learning (34.1%) after February 24, 2022; 3) correlation between negative trends of interest per 32% from July 2021 (100 GT Scale) to July 2022 (68 GT Scale) in Ukraine and positive trends of this indicator in European counties in August 2022 (80-100 GT Scale).

Chi-square test showed statistical significance of changes in interest in higher education (p-value = 0). Key findings demonstrate the following trends after February 24, 2022: distance learning development, increased Internet users' orientation towards professional education for high-paying jobs, popularity of flexible schedules.

Keywords	higher education trends, Internet users, war, Google Trends, comparative analysis, chi-square test
JEL Classification	I25, I21, J11

INTRODUCTION

The impact of war on society leads to significant changes in people's priorities and interests. During times of conflict, essential issues such as food security, personal safety, and economic stability take precedence, relegating strategic matters like higher education to a secondary position. This change in priorities is natural, as the immediate challenges posed by the war demand urgent attention and resolution. Although, changes in the level of interest in higher education among citizens is significant for the development of high-quality education and, subsequently, for sustainable economic development of the nation.

Russia's military aggression against Ukraine has led to the reduction of Ukraine's population and labor force through mass migration, including due to greater interest in a safe place for training without barriers during training in the conditions of military operations (power outages, unstable internet connection and missing technical support

for full-fledged training). Refugees are also often young people with families after beginning of the war. To be more specific, 90% of Ukrainian refugees mostly consists of young women with children, because most Ukrainian men aged 18 to 60 are restricted from leaving the country according to the martial law in Ukraine (OECD, 2023). UNHCR's survey in countries neighboring Ukraine (Czech Republic, Hungary, Moldova, Poland, Romania and the Slovak Republic), conducted between mid-May and mid-June 2022, showed that 53% of respondents emigrate from Ukraine travelling with children (5-17 years old). This decrease reflects refugees of working age who, in the absence of motivation or interest in Ukraine, will not return to the territory of Ukraine, which will lead to a significant reduction in the working population, even though people of retirement age remain in Ukraine, as a result, an increase in the economic burden on each worker in Ukraine is expected. As an example of age groups, the Ministry of Labor and Social Affairs of Czechia reveals that in June 2022 more than a quarter (28%) of refugees from Ukraine are under 30 years old. There are 356,625 Ukrainian newcomers who migrated to the Czech Republic after February 24, 2024, and are university graduates. This number is higher by 17.6% than the Czech population in 2023 (European Commission, 2023).

Skilled employees are essential for maintaining the operation of enterprises, facilitating innovation, and driving technological advancements that can replace existing processes with more cost-effective solutions, especially during war. Starting point of forming a skilled worker is higher education, therefore, it is important to explore the changes in the interest of Ukrainians in matters related to higher education and identify current trends despite limitations of official statistical data due to long period of their collection.

During wartime, the role of the Internet resources can be of particular importance, as it becomes the only available source of current information. In June 2023, a survey by the Civil Network Opora and the United States Agency for International Development (USAID) revealed that more than half of Internet users in Ukraine (57.7%) use the Internet as a source of getting information during war. Based on this, Internet inquiries about higher education in search platforms can be a strong source of data for analysis of current trends.

1. LITERATURE REVIEW

In times of instability and threats to national security, the economy becomes one of the key sectors responsible for providing material resources to counteract the consequences of the ongoing war, particularly the Russian aggression against Ukraine. Education plays a fundamental role in creating a business environment by establishing a robust informational and innovative foundation (Koibichuk et al., 2022). Essentially, knowledge becomes a valuable competitive resource (Vidic, 2022), contributing significantly to the country's national security through its close interconnection with business patterns and the intellectualization of human capital, leading to innovations (Kuzior et al., 2022a). Despite diverse trends in the digitalization of education and the economy (Samusevych et al., 2021), dynamic convergent relationships between the chains of economy, education, and national security have been confirmed

(Melnyk et al., 2022). This convergence has led to the development of an additive economy, which requires fewer additional resources compared to the subtractive economy, reduces resource deficits, and caters to the needs of a larger number of consumers, particularly significant during the ongoing war in Ukraine.

In line with Samoilikova et al.'s (2022) findings, "business-education-science" cooperation represents the most effective innovative approach for achieving sustainable development goals across various economic levels and aspects of human life. Moreover, a 1% increase in the level of "business-education-science" cooperation leads to a 0.04% rise in sustainable development levels.

Developing human capital is crucial for businesses, as a skilled and educated workforce can drive innovation, enhance productivity, contribute effectively to economic growth, and achieve sustaina-

ble economic progress faster. In the modern fast-paced world, the human resource will be a driving force initiating and sustaining dynamic changes (Nohu & Balaban, 2022). However, for this to happen, it is essential to understand the interests and needs of people to motivate employee development within workplaces. For instance, Kuzior et al. (2022b) found that employees from generations Y and Z left their jobs due to the lack of self-development opportunities, disagreement with the company's culture and values, or unsatisfactory relationships with their supervisors (Safarov et al., 2022). Addressing these issues is crucial for fostering a partnership approach, which is vital for human capital development (Salisu, 2022). To identify innovative determinants of human capital management, methodologies such as "the value explorer" for measuring social capital from an accounting perspective (Ievdokymov et al., 2020) and the use of the "checklist for Professional Communication and development" for motivating employees' development (Mujtaba & Meyer, 2022) have been successful. Additionally, alternative methodologies such as the assessment of youth competitiveness in Ukraine's labor market, ranking, and identifying priority areas at the regional level, have been employed (Oliinyk et al., 2020).

The initial assessment of human capital formed through education lays the foundation for higher education development. It is recognized that human learning should evolve alongside personal growth and the impact of technological progress (Melnyk et al., 2021), as individuals possess an inherent capacity for lifelong learning. Consequently, the integration of lifelong learning into higher education becomes imperative (Savga & Liviţchi, 2022). To achieve the goal of acquiring new knowledge and skills within the shortest time frame, innovative technologies such as artificial intelligence, virtual and augmented reality, gamification, big data, and cloud computing are utilized through modeling and digital twins (Melnyk et al., 2021; Lim et al., 2023). Leveraging artificial intelligence for learning holds great potential due to its extensive knowledge base and diverse knowledge dissemination methods (Skrynnyk & Vasilyeva, 2020). Moreover, collective learning surpasses individualistic learning in enhancing interaction, quality, and fostering positive interpersonal outcomes (Khushk et al., 2022). Additionally, es-

tablishing an Investment Lab within universities (Kaya et al., 2023) for experimental learning, providing practical skill development opportunities for students, and strengthening support for domestic academic publishing (Stavrova, 2022) are promising and have a positive impact on economic growth.

The war in Ukraine significantly impacted higher education management and led to various changes in stakeholder needs, including students, society, and the government. Universities in Ukraine had to adapt to the challenges posed by the war and find innovative solutions to fulfill their primary objective of meeting stakeholder needs. For instance, Kyiv National University (KNU) implemented measures to counter propaganda, provide psychological support, and minimize student losses during the war by offering flexible learning options and individual consultations. The university also strengthened international partnerships and grant initiatives to support its educational activities (Bugrov et al., 2023).

Similarly, the Poltava University of Economics and Trade demonstrated resilience by involving young people in professional and volunteer activities to support war refugees and internally displaced persons from occupied territories and areas of active hostilities (Nestulya et al., 2023). The university also used analytical approaches to address financial instability issues and stabilize its academic and scientific components. Lesya Ukrainka Volyn National University showcased its ability to adapt to new roles during the war, with employees and students volunteering to support the military and affected populations (Tsos & Makaruk, 2023). Universities located in areas near active military activities, such as the Zaporizhzhia Polytechnic National University, had to quickly respond to the situation on the frontlines. The university ensured protection against power outages and established backup communication channels to safeguard its digital infrastructure and minimize the impact of military threats on education (Greshta et al., 2023). In terms of agricultural education, Nifatova et al. (2023) evaluated the readiness of agrarian education to meet the country's personnel needs in the medium-term perspective of post-war recovery. They developed an integrated stability index based on various parameters related to education,

science, recognition, and financing to assess the adaptability of 15 agrarian universities to wartime transformations. Furthermore, Yu (2023) investigated the correlation between the student-teacher ratio and government financial resources based on regional differences and influencing factors, highlighting the importance of funding in maintaining an appropriate student-teacher ratio. Overall, these studies demonstrate the challenges faced by Ukrainian universities during the war and their resilience in finding solutions to fulfil stakeholder needs and ensure the continuity of education.

The study by Velychko et al. (2022) focuses on the impact of war on the resources for external quality assurance in educational programs in Ukraine. The research aims to develop algorithms and mechanisms for continuously stimulating higher education institutions to enhance the quality and efficiency of their educational activities. The study also proposes preventive procedures to mitigate the negative consequences of dishonestly achieving key performance indicators, advocating for measures beyond traditional periodic expert evaluations. Furthermore, the investigation conducted by Nestulya et al. (2023) introduces a distinctive method for calculating the integrated index of stability of universities with 15 agrarian universities during wartime transformations to meet the state's personnel needs in the medium-term perspective of post-war recovery.

The activities of universities demonstrate only part of changes in higher education in Ukraine after February 24, 2022, since to enhance the quality of university education for students and meet high quality of life indicators for sustainable development goals through value formation, there should be a system in which value is created through collaboration between all parties involved (Artyukhov et al., 2021; Paraschivescu & Şavga, 2016; Pudryk et al., 2023). To achieve this, it is crucial for vocational education institutions to develop a list and scope of educational services that precisely cater to the regional demands (Smiianov et al., 2020). Artyukhov et al. (2022) emphasized the importance of incorporating feedback from stakeholders about their satisfaction with economic and innovative factors into every analysis procedure to ensure the quality of education aligns with the sustainable develop-

ment goals. Polyakov et al. (2019) proposed a cognitive approach involving the creation of rules and explanations of human behavior, which can serve as a reliable foundation for constructing a model of knowledge-based national economic marketing using a multifactor model. A similar analysis of stakeholder interests and attitudes towards resources in higher education was conducted by Rosak-Szyrocka et al. (2022).

In summary, the literature on higher education demonstrates the adaptation learning and problem-solving during an ongoing war. Hoverer, it is important to find approaches to analyzing and forecasting current effects on higher education to decrease or even prevent resources losses among higher educational institutions and insure conditions for sustainable development of this sector. Therefore, it is essential to analyze the impact of the war in Ukraine on the dynamics of interest in higher education among internet users in Ukraine and European countries based on Google Trends data, which is the aim of the paper.

2. METHODS

Google Trends is a free online tool offered by Google that reflects Google searches, analyzes the popularity of search terms on their search engine over time and across different countries. The tool is widely used for content optimization, consumer insights, and tracking public interest in various subjects. The significance of Google Trends lies in its widespread popularity among internet users, making it an essential resource for tracking and understanding online search behaviors. Unlike other alternative search engines, Google Search stands for 86% of searching traffic worldwide in the current year 2023 (HubSpot, 2023). According to the World Bank, 79% of the population in Ukraine used the Internet in 2021, which is higher per 4% than this indicator in 2020 (75%) and per 9% than in 2019 (70%) (World Bank, 2023). Additionally, Google Trends database can be an appropriate alternative source of current trends in higher education, including students' activities since current official statistical data require more time for collection.

Google Trends is a mature resource for analyzing dynamics of web behavior among Internet users

and its algorithms have been collecting search inquiries from internet users since 2004 and present them in linear graphics based on such selected parameters as keywords, languages, timelines, and countries. The testing of this tool in papers of Preis et al. (2013), Mihaela (2020) and Askitas and Zimmermann (2009) confirms scientific nature of Google Trends results and can be fully used in scientific research.

The Google Trends Scale (GT Scale) is a unique scale of values generated by the Google Search platform, ranging from 0 to 100. It is admitted that 0 value represents not enough data for the chosen parameters to present trends. The peak of popularity is indicated by the value 100, the highest number of inquiries for higher education inquiries. 50 GT Scale means a middle level of popularity among internet users. To reveal quantitative measurement of GT Scale of interest to higher education, comparative analysis was used in periods from June 20, 2021 to February 23, 2022 and from February 24, 2022 to June 20, 2023. For qualitative measurement, trends analysis and the peak approach (what is higher than 80 GT Scale up to 100 GT Scale) are used. The studies by Rovetta and Bhagavathula (2020), Seung-Pyo et al. (2018), and Błajda et al. (2023) confirmed the statistical background of the peak approach. The research defined three levels of interest to higher education among internet users: low (0-25 GT Scale), middle (26-70 GT Scale), and higher point (71-100 GT Scale).

The list comprises 44 potential terms for two language groups in English, and their Ukrainian equivalents are used, resulting in 24 terms filtered by a logical analysis in these languages, ensuring the relevance and popularity in the context of interest in higher education (Table 1).

This study covers two groups of information retrievals:

1. Information retrievals (inquiries) in Google Search from Internet users who reside on the territory of Ukraine before and after the beginning of the war.

2. Information retrievals (inquiries) in Google Search from Internet users who reside in top-10 European recipient countries of Ukrainian refugees after the beginning of the war.

A sample of the top 10 European countries for recipients officially registered "refugee" status according to the United Nation Refugee Agency data after February 24, 2022 (Germany, Poland, Czechia, United Kingdom, Spain, Italy, Bulgaria, Romania, Moldova, Slovakia) was formed to investigate the second category of Google Trends Analysis. In fairness, it should be admitted that the Google Trends tool cannot clearly separate the citizens of those countries from the Ukrainian residents, but the change in dynamics after February 24, 2022 can be significantly indicated by this instrument.

To facilitate the results of Internet queries of Internet users living in Ukraine, a chi-square test was used. The chi-square test is a statistical non-parametric test used to determine the statistical significance of results when analyzing cate-

Table 1. List of keywords

Keywords in English	Ukrainian equivalent of keywords	Not relevant keywords in English	Not relevant Ukrainian keywords' equivalent
Higher education	вища освіта	Institution of higher education	вищий навчальний заклад
University	університет	Doctoral studies	докторантура
Student	студент	Academic degree	академічний ступінь
Faculty	факультет	Educational programs	навчальні програми
Specialty	спеціальність	Admission to higher education	вступ до закладу вищої освіти
Bachelor	бакалавр	International student exchange	міжнародний студентський обмін
Master's degree	магістр	Curriculum	навчальний план
Professional education	професійна освіта	Scholarships for students	стипендія для студентів
Distance education	дистанційна освіта	Student learning	навчання студента
Learning outcomes	результати навчання	–	–
Learning process	навчальний процес	–	–
Distance learning	дистанційне навчання	–	–

gorical data and testing for independence between variables. This test is used to assess whether the observed distribution of data significantly differs from the expected distribution, assuming that there is no association between the variables. The notation "df" stands for degrees of freedom, which is a measure of the number of independent pieces of information used to calculate statistics. The degrees of freedom for the chi-square test of this paper are 1, because there are two investigated timelines. P-value represents the probability of obtaining the observed results with the value between 0 and 1. The p-value is the probability that we will get the same results as the null hypothesis, and in this example, the threshold for this probability is 0.05. The null hypothesis assumes the constancy of obtaining the observed results in the current and expected period. If the calculated p-value is less than 0.05, the null hypothesis is considered false or rejected. And if the value is more than 0.05, then the null hypothesis is considered true.

As a result, key Google Trends Analysis parameters in this paper are:

- Timeline: The investigation period from June 20, 2021 to June 20, 2023 with a middle point of February 24, 2022;

- Countries: Ukraine, top-10 European counties' recipients of recorded Ukrainian refugees;

- General trends and month peaks of internet requests amount internet users (0-100 GT Scale);

- The average value for internet inquiries for terms (0-100 GT Scale);

- Keywords & Languages: 12 filtered terms in English ("higher education", "university", "student", "faculty", "specialty", "bachelor", "master's degree", "professional education", "distance education", "learning outcomes", "learning process" and "distance learning") and 12 filtered terms in Ukrainian Equivalents ("вища освіта", "університет", "студент", "факультет", "спеціальність", "бакалавр", "магістр", "професійна освіта", "дистанційна освіта", "результати навчання", "навчальний процес", "дистанційне навчання").

3. RESULTS

The analysis revealed that of the 24 identified keywords, 17 exhibited peaks of interest after February 24, 2022. The Google Trends of higher education terms in two Ukrainian and English in two time periods – before (from June 20, 2021 to February 23, 2022) and during the war (from February 24, 2022 to June 20, 2023) are demonstrated as linear diagrams (Table 2).

Google Trend analysis showed seasonal tendencies in Internet inquiries among students. The filtered 24 keywords were analyzed for relevance toward student interest via Google Trends. The war affected seasonal trends by changing seasonal peak of student interest: from autumn to winter ("faculty"), from autumn to spring ("master's degree", "professional education" and "learning outcomes"), from autumn to summer ("university" and "specialty"), from summer to spring ("distance learning"), and from winter to autumn ("student"). The trends for "higher education", "bachelor", "distance education" and "learning process" were at the same level before and after war. "Learning outcomes" and "learning process" peaked on October 23, 2021 and January 13, 2022, respectively, before February 24, 2022. After February 24, 2022, "professional education" and "distance education" reached their highest interest on March 19 2023 and June 18 2023, respectively. There were more graduates than applicants for the entire study period, except for 2021, when the number of graduates decreased by 5.5% and will recover by 6.8% next year. In 2022, the difference between entering and graduate students was 11.5%. The drop of number of graduate students is July 2021, which was affected by the starting of the full-scale war, and many students had difficulties with getting university degree.

The number of inquiries of "bachelor" increased rapidly after the war (by 87 GT scale points). The analysis showed an increase after February 24, 2022 in student interest by inquiries such as: "learning process" – 44.9%, "distance education" – 42.9% "student" – 28.8%, and "higher education" – 12.4%.

The number of inquiries of "бакалавр" (bachelor) increased rapidly after the war (by 87 GT scale points). The analysis showed an increase after

Table 2. Dynamics of Internet inquiries of keywords about higher education in English and Ukrainian among internet users in Ukraine before and during the war
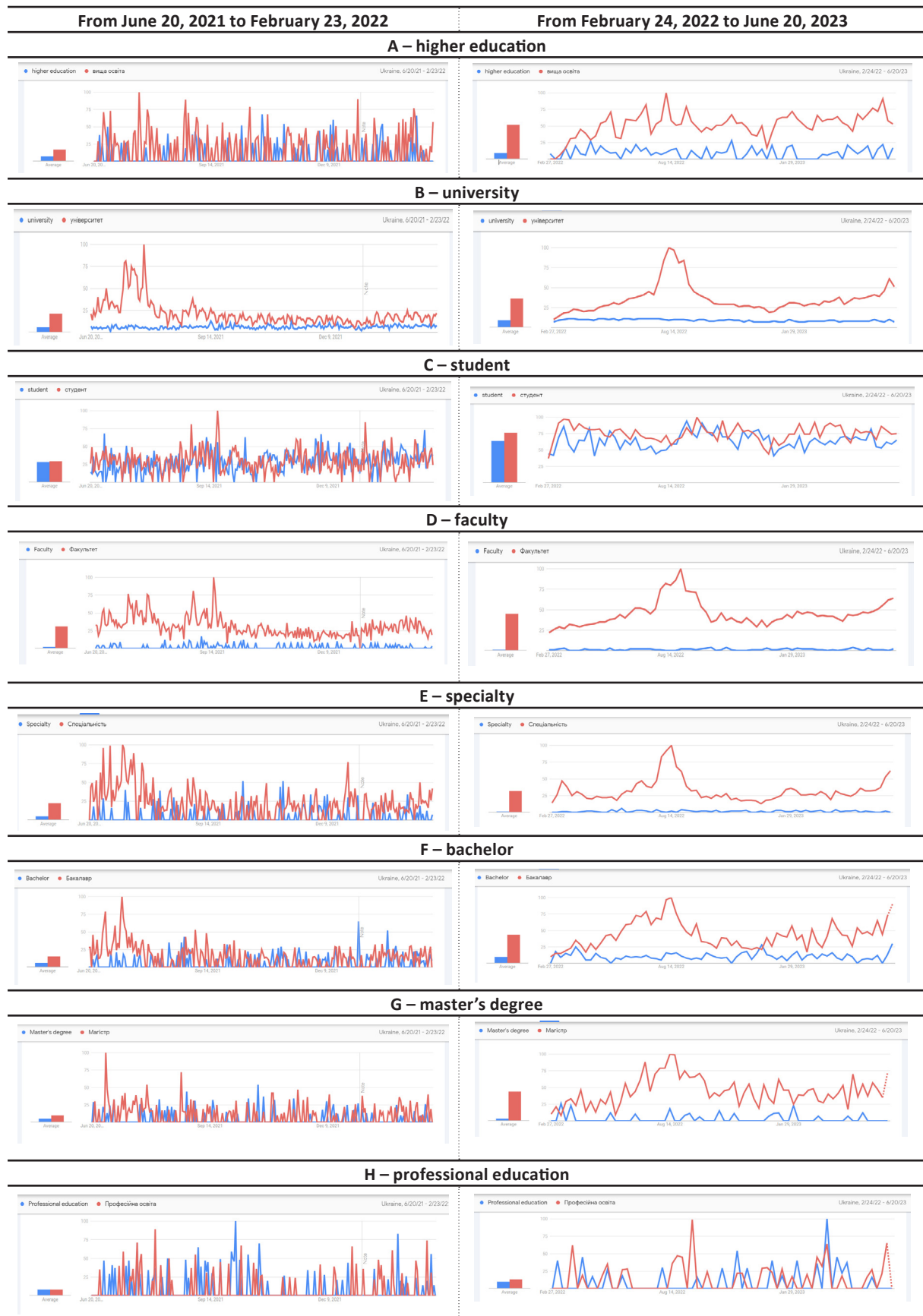
From June 20, 2021 to February 23, 2022	From February 24, 2022 to June 20, 2023
A – higher education	

| **B – university** | |

| **C – student** | |

| **D – faculty** | |

| **E – specialty** | |

| **F – bachelor** | |

| **G – master's degree** | |

| **H – professional education** | |

Table 2 (cont.). Dynamics of Internet inquiries of keywords about higher education in English and Ukrainian among internet users in Ukraine before and during the war

From June 20, 2021 to February 23, 2022	From February 24, 2022 to June 20, 2023
I – distance education	

| J – learning outcomes | |

| K – learning process | |

| L – distance learning | |

Note: Blue is for terms in English, red is for terms in Ukrainian equivalents.

February 24, 2022 in student interest in inquiries such as: "навчальний процес" (learning process) – 44.9%, "distance education" – 42.9% "student" – 28.8%, and "вища освіта" (higher education) – 12.4%.

Table 2 shows the presence of changes in dynamics of students' attitudes toward higher education – increasing interest. Thus, the positive changes from short-term intermittent peak dynamics to a smooth trend curve between two investigated periods were for inquiries with keywords: "higher education", "university", "student", "faculty", "specialty", "bachelor", "master's degree", "bachelor", and "distance learning" (Table 2). Seasonal tendencies for each keyword were found. Students' interest in higher education across various categories emerged in the months of June, August, September, October, December, and February. The keyword "professional education" held high level of interest before and after February 24, 2022 (100 on the GT scale).

The highest popularity in the term "Student" was recorded on September 4, 2021 (GT Scale 94). The term "bachelor" appeared more regularly in student inquiries in August during the war when compared to July before the war. The analysis showed that in the case of 15 out of 22 identified keywords, the peak of interest occurred during the war (after February 24, 2022) (Table 2). The peak of interest in the term "distance education" was recorded on June 18, 2022 (GT 100), which is higher per 30% than highest GT indicator before February 24, 2022. After February 24, 2022, the most frequently searched terms in the field of higher education in Ukraine were "Student", "Professional education", "Learning process" and "Distance education". The chi-square test, with degrees of freedom 11, demonstrates statistical significance for all keywords (p-value = 0), which means that the general dynamics of interest to higher education changed for all keywords after February 24, 2022. For each pair of specific two language key-

words, one of the most used p-values is 0.05. If the calculated p-value turns out to be less than 0.05, the null hypothesis is false, or nullified (hence the name null hypothesis). In the same period, the null hypothesis is confirmed for each pair of keywords separately, because p-value is more than 0.05, which means that the terms were seasonal before and during the war. However, based on the peak approach, the level of popularity for terms in English or in the Ukrainian Equivalent has increased: "student", "professional education" and "distance education".

According to the State Statistics Service, the number of entering students in 2022 academic year is 277,057 which is 6.38% less compared to 2021 and 11.54% compared to 2020. However, general trends demonstrate an increase in inquiries "university" in 2023, peaking in August.

According to the Ministry of Education and Science of Ukraine, 167 professional and higher education institutions were damaged and 24 were destroyed; As of February 24, 2023, 116 properties

and buildings of scientific and educational institutions were damaged and 4 were destroyed. Table 2 shows that the term "university" displayed a nearly identical pattern, with a single peak occurring in July-August of both 2021 and 2022. In Figure 10, the keyword pair "Professional education" exhibited a prolonged and more stable period of popularity after February 24, 2022. In 2022 academic year, there was a 0.68% increase compared to the previous year (1,053 million students).

According to the peaks, the most popular terms were "professional education", "learning outcome", "learning process before the war, and "professional education" and "distance education" after the war. During the full-scale war in 2022, there was an expansion in students' interest in terms such as distance education", "learning outcomes", and "learning process". The search statistics for keywords such as "університет" (university), "факультет" (faculty), "професійна освіта" (professional education), "магістр" (master's degree), and "дистанційна освіта" (distance

Table 3. List of terms and peaks according to Google Trends (GT) for individual terms

| Keyword | Ukrainian Equivalent | GT | Peak of Interest | | Test Results (Chi-Squared Test) | | |
			from June 20th, 2021 to February 23rd, 2022 (Before the War)	from February 24th, 2022 to June 20th, 2023 (After the War)	X2	df	p
Higher education	вища освіта	Peak date	21.10.2021	30.10.2022	58.2451	1	1
		GT Scale	68	27			
University	університет	Peak date	14.09.2021	26.06.2022	151.4	1	1
		GT Scale	14	12			
Student	студент	Peak date	17.02.2022	04.09.2022	7.65	1	0.994323
		GT Scale	73	94			
Faculty	факультет	Peak date	06.09.2021	26.02.2023	161.05	1	1
		GT Scale	17	4			
Specialty	спеціальність	Peak date	09.10.2021	05.06.2022	111.4	1	1
		GT Scale	52	6			
Bachelor	бакалавр	Peak date	01.08.2021	18.06.2023	273.307	1	1
		GT Scale	67	30			
Master's degree	магістр	Peak date	19.10.2021	13.03.2022	75.92	1	1
		GT Scale	54	26			
Professional education	професійна освіта	Peak date	02.10.2021	19.03.2023	1.3697	1	0.758137
		GT Scale	100	100			
Distance education	дистанційна освіта	Peak date	25.07.2021	18.06.2023	10.1111	1	0.998526
		GT Scale	70	100			
Learning outcomes	результати навчання	Peak date	23.10.2021	15.05.2022	21.2008	1	0.999996
		GT Scale	100	54			
Learning process	навчальний процес	Peak date	13.01.2022	08.01.2023	14.9275	1	0.999888
		GT Scale	100	90			
Distance learning	дистанційне навчання	Peak date	28.08.2021	19.03.2023	96.98	1	1
		GT Scale	83	3			

learning) experienced a significant surge, despite their English equivalents. The keyword pair "студент" (student) demonstrated the highest level of synchronization, with increased popularity after begging of the war. Increased interest in the "university" term by students had a peak in July-August of 2021 and 2022. Particular attention should be paid to the fact that student search term was "higher education" with "postponement from mobilization, "second higher education mobilization", and "second education admission conditions 2023".

Increasing interest in distance learning leads to an intelligent consumer trend, where consumer needs for higher education are identified via individualization of the processes of production and consumption of products, which can affect this production. Therefore, along with the creation of digital twins, which are an analogy of goods, one could talk about the creation of a digital twin that would characterize the main features of the consumer (Melnyk et al., 2021).

The war in Ukraine has indeed had a serious impact on the country's educational processes. Power outages and fear of danger force people to seek alternative ways of learning, including turning to online content to acquire knowledge. Moreover, due to the war, students at higher education institutions may face additional problems and stresses arising from constant anxiety and the need to take shelter in bomb shelters. This can affect their motivation and interest to higher education. To address these trends, the Ministry of Education and Science (The Ministry of Education and Science of Ukraine, 2023) is taking several steps, including creating measures to allow the admission of individuals who do not fully meet the knowledge and skill requirements for higher education. The number of university applicants has likely fluctuated before and after the war. For instance, external Independent Evaluation Exams (ZVO) are now conducted with video cameras to ensure fair and honest results and prevent any misuse. Moreover, for master's programs, there is a mandatory requirement for English language proficiency.

According to the UN Refugee Agency, the top recipients of students affected by war since February 24, 2022 are Germany, Poland, the Czech Republic,

the United Kingdom, Spain, Italy, Bulgaria, Romania, Moldova, and Slovakia (Table 4).

Table 4. Top-10 recipient European countries for refugees from Ukraine after February 24, 2022, billion people

Countries	Date of record	Refugees from Ukraine recorded in country as of date, after February 24, 2022
Germany	10.07.2023	1,079,815
Poland	17.07.2023	968,390
Czechia	23.06.2023	356,625
The United Kingdom	10.06.2023	209,300
Spain	23.06.2023	186,045
Italy	21.06.2023	163,570
Bulgaria	11.06.2023	162,935
Romania	18.06.2023	95,035
Moldova	23.07.2023	115,305
Slovakia	23.07.2023	105,245

The following three terms were chosen for the study of web behavior in Google Search, in particular interest in higher education: "university", "student", and "bachelor" since emigration or presence on European county territories related to educational emigration for entering to the universities in those counties.

According to Table 5, dynamics of Internet inquiries in Germany, Poland, Czechia, the United Kingdom, Spain, Italy, Bulgaria, Romania, Moldova, and Slovakia have changed from short-term effect peaks to long-term peaks among Ukrainian internet users after February 24, 2022. The peaks demonstrate the highest level of interest in "university" in August, September, February, and May during the wartime. The highest number of inquiries was in July 2022 (period of application for universities) in Poland, which is closely connected with the rapid increase of emigration abroad due to starting the active stage of military actions. The highest peak was in July 2022, which coincided with the period of university applications and a decline in the number of graduates in Ukraine in the same period due to war.

The analysis revealed significant changes in students' attitudes towards higher education in European counties from June 20, 2023 to June 20, 2023 with a middle point of February 24, 2022. There is a correlation between negative trends of student interest per 32% from July 2021 (100 GT Scale) to July 2022

Table 5. Dynamics of Internet inquiries of keywords "university", "student", and "bachelor" in top-10 European recipient counties for refugees from Ukraine before and during the war
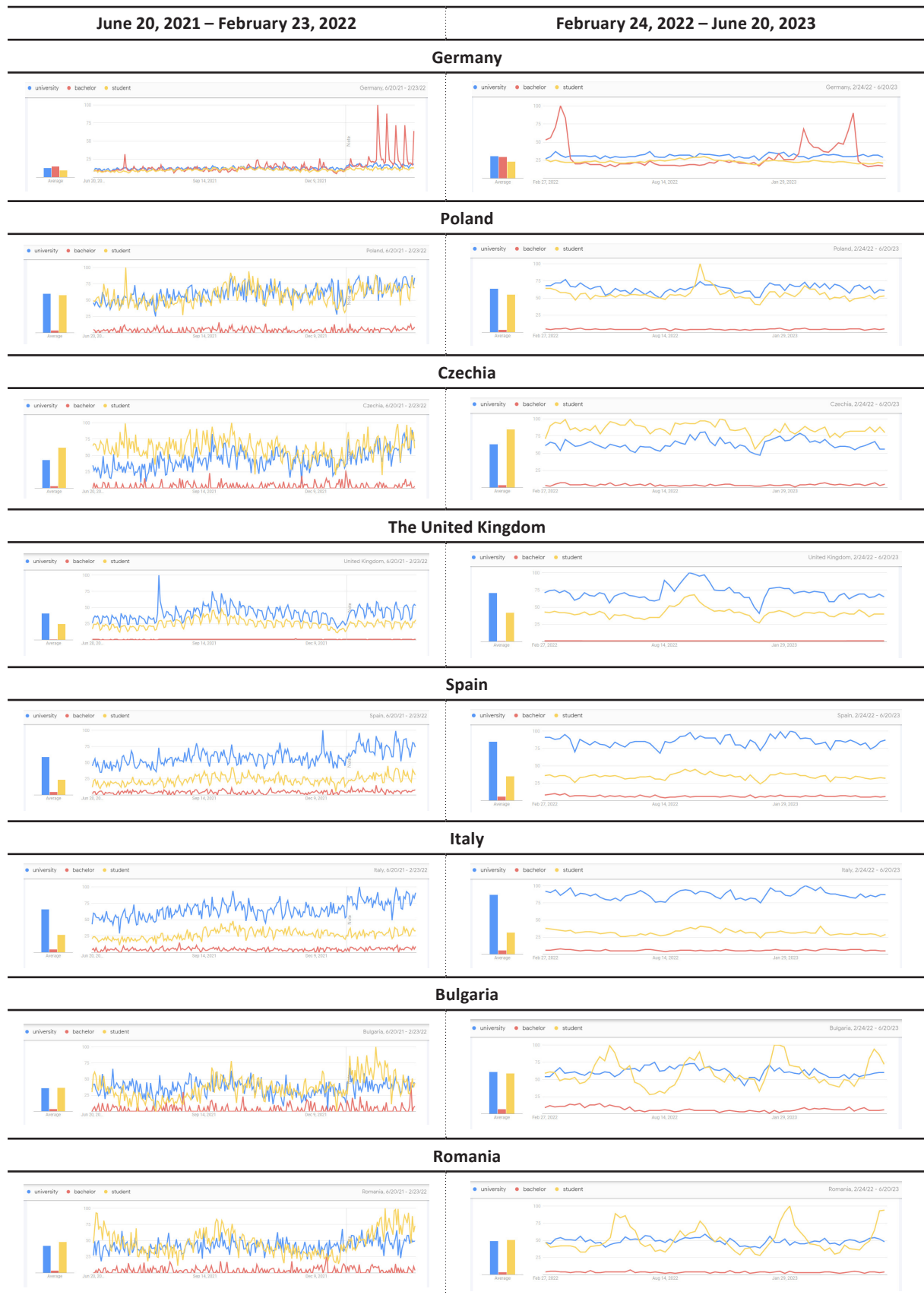
June 20, 2021 – February 23, 2022	February 24, 2022 – June 20, 2023

Germany

Poland

Czechia

The United Kingdom

Spain

Italy

Bulgaria

Romania

Table 5 (cont.). Dynamics of Internet inquiries of keywords "university", "student", and "bachelor" in top-10 European recipient counties for refugees from Ukraine before and during the war

June 20, 2021 – February 23, 2022	February 24, 2022 – June 20, 2023
Moldova	
Slovakia	
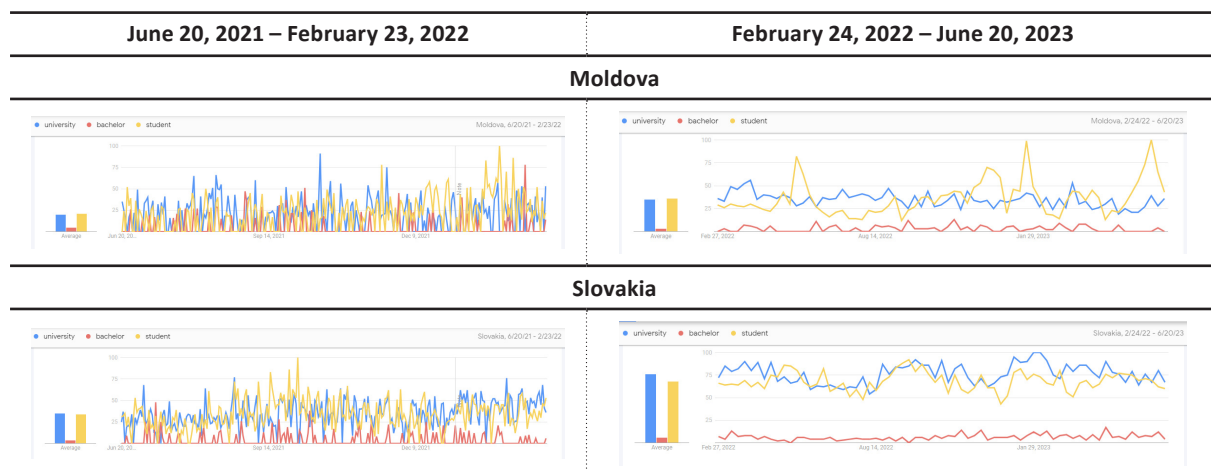
Note: Blue stands for the term "university", red for "bachelor", and yellow for "student".

(68 GT Scale) in Ukraine, and a positive trend of the same indicator in the investigated European counties is 80-100 GT Scale after February 24, 2022 to August 2022. Moreover, the number of graduate students in 2022 academic year fell by 33.3% compared to the previous year in Ukraine. The war caused a lot of barriers in gaining higher education in Ukraine and led to forced education emigration to European counties. However, there are a number of populations who have decided to get new qualification in Ukraine too, because the number of entering students grew by 6.4% in 2022. Student demand in European counties has led to the following trends: distance education with flexible time to be not affected by war consequences, self-study approach arranged by students to have opportunity to arrange volunteer and other activities, and specialties and faculties that provide professional skills for sustainable employment in the labor market and preferences. The results of student attitudes are distance education with flexible time to be not affected by war consequences, self-study approach arranged by students to have opportunity to arrange volunteer and other activities, and specialties and faculties that provide professional skills for sustainable employment in the labor market and preferences.

4. DISCUSSION

Analysis of interest in higher education among consumers of higher education in Ukraine and European countries during the ongoing war has not been widely disseminated. This paper discusses changes in attitudes, motivations towards a particular area of higher education.

Gerasymenko and Petrenko (2023) used a traditional method of collecting information – a survey among students of the medical faculty at the university on the subject of changes in the interest and motivation of students towards higher education. The student survey results show that for most students (77.3%), knowledge of the discipline is more important than the grade, which is motivated by the prospect of decent employment. However, it was found that 68% of students indicated that their attitude towards higher education changed during the war, in particular, this attitude became more responsible. This study differs from the study by Gerasymenko and Petrenko (2023) by the method of data collection, namely Google Search, which allows expanding the sample of not only students, but also potential entering students. Moreover, unlike the work of Gerasimenko and Petrenko (2023), the geography in this work is not limited to Ukraine, but includes European countries.

Lesik et al. (2022) analyzed the factors that affected the higher education system in Ukraine using Data Envelopment Analysis (DEA), graphical analysis via DEAP Version 2.1, and regression analysis. The methodology is based on assessing quality of subsequent decision making at the level of educational institutions, educational management, and added value across 24 grouped regions

of Ukraine. This study also uses a graphical method to convey the changes that have occurred since the beginning of the full-scale war in Ukraine, but this tool is less accessible than Google Trends analysis and can be difficult to use. The analysis is carried out by geographical distribution, without chronological and keyword analysis.

Lakhmotova et al. (2022) explore the issue of motivation for distance learning among students of higher education institutions during times of martial law. The methodology involved the use of online surveys using a 5-point rating scale (5 being the highest motivation) through Google Forms among third-year students of Vasyl Stefanyk Precarpathian National University, V.N. Karazin Kharkiv National University, and H.S. Skovoroda Kharkiv National Pedagogical University. The survey results showed that 88% of all respondents were driven by external motivation towards distance learning in Ukraine after February 24, 2022. Key factors of external motivation were scholarship support (52 students out of 85 rated it 5 points) and emotional state (35 students). This study proposes to focus on the interest specifically in the concept of distance education, while this paper finds that Google Trends mainly attracted terms such as "faculty", "major", "university", and others.

Zakharov et al. (2023) investigated the motivations of applicants to a medical higher education institution in choosing the medical profession based on the results of surveys conducted with applicants who were admitted for master's degree studies in Medicine at Dniprovskyi State Medical University in 2022. According to the methodology, statistical analysis was performed using the STATISTICA software package. The main motivations for entering the medical higher education institution were interest in medical science (97.5%), a desire to help others (93.1%), the possibility of obtaining a prestigious profession (88.6%), and the opportunity for guaranteed employment (81.2%). Zakharov et al.'s study of results is based on a specific group of students entering graduate school, while this study included a study of all students from applicants to undergraduate programs enrolled in bachelor's and master's programs.

A further research perspective is the development of various tools to identify the needs of users of higher education by developing roadmaps in the framework of short-term and long-term forecasts of higher education trends and the development of effective recommendations for university management.

CONCLUSION

The paper aims to investigate changes in interest in higher education among internet users based on their web behavior in Google Search after the war. Google Trends analysis with the combination of a peak approach and chi-square test allowed investigating the results in geographical, chronological and keyword measurements.

General trends in Ukraine demonstrate increased interest in higher education from low (0-40 GT Scale) or middle (40-50 GT Scale) point up to higher point (80-100 GT Scale) after February 24, 2022 and during the ongoing war. The most significant changes in interest among inquiries of users residing on the territory of Ukraine showed the dynamics of popularity of "higher education" (per 30% of GT Scale), "universities", and "professional education" (per 24% of GT Scale), according to Google Trends Analysis in Ukraine. According to the chi-square test, the seasonality trends in interest of higher education have changed after February 24, 2022, which confirms the hull hypothesis that seasonality trends in interest of higher education for each keyword pair were not affected by the war. The peak approach shows peaks in June, when the examination campaign for admission to universities starts, and in August, when the academic year begins at universities.

An analysis of European countries reveals a general increase or persistence at an average or high level of interest in at least one investigated term in higher education among residents, except Germany. The interest to higher education among Internet users in Germany was low (average 9-12 GT Scale for all

three terms) till January 2022. The largest number of refugees arrived in Poland, including those wishing to receive higher education. However, the internet inquiries of the term "bachelor" was at the same low level (4 GT Scale) during the entire investigated period, while "student" and "universities" was at the middle level of interest. The number of Internet requests among residents of the Czech Republic after February 24, 2022 shows an increase of 20% for the terms "student" and "universities"; Poland, Czech Republic, Great Britain, Spain, Italy, Bulgaria, Romania, Moldova and Slovakia. As for the United Kingdom, the average level of interest increased only for the term "university" – from 42 GT point to 71, with peaks for August 2021 and September 2022. Spain and Italy have similar changes in trends for higher education, with increasing interest in "universities" for 5 GT point and 20 GT point accordingly in average measurements. Search activities most similar to Ukrainian seasonal trends appeared among Internet users in Bulgaria, Romania, Moldova, where the share of Ukrainian refugees is one third of the population. In Slovakia, the level of interest in terms "university" and "student" significantly increased from low to high level of interest (average GT scale 76 and 68 during the war, while before 39 and 39) after February 24, 2022.

The above results show that the interest in higher education among Ukrainian and European Internet users is growing. However, web behavior has shown an increase in interest in those countries that are located far from Ukraine. That is why the government of Ukraine, together with Ukrainian universities, should provide alternative educational programs for distance learning with employment after graduation, create a safe educational environment, provide a powerful resource system at universities to stimulate the return to Ukraine of more young people who are residents of another country, which bring a positive economic effect. Moreover, it would be useful to develop these reforms and programs based on the interests and needs of young people so that they have a higher level of effectiveness. Therefore, it is planned to draw up maps of interests of higher education in the future perspective of research.

AUTHOR CONTRIBUTIONS

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