Małgorzata Przybyła-Kasperek
University of Silesia in Katowice, Institute of Computer Science, Poland
https://orcid.org/0000-0003-0616-9694

Kornel Chromiński
University of Silesia in Katowice, Institute of Computer Science, Poland
https://orcid.org/0000-0001-9875-5812

Eugenia Smyrnova-Trybulska
University of Silesia in Katowice, Faculty of Arts and Educational Science, Poland
https://orcid.org/0000-0003-1227-014X

Nataliia Morze
Borys Grinchenko Kyiv University, Faculty of Information Technologies and Mathematics
https://orcid.org/0000-0003-3477-9254

Ainur Bazarbayeva
Kazakh National Women's Teacher Training University, Institute of Physics, Mathematics and Digital Technologies, Kazakhstan
https://orcid.org/0000-0002-8810-196X

Importance, Popularity and Elements of Educational Platforms – A Study of the Opinions of Students from Poland, Ukraine and Kazakhstan

Abstract

This article presents a comparative international research study analyzing the opinions of students from Poland, Ukraine, and Kazakhstan regarding the importance, popularity, and elements of educational platforms in the field of computer science. The study employed the Kruskal-Wallis test for statistical analysis. The research questions addressed are as follows: RQ1: Which educational platforms, in general, and which specific platforms, are most popular among students from Poland, Ukraine and Kazakhstan and which specific platforms? RQ2: What topics are most frequently searched for on educational platforms, and what motivates students

from Poland, Ukraine and Kazakhstan to engage in learning through educational platforms? RQ3: How do students from Poland, Ukraine and Kazakhstan evaluate the usefulness of different types of content posted on educational platforms, and do they use various platforms to share their code? RQ4: How do students from Poland, Ukraine and Kazakhstan evaluate the elements of courses on educational platforms that they consider most important or useful. RQ5: How do students from Poland, Ukraine and Kazakhstan evaluate the value of courses offered on educational platforms? Five hypotheses are proposed: The country of origin does not affect the frequency of use of educational platforms. The country of origin affects the topics of courses that students are interested in on educational platforms. The country of origin does not affect the motivation to take courses on educational platforms. The country of origin does not affect the evaluation of elements of the courses on educational platforms that students find most important or useful. The country of origin affects the evaluation of value of courses provided on educational platforms. The most popular topics on these platforms are programming and computer networks, with students from Kazakhstan also displaying a keen interest in subjects related to artificial intelligence and computer graphics. Additionally, this study analyzes the conditions of learning and teaching in specialized modules at each university, including teacher requirements, curricula, and the potential for practical implementation of new knowledge by students. Furthermore, the study examines course elements that are most essential to students, such as video recordings of lectures, tutorials/instructional videos, practical tasks, and solutions to tasks. The article concludes with a discussion and summary of the findings.

K e y w o r d s: Educational platforms, Student opinion, Tutorials, Practical task, Questionnaire, Kruskal-Wallis test

Introduction

The continuous success of Massive Open Online Courses (MOOCs) is driving an increasing number of institutions to adopt this method of delivering distance education. In 2014, there were over 400 universities engaged in providing MOOCs (Miranda, Isaias & Pifano, 2015), offering more than 2,400 courses. Online education has gained significant prominence in the 21st century, particularly following the COVID-19 pandemic. One of the major trends in higher education is the widespread adoption of Massive Open Online Courses (MOOCs), now a common feature in many universities worldwide (Nguyen, 2022). Despite the potential benefits of MOOCs in expanding educational choices and enhancing learning, the persistent issue of low completion rates remains (Wang, Cao, Xu, & Li, 2022).

While Coursera, Udacity, and edX continue to be the dominant MOOC providers, there are approximately 50 MOOC platforms, each offering unique courses and learning approaches. Given this diverse array of providers, this paper aims to develop a model for assessing the quality of MOOC platforms (Miranda, Isaias, & Pifano, 2015).

Literature review

The aim of the research was to develop and test an introductory computer science course for a middle school titled "Fundamentals of Computational Thinking Development (FACT)". This course was designed to prepare and inspire middle school students for future engagement in algorithmic problem solving. Furthermore, FACT was piloted as a seven-week course on Stanford's OpenEdX MOOC platform for blended classroom learning (Grover, Pea, & Cooper, 2015). The research assessed changes in students' perceptions of computer science as a discipline. The r esults, obtained through mixed-method analysis, indicated that students in both the pilot and the main studies (1) demonstrated significant progress in their algorithmic thinking skills, (2) were able to transfer their learning from Scratch to a text-based programming context, and (3) exhibited substantial improvements in their understanding of computer science as a discipline (Grover, Pea, & Cooper, 2015). The authors stressed that students' previous computer experience, as measured by entrance tests, and their math abilities were strong predictors of learning outcomes.

Miranda, Isaias, and Pifano (2015) proposed a model for assessing the quality of MOOC activities, based on six categories: openness, mass, content, communication tools, evaluation methods and participants. These categories reflect fundamental aspects of MOOC platforms and were derived from an extensive literature review of MOOCs, supported by an analysis of specific courses offered on five MOOC platforms: edX, Coursera, Udacity, FutureLearn and MiriadaX (Miranda, Isaias, & Pifano, 2015). Veletsianos and Shepherdson (2016) conducted a systematic analysis and synthesis of the empirical MOOC literature published between 2013 and 2015.

In their study, Zhu, Sari, & Lee (2020) explored various research methods, topics, and trends in MOOC empirical research, with a focus on student-related themes, design, and instructor-related aspects. Among student-focused topics, student retention, learning experience, and engagement were frequently discussed. The majority of MOOC authors were affiliated with institutions in the US, China, and Spain (Zhu, Sari, & Lee, 2020). In a review of sensory learning MOOCs, Limone, Pati, and Loprior (2022) examined empirical MOOC studies published

between 2008 and 2021. They conducted a comprehensive search across databases including PubMed, Scopus, Web of Science, and Google Scholar. The review aimed to enhance understanding of sensory acquisition and its future implications for research.

Nguyen (2022) emphasized that learners in MOOCs typically interact with pre-designed materials and often engage in self-directed learning. Understanding learner satisfaction with such courses is crucial for improving their learning experiences and performance. Nguyen's study employed a mixed-methods approach, combining a survey design with semi-structured interviews involving 120 students of a Vietnamese private university enrolled in academic writing courses on Coursera, one of the world's leading MOOC platforms (Nguyen, 2022). The study identified moderate correlations between students' satisfaction and their perceived usefulness of Coursera courses. Pedagogically, the study highlighted the need for teacher feedback, faster support from course designers, and user-friendly plagiarism checking tools to enhance learners' satisfaction with MOOCs.

Wang, Cao, Xu, and Li (2022) conducted a systematic review of articles on learning engagement in MOOCs published between 2015 and 2022. Their review revealed that engagement in learning can be measured through various methods, including diary, text, image, interview, and survey data analysis. They categorized the factors influencing engagement as intrinsic (e.g. satisfaction with learning) or extrinsic (e.g. curriculum design). The authors emphasized the importance of Course Instructors providing technical support ("scaffolding") to enhance self-directed learning and increase student engagement in MOOCs (Wang, Cao, Xu, & Li, 2022).

Zhu, Sari, and Lee (2018) conducted a systematic review of research methods and topics in empirical MOOC literature published between October 2014 and November 2016. Their study explored key areas of MOOC research, with an emphasis on student retention and motivation as most frequently cited, followed by student experience, satisfaction, assessment and instructional design (Zhu, Sari, & Lee, 2018).

With the growing number of people learning on Massive Open Online Courses (MOOCs), self-directed learning (SDL) skills are essential for their success. An analysis of how to support self-directed learning in MOOCs in the context of motivation, learning strategies and instruction was carried out by Zhu, Bonk, & Berri (2022). Their study aimed to investigate student motivation to enroll in MOOCs and their SDL strategies, as well as the instructional elements supporting SDL from the students' perspective. Among their findings, the authors identified that the instructional elements such as self-assessment, discussion forums, feedback from instructors, flexibility, clearly defined learning goals, authentic content and small training units were instrumental in supporting SDL. The implications of the study are discussed in the article (Zhu, Bonk, & Berri, 2022). The data obtained from the research – semi-structured interviews with 15 students from three MOOC

courses were analyzed using thematic analysis. The researchers found that motivation for enrolling in MOOCs included intrinsic motivation (e.g. curiosity, deepening personal knowledge and personal interest) and extrinsic motivation (e.g. supporting formal education and career development). The learning strategies used by MOOC students are Task Strategies, Self-Control, and Self-Management Strategies. Task strategies included taking notes, reading texts or subtitles, watching videos, and doing further research. Self-monitoring strategies included self-assessment, self-reflection, progress indicators, final projects, and authentic tasks (Zhu, Bonk, & Berri, 2022).

Some of the important issues have been the essential study interests of MOOC scholars in recent years. Papadimitriou (2023) discussed critical research questions related to MOOC effectiveness, including dropout rates, completion rates, loneliness, and the potential of Adaptive and Intelligent MOOCs. The study examined the learner characteristics used for adaptation and the methods and techniques employed to improve traditional MOOCs.

The research conducted by Smyrnova-Trybulska et al., in 2015–2022 focused on assessing the digital competences of pre-service and in-service teachers who completed the MOOC "Contemporary ICT Tools and Innovative Methods of Creative Education". The study examined various theoretical and practical aspects (Smyrnova-Trybulska et al., 2016), social and educational dimensions (Smyrnova-Trybulska et al., 2015) as well as methodological aspects of developing MOOCs (Smyrnova-Trybulska et al., 2017). Following the Preliminary Analysis of the Development and Implementation of the MOOC Project (Smyrnova-Trybulska, Sekret, & Morze, 2021), the most recent study (2022) provides a brief description of the MOOC, outlines the course requirements and analyzes the learning outcomes through the students' self-evaluation and feedback. The MOOC was developed in both Polish and English as part of the project "MOOCs for Sciences of Education" and hosted on the Polish MOOC platform Navoica (www.navoica.pl) within the framework of a competition, initiated by of Ministry of Education and Science of Poland and National Centre for Research and Development (NCBR – Narodowe Centrum Badań i Rozwoju) under the theme "Direction to the MOOC". The conclusions drawn from the focussed assessment of the MOOC and the overall recommendations for enhancing MOOC effectiveness in formal education and improving learning outcomes were derived from research and are presented accordingly (Smyrnova-Trybulska, Sekret, Morze, & McKay, 2022). Despite significant progress, there remain research questions that still need to be answered. This article contributes new research results obtained from an international comparative study conducted in Poland, Ukraine, and Kazakhstan to the research area.

M. Przybyła-Kasperek, K. Chromiński, E. Smyrnova-Trybulska, N. Morze, A. Bazarbayeva

Methodology

The research presented in this paper was conducted through a questionnaire survey simultaneously administered at three universities in three different countries: Poland, Ukraine and Kazakhstan. It is important to note that the higher education systems and mentalities in Poland, Kazakhstan, and Ukraine are influenced by historical, cultural, and socio-economic factors. All three countries were part of the Socialist Bloc, and the Soviet Bloc, that was the coalition of communist states of Central and Eastern Europe, and they gained independence in the early 1990s after the dissolution of the USSR. This shared history has left a significant impact on their political, economic, and social structures. These countries have a three-tier higher education system – Bachelor's, Master's, and Doctorate – following the Bologna Process standards. All three countries are increasingly recognizing the importance of globalization and are working to internationalize their higher education systems. In Poland, the education system is aligned with the European Higher Education Area standards. Kazakhstan, like Ukraine, has a Soviet legacy that has influenced its educational system.

The survey was conducted anonymously and on a voluntary basis. The questionnaire, available via Google Form online, was distributed to students majoring in computer science. It encompassed a range of questions regarding educational platforms. The questionnaire questions were divided into four thematic groups: sociological characteristics, frequency of use of educational platforms, the most interesting topics of the courses, assessment of the usefulness of various contents within the courses and the use of code-sharing platforms. Such division appear thematically coherent and provide a comprehensive analysis of the topic. The answers to most of the questions were provided on a 5-point scale, which allows for a wide interpretation. The collected data were analyzed using various statistical methods, in particular the Kruskal-Wallis test, along with various statistical metrics and charts, with a special emphasis on box-plot graphs. Depending on the research question addressed, datas were collected in appropriate groups and their characteristics were compared. The primary objective of this study was to examine differences in students' attitudes, frequency of use, and assessment of the usefulness of courses offered on educational platforms. The study also investigated the topics of courses on educational platforms that were of greatest interest to students from different countries. To achieve this, multiple statistical metrics were computed, and the results were visually represented using column graphs and box-plot graphs. Furthermore, several statistical tests were conducted to validate the five main hypotheses, which are detailed below. These hypotheses pertain to the frequency of educational platform usage, the preferred course topics, motivations for taking courses on educational platforms, evaluations of course elements, and assessments of the value of courses offered on educational platforms.

Questionnaire, purpose and research questions

Our research aimed to explore students' attitudes toward a variety of educational platforms, identify the platforms most frequently utilized, and ascertain which elements provided on these platforms were most valuable to students. The survey was conducted in June 2023 and involved students majoring in computer science from the University of Silesia in Katowice, Poland (Faculty of Science and Technology), Borys Grinchenko Kyiv University, Ukraine, and West Kazakhstan Agrarian-Technical University named after Zhangir Khan. The selected universities have much in common. All three universities offer a wide range of programs in various fields. They all have a strong focus on research and innovation. The West Kazakhstan Agrarian-Technical University has a specific focus on agrarian and technical fields, setting it apart from universities with a broader range of programs. Also, the West Kazakhstan Agrarian-Technical University is noted as being among the youngest universities in the country, while the other two have a longer history. It should be noted that there are multidimensional differences between students from the analyzed universities, such as differences of situation of students, governmental support, economic and war stability. However, in this research we did not analyze these factors. Such analysis and the impact of various parameters on the students' perceptions of MOOC will be conducted in future work. A total of 158 responses were collected, with respondents selected randomly. Students at various stages of their studies were invited to participate in the survey through email invitations, and their participation was entirely voluntary. Selected research results were presented in the Comparative International Research In Area Of Educational Platform And MOOCs In Opinion Of IT Students Using Data Mining Analysing (Chromiński, Przybyła-Kasperek, Smyrnova-Trybulska, Bazarbayeva, Morze, 2023).

Sociological metrics

In order to study the relationship between student characteristics and attitude towards educational platforms, the questionnaire included sociological questions. The sociological characteristics questions and possible responses in the questionnaire are presented below:
- gender – male, female
- degree of study – Engineer's Degree, Master's Degree
- age – <19–20>, <21–22>, <23–24>, <25–26>, <27–28>, <29–30>, >30

Descriptive statistics on the responses obtained related to the sociological metrics are presented in Table 1.

Table 1.

Descriptive statistics on responses to sociological questions

Gender	Quantity/ Percentage	Degree of study	Quantity/ Percentage	Age	Quantity/ Percentage
Male	117/74.05	Engineer's Degree	114/72.15	<19–20>	18/11.39
Female	41/25.95	Master's Degree	44/27.85	<21–22> <23–24>	70/44.30 33/20.89
				<25–26>	8/5.06
				<27–28>	4/2.53
				<29–30> >30	5/3.16 20/12.66

S o u r c e: Own work.

Based on the results obtained, it can be concluded that the majority of respondents were male engineering students. The largest group consisted of individuals aged 21 to 24 years old, constituting 65% of the respondents. Concerning the participation of students from different countries, the largest group was from Poland – 81 students responding to the questionnaire. Additionally, 40 students from Kazakhstan and 37 students from Ukraine participated and answered the survey questions.

In Poland, Kazakhstan and Ukraine students often start their higher education with a Bachelor's degree, typically around 19–20 years old in Poland, the age of 18–19 in Kazakhstan and around 17–18 years old in Ukraine; after completing secondary education. So there are some differences, however, small and it is unlikely that they have much impact on the distribution of age of questionnaire participants. Therefore, it seems that due to the similarity in terms of age of study and many aspects resulting from the historical homogeneity of the education background in Central and Eastern European countries, groups of students from Poland, Kazakhstan and Ukraine seem to be quite homogeneous.

Research questions and hypotheses

The research conducted can be categorized into three main areas.

The first group examined the frequency of the use of educational platforms in general and identified the most popular platforms. Our next group of questions focused on what topics are most frequently searched for on educational platforms, and explored the motivation behind students' engagement in educational platforms. The last group of questions concerned evaluating the usefulness of different types of content posted on educational platforms and investigated whether students use a variety of platforms to share their code.

The research questions (RQ1–RQ5) are as follows:

RQ1: Which educational platforms, in general, and which specific platforms, are most popular among students from Poland, Ukraine and Kazakhstan?

RQ2: What topics are most frequently searched for on educational platforms, and what motivates students from Poland, Ukraine and Kazakhstan to engage in learning through educational platforms?

RQ3: How do students from Poland, Ukraine and Kazakhstan evaluate the usefulness of different types of content posted on educational platforms, and do they use various platforms to share their code?

RQ4: How do students from Poland, Ukraine and Kazakhstan evaluate the elements of courses on educational platforms that they consider most important or useful.

RQ5: How do students from Poland, Ukraine and Kazakhstan evaluate the value of courses offered on educational platforms.

Hypotheses determined based on RQ1–RQ5 are as follows:

H1: The country of origin does not affect the frequency of use of educational platforms.

H2: The country of origin affects the topics of courses that students are interested in on educational platforms.

H3: The country of origin does not affect the motivation to take courses on educational platforms.

H4: The country of origin does not affect the evaluation of elements of the courses on educational platforms that students find most important or useful.

H5: The country of origin affects the evaluation of value of courses provided on educational platforms.

Results and statistical tests

In this section, we will present statistical tests, analyses and their outcomes related to the usage of educational platforms, categorized into three themes corresponding to the topics listed above.

Frequency of use and the most popular educational platforms

In this part of the questionnaire, we explored the popularity of educational platforms and identified which ones are most frequently used by students. The main questions and their potential responses were as follows:

1. How often do you use educational platforms to learn about programming/IT issues? – Three or more times a week, Once a week, Once every two weeks, Once a month, Once every six months, Once a year, Never.
2. Indicate how often you use educational platforms to learn about programming/IT issues.
   a) Udemy
   b) Codecademy
   c) Coursera
   d) edX
   e) Khan Academy
   f) FreeCodeCamp
   g) Treehouse
   h) Udacity
   i) Navoica
   j) Prometheus
   k) Cognitive Class

For the second question, the respondents provided their frequency of use on a 5-point scale, with 1 indicating "I do not use" and 5 indicating "I use very often."

Descriptive statistics regarding the responses obtained for the first question are presented in Table 2. The first column provides aggregated results for all countries, and the subsequent three columns show down the results by country.

Table 2.
Descriptive statistics on responses to the question related to frequency of usage educational platforms

Frequency of usage	Total Quantity/ Percentage	Poland Quantity/ Percentage	Kazakhstan Quantity/ Percentage	Ukraine Quantity/ Percentage
Never	5/3.16	2/2.47	2/5	1/2.70
Once a year	2/1.27	1/1.23	0/0	1/2.70
Once every six months	9/5.70	5/6.17	4/10	0/0
Once a month	21/13.29	11/13.58	4/10	6/16.22
Once every two weeks	18/11.39	9/11.11	4/10	5/13.51
Once a week	49/31.01	24/29.63	11/27.5	14/37.84
Three or more times a week	54/34.18	29/35.80	15/37.5	10/27.03

S o u r c e: Own work.

The first conclusion drawn from the results is that students in computer science use educational platforms quite frequently – there are only a few students who do not use these platforms at all or use them only once a year. It is evident that the distributions of results in Poland, Kazakhstan and Ukraine are very similar.
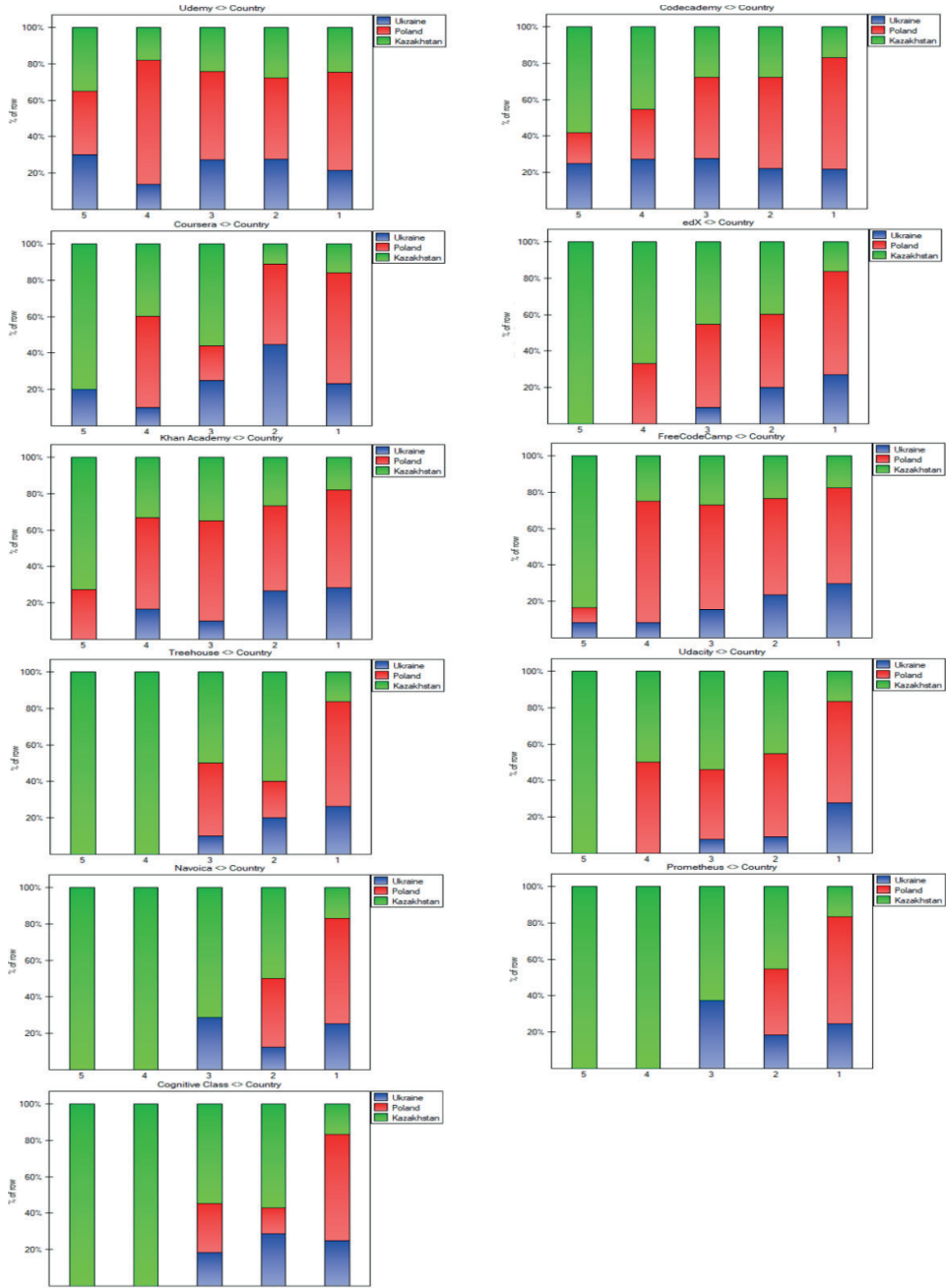
Figure 1. Charts of the responses obtained related to the question how often you use educational platforms to learn about programming/IT issues, with 1 indicating "I do not use" and 5 indicating "I use very often"

S o u r c e: Own work.

This leads to a hypothesis that the country of origin does not significantly affect the frequency of educational platform use. The statistical significance of this hypothesis was assessed using The Kruskal-Wallis tests for groups defined by country. The result $H(2,158) = 0.19$ and *p-value* equal to 0.91 were obtained. Therefore, it confirmed the first hypothesis H1, stating that the country of origin has no effect on the frequency of educational platform usage. Similarly, the Kruskal-Wallis test was performed to verify whether age has an impact on the frequency of students' use of educational platforms. Once again, no statistically significant differences were found in the frequency of platform use among groups of students categorized by age.

Figure 1 presents a column chart illustrating the responses to the second question about the frequency of use of each educational platform, categorized by the country in which the respondents study. It is evident that the most popular educational platform is Udemy, as indicated by the highest columns across all countries for the answer 5 – "I use very often." Codecademy and FreeCodeCamp follow closely in terms of frequency of use, occupying the second position. Khan Academy ranks third in terms of popularity, while other educational platforms are used less frequently.

Remarkably, there is no significant difference in the distribution of the frequency of use for each platform among students from the analyzed countries. The same platforms appear to be the most popular in Poland, Ukraine, and Kazakhstan. To verify this observation, the Kruskal-Wallis test was conducted to assess whether there were significant differences in the average frequency of use of individual platforms by country. The test confirmed that there is no significant difference in the case of the Udemy platform. However, for the other platforms, it indicated significant differences in the averages. A further analysis of the box-plot graphs revealed that the results from students in Kazakhstan had an influence on this outcome, as a small group of students often selected the highest answer, 5, which accounts for the observed differences.

Topics most frequently utilized on educational platforms, and motivation for using educational platforms

In this part of the questionnaire, we explored the topics of the courses that are most commonly used on educational platforms, and the motivations that led students to take a course on these educational platforms. The main questions and potential responses were as follows:

3. Select the topics of the courses you use on educational platforms.
   a) Programming
   b) Artificial intelligence
   c) Computer networks
   d) Computer graphics

    e) Databases
    f) Mathematics
    g) Biometrics
    h) Computer architecture
4. What was your motivation for starting the course?
    a) Willingness to learn about new technologies/issues
    b) Supplementing the topics taught as part of the studies
    c) A lack of understanding of the topics covered in the studies and the need for self-study
    d) Labor market need, employer suggestion

Responses to all questions were rated using 5-point scale, where 1 indicated "I do not use" or "Absolutely disagree," and 5 indicated "I use very often" or "Absolutely agree.".

Figure 2 presents a column chart illustrating the responses to the question regarding the topics of courses that students use on educational platforms, categorized by the country in which the respondents study. It is evident that programming is the most popular topic on educational platforms. In the second place are students interested in computer networks and databases. Artificial intelligence takes the third place in terms of students' interest. Other courses have gained moderate interest, with biometrics topics receiving the least interest from students.

The Kruskal-Wallis test was performed to verify whether there are significant differences in the average interest level of students from different countries in particular topics. The results, including group size, p-values, and test statistic values, are presented in Table 3. All obtained results are statistically significant. Thus, hypothesis H2, which posits that the country of origin does affect the topics of courses that students are interested in on educational platforms, is confirmed. In addition, Figure 3 includes box-plot graphs prepared for each topic and country separately. It is noticeable that students from Kazakhstan exhibit particularly higher interest in the topics offered on educational platforms, a trend that is consistent across all topics. When comparing Polish and Ukrainian students, it is Polish students who show more interest in the topics related to computer networks and mathematics. Conversely, Ukrainian students display more interest in topics related to computer graphics and databases.

Such differences in students' interest in particular topics are probably due to the specificity of specializations offered at various universities at which students study. A detailed discussion of the various study profiles is provided in the Discussions section, but we will now present the basic profiles. At the considered university in Poland, the emphasis is putted mainly on software and engineering applications as well as computer graphics. The main area of interest of the considered university in Kazakhstan is artificial intelligence and information systems and technologies. However, the main area of interest of the considered university in Ukraine is computer engineering, programming, mathematics and cybersecurity.
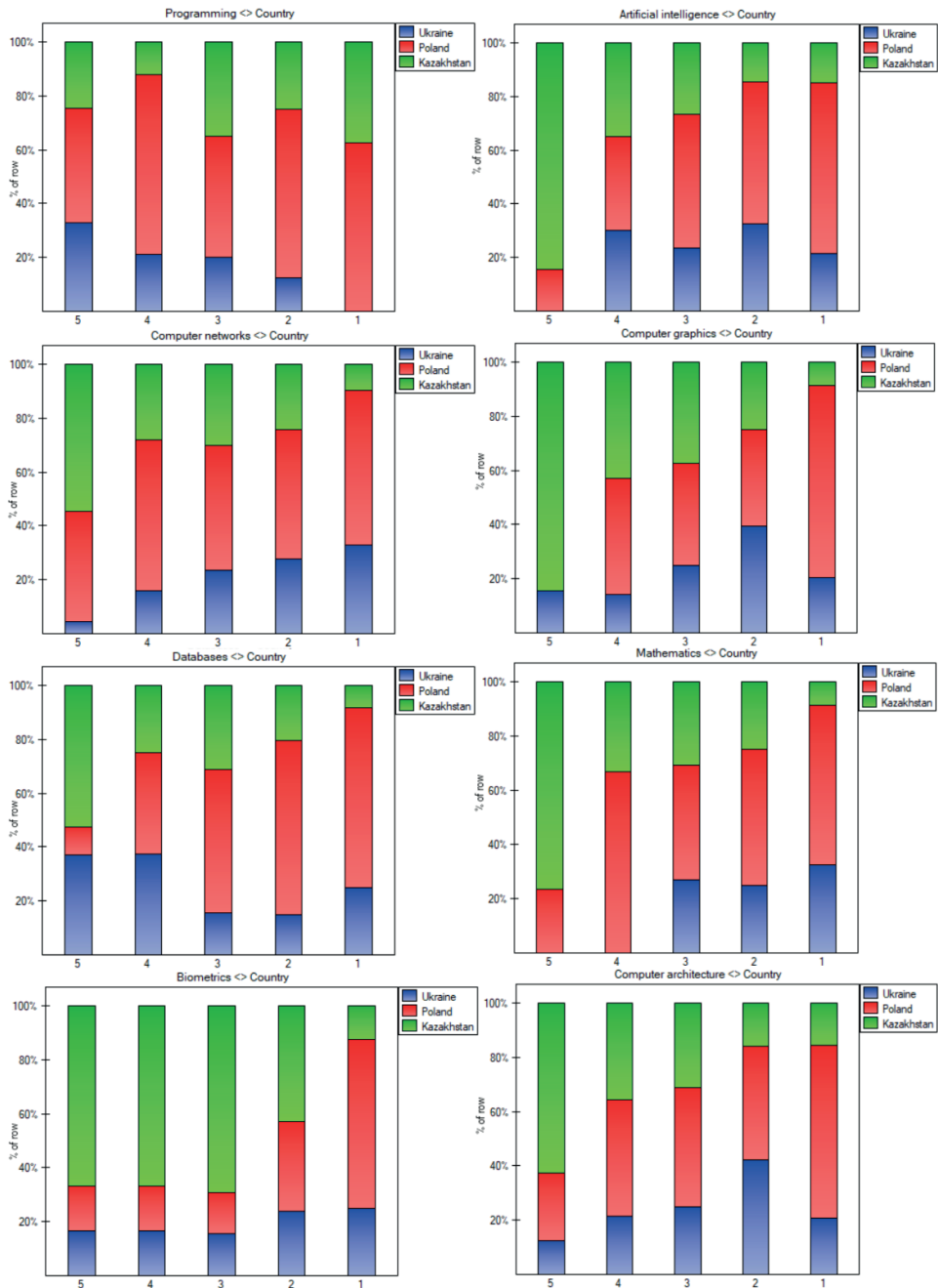
Figure 2. Charts of the responses obtained related to the question about topics of the courses used by students on educational platforms, with 5 indicating "I use very often", 1 indicating "I do not use"

S o u r c e: Own work.

Table 3.
The Kruskal-Wallis test results for the responses obtained related to the question about topics of the courses used by students on educational platforms

Topic	Kazakhstan	Poland	Ukraine
n	40	81	37
Programming		H(2,158)=6.111; p-value=0.047	
Artificial intelligence		H(2,158)=18.204; p-value=0.0001	
Computer networks		H(2,158)=16.946; p-value=0.0002	
Computer graphics		H(2,158)=37.125; p-value=0.0001	
Databases		H(2,158)=17.786; p-value=0.0001	
Mathematics		H(2,158)=28.968; p-value=0.0001	
Biometrics		H(2,158)=37.182; p-value=0.0001	
Computer architecture		H(2,158)=14.841; p-value=0.0006	

S o u r c e: Own work.

The next aspect investigated concerned students' motivation when taking a course on educational platforms. Figure 4 presents a column chart illustrating the responses to the question about the motivation for starting a course on educational platforms, categorized by the country in which the respondents study. As observed, the primary motivation for students in all countries was the desire to learn about new technologies and issues. Moreover, students from Poland were frequently motivated by the need to address specific issues or difficulties that arose during their studies. In contrast, for students from Kazakhstan and Ukraine, supplementing their academic material was not as significant a motivation for taking courses on educational platforms. Surprisingly, the motivation related to labor market needs was relatively average for students. It appears that Kazakh students had the highest motivation when it came to supplementing their knowledge required for their jobs.

The Kruskal-Wallis test was performed to verify whether there are significant differences in the average assessment of motivation for taking courses on educational platforms between countries. The test confirmed that there is no significant difference in almost all tested aspects. Only for the motivation of willingness to learn about new technologies/issues statistically significant difference in averages was confirmed with values $H(2,158) = 8.063$, *p-value* = 0.0177. In this case, Ukrainian students demonstrated the highest motivation for taking courses with a desire to expand their knowledge, as can be seen in Figure 5, which includes box-plot graphs for each motivation and country separately. Thus, hypothesis H3, which posits that the country of origin, in general, does not affect the motivation to take courses on educational platforms, is confirmed.
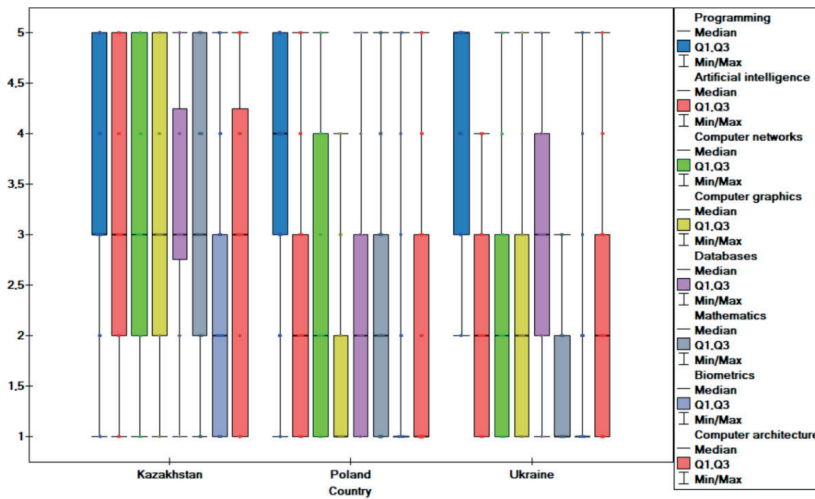
Figure 3. Box-plot graphs of the responses obtained related to the question about topics of the courses used by students on educational platforms, with 5 indicating "I use very often", 1 indicating " I do not use"
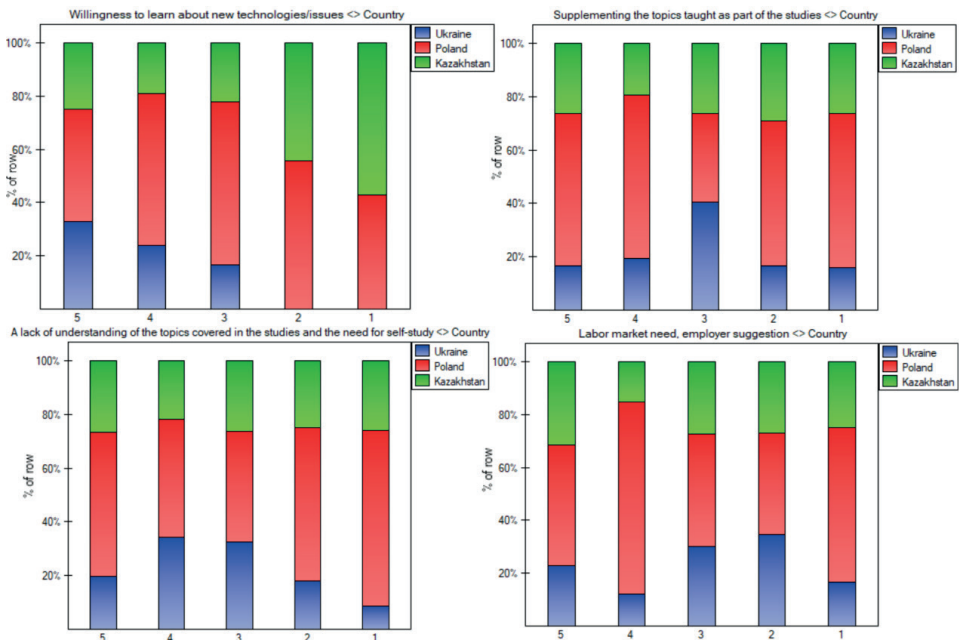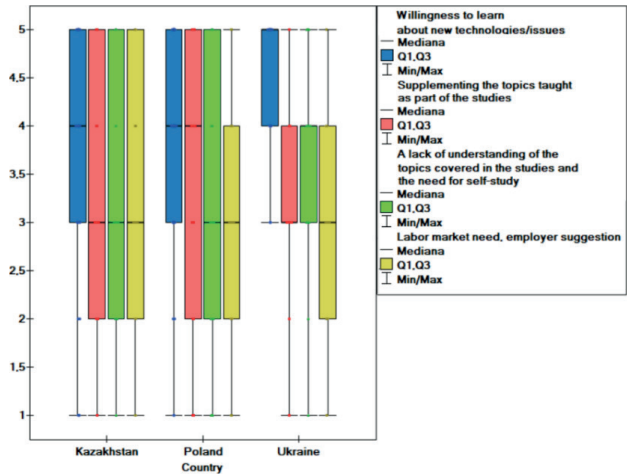
S o u r c e: Own work.

Figure 4. Charts of the responses obtained related to the question about the motivation for starting the course on educational platforms, with 5 indicating "Absolutely agree", 1 indicating "Absolutely disagree"

S o u r c e: Own work.

Figure 5. Box-plot graphs of the responses obtained related to the question about topics of the courses used by students on educational platforms

S o u r c e: Own work.

Usefulness of different types of content posted on educational platforms and usage of a variety of platforms to share students' code

In the last part of the questionnaire, we focused on the content of courses that students find most useful on educational platforms. Additionally, we inquired whether students themselves use these platforms to share their code. The primary questions and possible responses were as follows:

5. What elements of the course on educational platforms do you find most important/useful
   a) Theoretical description to the topic
   b) Video recordings of lectures
   c) Tutorials/Instructional videos
   d) Practical tasks
   e) Solutions to tasks
   f) Control tests
6. Do you think the courses offered on educational platforms are valuable?
7. Do you use code sharing platforms/tools – specifically Git systems (GitHub, GitLab, Bitbucket, etc.) – as part of expanding your knowledge?
8. Do you use code sharing platforms/tools – specifically Stack Overflow systems – as part of expanding your knowledge?
   For all these questions, the possible responses were defined using a 5-point scale, where 1 signifies "Not useful" or "I do not use" or "Absolutely disagree," and 5 denotes "Very useful" or "I use very often" or "Absolutely agree."

Figure 6 presents a column chart illustrating the responses to the question about the elements of the course on educational platforms that students find most important and useful, categorized by the country in which the respondents study. It is evident that students from all analyzed countries highly value course content such as Tutorials/Instructional Videos, Practical tasks, and Solutions to tasks. Additionally, Figure 7 highlights that these elements hold particular importance for students from Poland and Ukraine. Video recordings of lectures were also considered quite significant by students. Conversely, the elements of courses on educational platforms that students find the least important are Theoretical descriptions of the topic and Control tests.
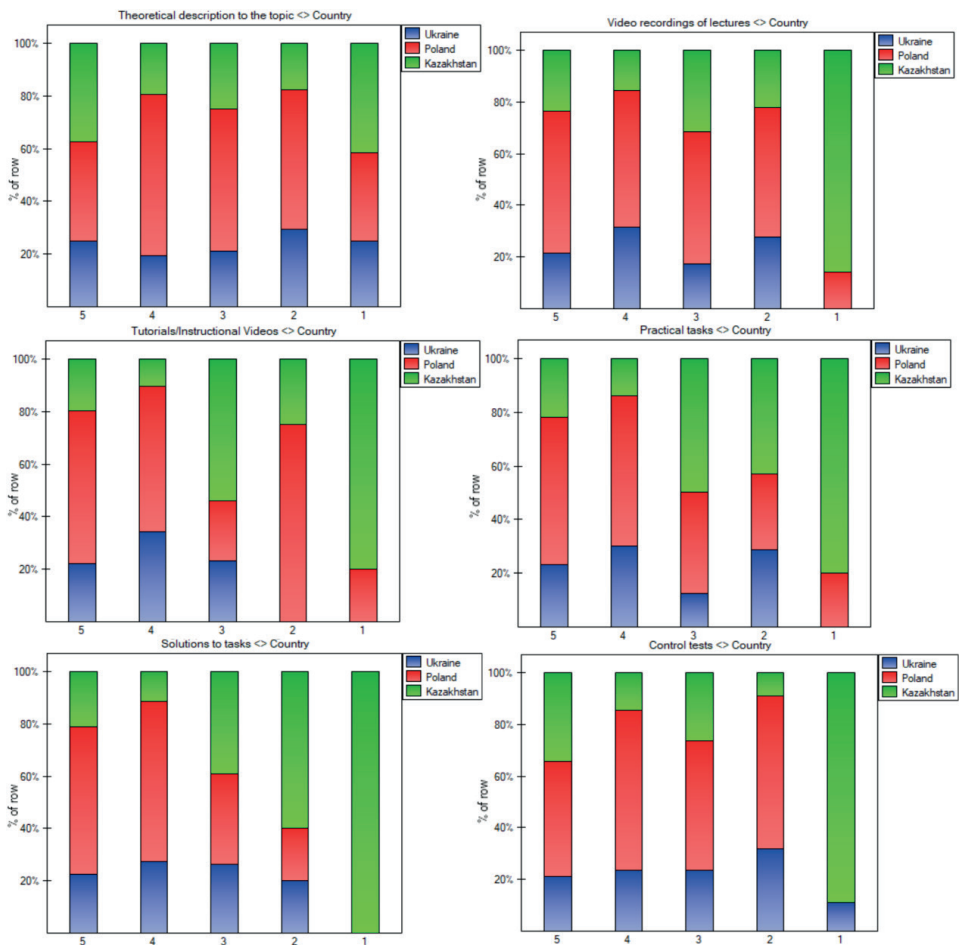

*Figure 6. C*harts of the responses obtained related to the elements of the course at educational platforms that students find most important/useful, with 5 indicating "Very useful", 1 indicating "Not useful"

S o u r c e: Own work.

The Kruskal-Wallis test was performed to verify whether there are significant differences in the average evaluation of elements of the course on educational platforms that students find most important and useful. The test confirmed that there is no significant difference in almost all the tested aspects. This confirmed hypothesis H4, suggesting that the country from which the student originates, in general, does not affect the evaluation of elements of the course on educational platforms that students find most important and useful. However, for the elements such as Tutorials/Instructional Videos and Solutions to tasks, a statistically significant difference in averages was confirmed with values $H(2,158) = 8.365$ *p-value* = 0.0153 and $H(2,158) = 8.183$ *p-value* = 0.0167, respectively. Polish students rated these elements as the most relevant, while students from Kazakhstan gave them lower ratings.
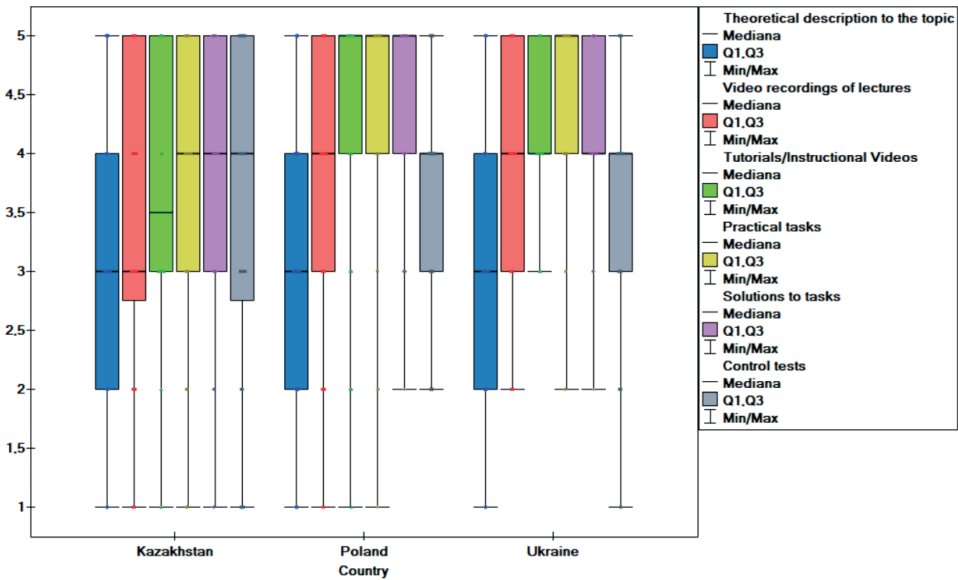

Figure 7. Box-plot graphs of the responses obtained related to the question about elements of the course on educational platforms that students find most important/useful

S o u r c e: Own work.

A question was also posed whether students find the courses posted on educational platforms valuable. Figure 8 presents a column chart illustrating the answers to this question, and the box-plot graphs display the responses obtained, categorized by the country in which the respondents study. As observed, Ukrainian students rate the value of courses available on educational platforms the highest. Students from Poland, who also rate the value of such courses highly, come in second place. The lowest importance or valence of courses is given by students from Kazakhstan.

The Kruskal-Wallis test confirms significant differences in the average evaluation of the value of courses provided on educational platforms, with results $H(2,158) = 12.223$ *p-value* $= 0.0022$. Thus, hypothesis H5 is confirmed, suggesting that the country of origin does affect the evaluation of the value of courses provided on educational platforms. Such differential student evaluation of the value of courses may result from their expectations towards the courses and attitudes. This specific attitude may be related to comparing courses conducted at individual universities with courses conducted using educational platforms. A detailed analysis of the specificity of all the considered universities is presented in the Discussions section, but it is definitely the level of knowledge and specificity of the classes that are offered at each university that determines the level of students' expectations towards courses on educational platforms.

The final stage of the research investigated whether students also share their work, specifically their program code, on platforms. Figure 9 presents a column chart illustrating the answers to the question of whether students use code sharing platforms/tools, and Figure 10 provides the box-plot graphs for the obtained results. It is evident that students use platforms like Git systems (GitHub, GitLab, Bitbucket, etc.) or Stack Overflow systems as part of expanding their knowledge. The only exception is students from Kazakhstan, who are less likely to use Stack Overflow systems. The Kruskal-Wallis test confirms significant differences in the usage of code sharing platforms/tools like Stack Overflow systems as part of expanding knowledge among students from the studied countries, with results $H(2,158) = 17.696$ *p-value* $= 0.0001$.
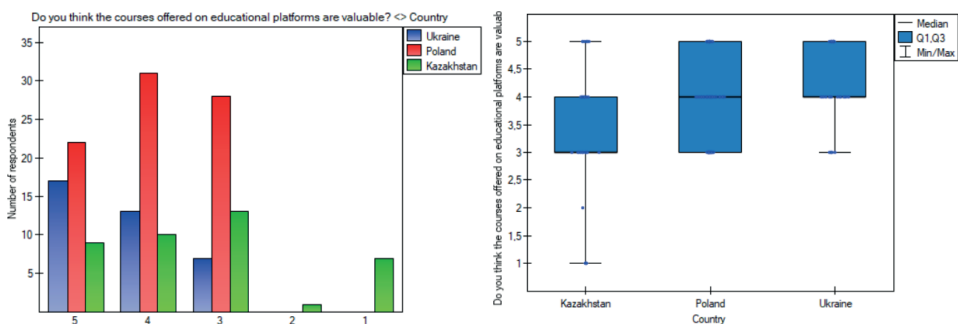

Figure 8. Charts and box-plot graphs of the responses obtained related to the question about whether students find the courses posted on educational platforms valuable
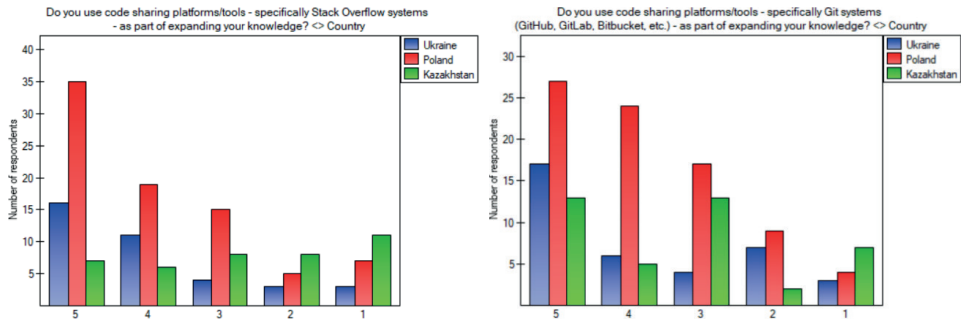
S o u r c e: Own work.

Figure 9. Charts of the responses obtained related to whether students used code sharing platforms/tools, with 5 indicating "I use very often", 1 indicating "I do not use"
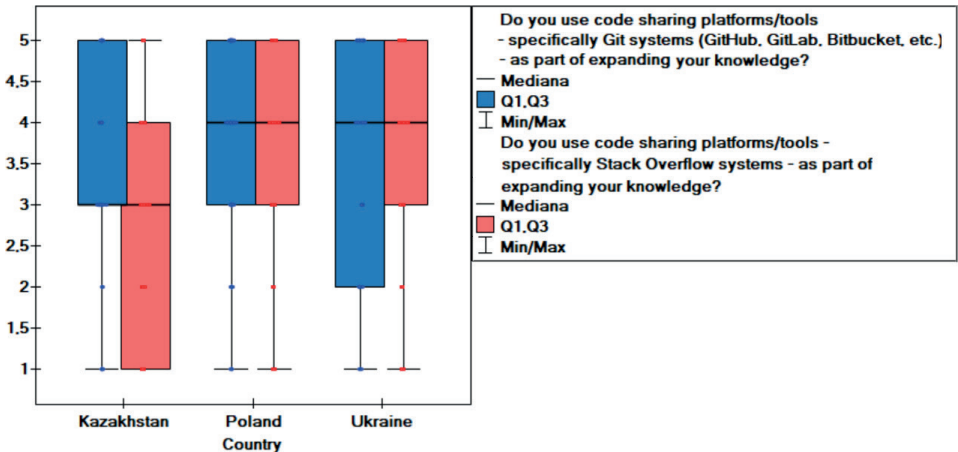
S o u r c e: Own work.

Figure 10. Box-plot graphs of the responses obtained related to whether students used code-sharing platforms/tools

S o u r c e: Own work.

Discussions

At the University of Silesia in Katowice, in the field of computer science, there is a strong emphasis placed on issues such as programming, including web applications programming and computer networks. This emphasis is also reflected in the most popular courses among Polish students on educational platforms. As Figure 3 shows, programming courses are the most popular among Polish students

on educational platforms, with computer networks being the second most popular. The specialities offered in the field of computer science are as follows:

Software engineering – students acquire knowledge and skills in all aspects of software development, with a special emphasis placed on programming, modern application development methodologies, and user interface design.

Information systems engineering – the program covers the design of information systems, with an emphasis on practical aspects such as databases, desktop application programming, web application development, mobile application development, and cloud computing. The curriculum is aligned with current trends in software development and labour market requirements.

Web and hybrid application graphics – students gain expertise in designing graphical interfaces for web applications, with a focus on front-end design for web and mobile applications, back-end programming for mobile apps, interactive and real-time graphics design, and the application of geometric modelling methods and multi-resolution image analysis.

Computer game programming – graduates of the specialty are capable of designing and implementing computer games and multimedia applications using advanced techniques and tools, in line with the latest industry trends.

Web application design – this program introduces students to modern methods of building interactive web applications that run in web browsers and other environments. Students learn front-end application design (HTML, JavaScript, Bootstrap, JQuery) and back-end application development (MVC, PHP, JEE), as well as technologies for building, testing, and maintaining web applications across various operating systems.

Computer networks and mobile devices – the speciality focuses on designing and configuring modern internet networks, including the selection of communication protocols and hardware and software configuration. Practical knowledge is gained through hands-on experience with CISCO equipment.

Data processing technologies – the educational content covers a wide range of data processing methods and technologies, with a particular emphasis on designing, implementing, and analyzing information systems that support data processing in business, engineering, and scientific applications.

In Kazakhstan, both the West Kazakhstan Agrarian-Technical University named after Zhangir Khan and the Kazakh National Women's Teacher Training University, located in Uralsk and Almaty, respectively, train computer science specialists for various fields of activity. Due to the widespread use of AI in many areas of life, there is a significant interest among students in artificial intelligence, which is reflected in the diagrams above and is also evident in research projects and student startups. The educational programs in the field of computer science in Kazakhstan include:

Information Systems and Technologies – this program covers programming, web programming, database administration, information systems, computer net-

works, and information security. It offers learning trajectories and elective subjects that allow students to specialize in their chosen field and function professionally after graduation.

In 2023, the Ministry of Higher Education and Science of the Republic of Kazakhstan implemented the "Coursera in Kazakh Language" programme, providing free access to Coursera platform courses in English and Kazakh to over 20,000 students from 25 regional universities in Kazakhstan, including the Kazakh National Women's Teacher Training University. As a result, more than 22,000 courses were made available.

Borys Grinchenko Kyiv University got access to more than 5,200 free courses and 2,200 managed projects from the world's leading universities thanks to Coursera's cooperation with the Ministry of Education and Science of Ukraine. Also, the BGKU elaborated a digital campus (https://digital.kubg.edu.ua), which includes a lot of useful e-services for students and academic teachers, which successfully support the didactic and scientific work at the university.

Borys Grinchenko Kyiv University educates students in the following educational programs for bachelors: Informatics, Computer Engineering, Security of Information and Communication Systems and prepares the following specialists:

In the field of information and analytical systems, there are: developer of computer systems, system administrator, a specialist in computer modelling, forecasting and optimization of processes in various industries, a specialist in design and implementation of modern databases, designer of computer systems, analyst of computer systems.

In the field of Security of information and communication systems it offers: cyber security specialist, cyber security analyst, cyber security project manager, cyber security engineer;

In Computer Engineering, there are: Programming Engineer, Network Engineer, Hardware Development Engineer, Software Tester, Data Analyst, Web Developer, Technical Support Engineer.

Students in these bachelor's programmes study the following subjects: technology of creating software products, programming, system programming, computer architecture, parallel and distributed computer systems, computer networks, applied modelling and programming, design of embedded systems, robotics, computer graphics and animation, programming: decision-making management systems, computer game development technologies, information analysis and processing technologies, databases and information systems, algorithms and data structures.

In addition, the university implements the following master's programs: information and analytical systems, security of information and communication systems, where students have the opportunity to study the following subjects: computer modelling of systems, information and analytical systems, analysis and processing of big data, computer URBAN monitoring systems, digital technologies of communications and management, IT project management, data analytics, computer

modelling of systems, software engineering, processing and analysis of big data, artificial intelligence, information-analytical systems.

Electronic training courses hosted in LMS Moodle have been developed and implemented for all academic disciplines at the University of Grinchenko. Since distance learning has been systematically introduced at the university for more than 10 years, and the developed e-learning courses are evaluated and certified, students are used to using their own Moodle system with training courses. This can be explained by a low interest of students from Ukraine in using MOOC materials posted on open platforms. University students have enough e-course material for learning, created by the university's teachers themselves, which is highly appreciated by students. In addition, the university does not encourage the use of open platforms and learning on them, since according to the internal regulation of the organization of the educational process, students are not credited with the certificates they received while studying at MOOC.

Conclusions

In conclusion, the findings of this research have provided valuable insights into the impact of the country of origin and the university where the student is studying on various aspects of students' engagement with educational platforms. It has been demonstrated that the country of origin does play a significant role in shaping students' preferences and behaviours within the educational context.

Firstly, the notion that the country of origin does not affect the frequency of use of educational platforms has been refuted.

Secondly, the research supports the hypothesis that the country of origin does influence the topics of courses that students are interested in on educational platforms. This highlights the importance of considering cultural and societal factors in tailoring educational content to meet the diverse preferences and needs of students from different regions.

In terms of motivatio to take courses, the hypothesis suggesting that the country of origin does not affect motivation has been contradicted.

Interestingly, while the country of origin may not significantly impact the evaluation of specific elements within courses, such as content or delivery methods, the research suggests that it does influence the overall perceived value of courses on educational platforms. This underscores the importance of considering cultural perspectives in designing and delivering courses to ensure they are perceived as valuable and relevant across different regions.

In essence, this study highlights the multifaceted influence of the country of origin on students' interactions with educational platforms. Acknowledging and

understanding these influences is crucial for educators and platform developers to create more inclusive and effective educational environments that cater to the diverse needs and expectations of students worldwide.

The main recommendation for academic teachers is to consider whether completing a specific course on an educational platform, aligned with the module's content, could be recognized or rewarded in some way when grading the module. It is important to note that this should not necessarily be a mandatory component of module credit since some courses on these platforms may require payment, and students should not be obligated to access them. However, for more active students who have invested their time and resources in completing these courses, acknowledging their effort when determining the final module grade could be a motivating incentive. Regarding the recommendation for teachers of universities in Kazakhstan to help students use the opportunities presented by these programs, this is a good opportunity for students, who may not have a high level of proficiency in English. Encouraging students to use these resources should depend on the level of the course.

An obvious limitation of educational platforms is the absence of direct interaction with a teacher or mentor who can provide motivation, serve as a positive role model in the discipline, and offer personalized support aligned with students' individual needs. The educational platforms examined in this study do not provide artificial intelligence modules that could partially mimic a teacher's support. Future research should explore the impact of artificial intelligence-based modules available on educational platforms and their influence on the learning process of students.

Acknowledgements

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Małgorzata Przybyła-Kasperek, Kornel Chromiński, Eugenia Smyrnova-Trybulska, Nataliia Morze, Ainur Bazarbayeva

Znaczenie, popularność i elementy platform edukacyjnych – badanie opinii studentów z Polski, Ukrainy i Kazachstanu

Streszczenie

W artykule zaprezentowano analizę porównawczą wyników międzynarodowych badań, dotyczących opinii studentów informatyki z Polski, Ukrainy i Kazachstanu na temat znaczenia, popularności i elementów platform edukacyjnych. Zastosowano statystyczny test Kruskala-Wallisa. Otrzymano odpowiedzi na pytania badawcze: : RQ1: Które platformy edukacyjne, ogólnie i ściśle rzecz biorąc, są najbardziej popularne wśród studentów z Polski, Ukrainy i Kazachstanu? RQ2: Jakie tematy są najczęściej wyszukiwane na platformach edukacyjnych i co motywuje studentów z Polski, Ukrainy i Kazachstanu do angażowania się w naukę za pośrednictwem platform edukacyjnych? RQ3: Jak uczniowie z Polski, Ukrainy i Kazachstanu oceniają przydatność różnych rodzajów treści publikowanych na platformach edukacyjnych i czy używają różnych platform do udostępniania swojego kodu? RQ4: Jak studenci z Polski, Ukrainy i Kazachstanu oceniają elementy kursów na platformach edukacyjnych, które uważają za najważniejsze lub najbardziej przydatne? RQ5: Jak studenci z Polski, Ukrainy i Kazachstanu oceniają wartość kursów oferowanych na platformach edukacyjnych. Zaproponowano pięć hipotez: Kraj pochodzenia nie wpływa na częstotliwość korzystania z platform edukacyjnych. Kraj pochodzenia wpływa na tematy kursów, którymi studenci są zainteresowani na platformach edukacyjnych. Kraj pochodzenia nie wpływa na motywację do uczestnictwa w kursach na platformach edukacyjnych. Kraj pochodzenia nie wpływa na ocenę elementów kursów na platformach edukacyjnych, które studenci uważają za najważniejsze lub najbardziej przydatne. Kraj pochodzenia wpływa na ocenę wartości kursów oferowanych na platformach edukacyjnych. Najpopularniejszymi tematami na platformach edukacyjnych są programowanie i sieci komputerowe, natomiast studentów z Kazachstanu bardzo interesują także tematy związane ze sztuczną inteligencją i grafiką komputerową. Dodatkowo przeanalizowano warunki kształcenia i nauczania modułów specjalistycznych na każdej uczelni, m.in. wymagania nauczycieli, programy nauczania, możliwość praktycznego wdrożenia nowej wiedzy przez studentów. Również analizowano elementy zajęć, które

są dla studentów najbardziej istotne, m.in. nagrania wideo wykładów, filmy instruktażowe, zadania praktyczne i rozwiązania zadań. Na zakończenie artykułu przedstawiono dyskusję i wnioski.

S ł o w a   k l u c z o w e: Platformy edukacyjne, Opinia studentów, Tutoriale, Ćwiczenia praktyczne, Kwestionariusz, Test Kruskala-Wallisa

Małgorzata Przybyła-Kasperek, Kornel Chromiński, Eugenia Smyrnova-Trybulska, Nataliia Morze, Ainur Bazarbayeva

Importancia, popularidad y elementos de las plataformas educativas: estudio de las opiniones de estudiantes de Polonia, Ucrania y Kazajstán

R e s u m e n

El artículo presenta un análisis comparativo de los resultados de una investigación internacional sobre las opiniones de estudiantes de informática de Polonia, Ucrania y Kazajstán sobre la importancia, la popularidad y los elementos de las plataformas educativas. Se utilizó la prueba estadística de Kruskal-Wallis. Se respondieron las siguientes preguntas de investigación: RQ1: ¿Qué plataformas educativas, en general, son las más populares entre los estudiantes de Polonia, Ucrania y Kazajstán y qué plataformas específicas? RQ2: ¿Qué temas se buscan con más frecuencia en las plataformas educativas y qué motiva a los estudiantes de Polonia, Ucrania y Kazajstán a participar en el aprendizaje a través de plataformas educativas? RQ3: ¿Cómo evalúan los estudiantes de Polonia, Ucrania y Kazajstán la utilidad de los diferentes tipos de contenidos publicados en las plataformas educativas, y utilizan varias plataformas para compartir su código? RQ4: ¿Cómo evalúan los estudiantes de Polonia, Ucrania y Kazajstán los elementos de los cursos de las plataformas educativas que consideran más importantes o útiles? RQ5: Cómo evalúan los estudiantes de Polonia, Ucrania y Kazajstán el valor de los cursos ofrecidos en plataformas educativas. Se proponen cinco hipótesis: El país de origen no afecta a la frecuencia de uso de las plataformas educativas. El país de origen afecta a los temas de los cursos que interesan a los estudiantes en las plataformas educativas. El país de origen no afecta a la motivación para realizar cursos en plataformas educativas. El país de origen no afecta a la evaluación de los elementos de los cursos en plataformas educativas que los estudiantes consideran más importantes o útiles. El país de origen afecta a la evaluación del valor de los cursos ofrecidos en las plataformas educativas. Otra hipótesis es que el país de origen de un estudiante influye en los temas de los cursos que les interesan en las plataformas educativas. Los temas más populares en las plataformas educativas son la programación y las redes informáticas, mientras que los estudiantes de Kazajstán también están muy interesados en temas relacionados con la inteligencia artificial y los gráficos por ordenador. Además, se analizaron las condiciones de educación y enseñanza de módulos especializados en cada universidad, p.e. Requisitos de los profesores, planes de estudio, posibilidad de implementación práctica de nuevos conocimientos por parte de los estudiantes. Además, aquellos elementos del curso que son más importantes para los estudiantes, p.e. Se analizaron grabaciones de vídeo de conferencias, vídeos instructivos/instructivos, tareas prácticas y soluciones de tareas. Al final del artículo se presenta una discusión y conclusiones.

P a l a b r a s   c l a v e: Plataformas educativas, Opinión de los estudiantes, Tutoriales, Tarea práctica, Cuestionario, Pruebas de Kruskal-Wallis

Малгожата Пшибыла-Касперек, Корнел Хроминский, Евгения Смирнова-Трыбульска, Наталья Морзе, Айнур Базарбаева

Важность, популярность и элементы образовательных платформ - исследование мнений студентов из Польши, Украины и Казахстана

А н н о т а ц и я

В статье представлен сравнительный анализ результатов международного исследования мнений студентов-компьютерщиков из Польши, Украины и Казахстана о важности, популярности и элементах образовательных платформ. Использовался статистический критерий Краскела-Уоллиса. Были даны ответы на следующие вопросы исследования: RQl: Какие образовательные платформы в целом наиболее популярны среди студентов из Польши, Украины и Казахстана и какие конкретно? RQ2: Какие темы чаще всего ищут на образовательных платформах и что мотивирует студентов из Польши, Украины и Казахстана участвовать в обучении с помощью образовательных платформ? RQ3: Как студенты из Польши, Украины и Казахстана оценивают полезность различных типов контента, размещенного на образовательных платформах, и используют ли они различные платформы для обмена кодом? RQ4: Как студенты из Польши, Украины и Казахстана оценивают те элементы курсов на образовательных платформах, которые они считают наиболее важными или полезными. RQ5: Как студенты из Польши, Украины и Казахстана оценивают ценность курсов, предлагаемых на образовательных платформах. Предлагается пять гипотез: Страна происхождения не влияет на частоту использования образовательных платформ. Страна происхождения влияет на тематику курсов, которые интересуют студентов на образовательных платформах. Страна происхождения не влияет на мотивацию к изучению курсов на образовательных платформах. Страна происхождения не влияет на оценку элементов курсов на образовательных платформах, которые студенты считают наиболее важными или полезными. Страна происхождения влияет на оценку ценности курсов, предлагаемых на образовательных платформах. Другая гипотеза заключается в том, что страна происхождения студента влияет на темы курсов, которые интересуют студентов на образовательных платформах. Самыми популярными темами на образовательных платформах являются программирование и компьютерные сети, при этом студентов из Казахстана также очень интересуют темы, связанные с искусственным интеллектом и компьютерной графикой. Кроме того, были проанализированы условия образования и преподавания специализированных модулей в каждом университете, например: требования преподавателей, учебные планы, возможность практического применения студентами новых знаний. Кроме того, те элементы курса, которые наиболее важны для студентов, например, анализировались видеозаписи лекций, обучающие видеоролики, практические задания и решения задач. В конце статьи представлены обсуждение и выводы.

К л ю ч е в ы е   с л о в а: Образовательные платформы, Мнение студентов, Учебные пособия, Практические занятия, Анкета, Тест Крускала-Уоллиса