Organization and Conduct of Career Guidance Subject Olympiads by Means of Computer Testing in the Practice of the Centre for Testing and Diagnostics of Knowledge of the Lviv Polytechnic National University

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Abstract

This article delves into the intricacies of organizing diagnostics and knowledge control through computer testing for the purpose of evaluating and monitoring the academic performance of students participating in subject Olympiads. The research is conducted by the Centre for Testing and Diagnostics of Knowledge at Lviv Polytechnic National University. The paper underscores crucial criteria for the development of test technologies, emphasizing aspects such as relevance, reliability, and validity. Significantly, it addresses a notable gap in existing research by exploring the utilization of computer tools and the Moodle modular object-oriented dynamic environment for administering subject Olympiads.

The primary objectives of the study encompass defining the tasks of the Center for Testing and Diagnostics of Knowledge, presenting the key stages involved in organizing subject Olympiads, and conducting a comprehensive analysis of the structure of typical Olympiad tests facilitated by the Moodle toolkit. The conclusion drawn from this research underscores the pivotal role of such career guidance measures in aiding prospective higher education entrants. It posits that these measures enable individuals to make informed and conscious choices regarding specific specialties and educational programs aligned with their preferences, inclinations, and abilities.

Furthermore, the study positions itself as a contribution to the advancement of the educational field. It substantiates the relevance and expediency of subject Olympiads, showcasing how the analysis of their results supports the efficacy of these events. Additionally, it emphasizes the significance of employing computer testing methods for the assessment and monitoring of students' knowledge in the realm of educational practice. Ultimately, the research advocates for the continued implementation of such measures to foster the development of the educational landscape.

Keywords

Education, students, entrants, computerization, specialists, educational standards, quality, testing, technology.

1. Introduction

We define career guidance as a scientific and practical system of preparing an individual for a conscious choice of a future profession. Today, there are various forms and methods of career guidance influence on students. The effectiveness of career guidance activities depends on the selection of methods and a comprehensive approach. Important events that help attract talented students to higher

education are Olympiads, which are held in institutions of higher education. Hence, subject Olympiads "Future with the Polytechnic" are held every year at the Lviv Polytechnic National University for graduation class pupils. Participation in the subject Olympiad allows not only to test the level of knowledge, but also the ability to apply it to solve various problems, often not standard ones, in order to test the logical and analytical thinking of future potential applicants. In addition, participation in the Olympiads allows you to learn about the university, its history, structure, majors and specializations that are taught at the higher education institution, as well as the teaching staff, famous scientists who left the walls of the university in the past and those who are actively engaged in science now. Participation in the Olympiad will also help students to provide objective arguments in the motivation letter of the applicant, where they need to write the interest and rationale for studying at the Lviv Polytechnic, as well as indicate achievements in studies and other activities. Testing is effectively used as a means of diagnosis and evaluation of knowledge.

With our research, using the example of testing at the Lviv Polytechnic, we wanted to prove that the experience of using testing shows that today it is one of the reliable assessment tools, and testing using computer software provides objectivity, which justifies the choice a topic that remains relevant.

The tests were subject to high requirements, which, in addition to reliability and objectivity, include validity and relevance. Reliability of a test means that it shows the same results every time during tests. There should be objective control and pedagogics makes active attempts to solve this problem because it faces a number of challenges, including organizational and psychological ones. Validity means that the test identifies and measures the level of mastery of the knowledge that the test developer wants to measure. Relevance means that the result must be relevant to a well-formulated question. The test question must be clearly worded and have a specific answer option. At the Lviv Polytechnic, test tasks for Olympiads are developed by teachers based on the school curriculum of general secondary education establishments. Vocational guidance measures make it possible to find promising young people and carry out knowledge diagnostics with the help of objective assessment tools with the use of computer technology

The purpose of this study is to analyze the practice of conducting and determine the expediency of organizing career orientation subject Olympiads in universities using computer testing

The main tasks are to analyze references on the research topic, study the features of diagnosing and monitoring students' knowledge during Olympiads at universities, monitoring test results and identifying potential applicants who may be interested in studying at this university, as well as promoting the popularization of higher education and scientific activity among young people.

The object of the research is the university Olympiads as one of the means of career guidance and preparation of an individual for a conscious choice of a future profession.

The subject of the research is the practice of holding subject Olympiads on the example of the Centre for Testing and Diagnostics of Knowledge of the Lviv Polytechnic National University.

2. Analysis of sources

Successful professional identification of high school students is important today. This is an important stage in the life of every young person. A future entrant needs to take into account the whole range of personal characteristics to build his/her future career: preferences, hobbies, interests, values, inclinations, desires and aspirations. M. Hryniova [1] considers the ability of an individual to find his/her place in society according to his/her abilities, capabilities and preferences. It is career guidance that helps determine the future career of an individual and making a meaningful choice. There are different approaches to the interpretation of the concept of "professional self-determination" in the literature. However, as emphasized by M. Hryniova and O. Khannanova, the general opinion remains that it is a process of choice, taking into account the personal capabilities of the person and the requirements of the chosen profession [2]. In her study, T. Tanko notes that career guidance at all its levels should be considered as an integral activity for the development of an individual's career to ensure his individual well-being and optimal inclusion in public life [3]. In today's society, future applicants cannot successfully realize their social and professional orientations without a high-quality introduction to numerous specialties. Therefore, institutions of general secondary education should help in the formation of life orientations, the choice of a future profession and professional training [4;5].

The publication "Vocational Education in the New Ukrainian School", prepared with the support of the European Union and its Member States, including Germany, Finland, Poland and Estonia within the EU4Skills Program: Better Skills for Modern Ukraine, is important. Its task is to increase the effectiveness of changes in the vocational education and modernize the infrastructure. The EU4Skills program works at the national level and in seven pilot Oblasts Vinnytsia, Poltava, Zaporizhzhia, Rivne, Lviv, Mykolaiv and Chernivtsi. The document was prepared as part of 2.10. activity and is implemented by Solidarity Fund PL. [6].

In turn, each university should do a lot of work to popularize not only the educational institution itself, but also specialties. Olympiads for students play a big role in this as an effective way to systematize and generalize knowledge in preparation for admission and presentation of the institution of higher education itself. Computer-based testing is used to assess students' academic achievements. Noteworthy is the study by such authors as V. Pavlysh, Z. Pikh, A. Zahorodnii, V. Haba, V. Huk "Testing in the knowledge assessment system of entrants and students at Lviv Polytechnic National University", which notes that the experience of using testing as an element of the system of control measures, a means of assessing knowledge during competitive selection for training, indicates that today it is one of the reliable and objective assessment tools [7-9].

The works of such scientists as D. Zakatnov, V. Korneshchuk, O. Morhulets [10-12] deal with the career guidance as a prerequisite for the training of competitive specialists, technologies for preparing young students for vocational determination.

In the light of our research, the works of Herr E., Maduakolam I., Savickas M., Zunker Vernon G., as well as such publications as "The ASCA National Model: A Framework for School Counseling Programs" and "Encyclopedia of career development" [13-19] are worth noting.

3. Methods

To achieve the goal and solve the identified tasks, the following general scientific research methods were applied:

- theoretical – analysis and synthesis, which made it possible to analyze publications on the selected topic;
- empirical: conducting a questionnaire to determine the affiliation of the participants to the regions and obtaining data on the popularity of the choice of disciplines among the participants;
- observations on finding out the number of people according to gender statistics among the participants of the Olympiads;
- the method of descriptive statistics, which allowed us to quantitatively present the results of the obtained data.

The chosen methodology made it possible to track the practice of conducting professional orientation Olympiads by the Center for Testing and Diagnostics of Knowledge by means of computer testing according to the selected model and to determine the expediency of organizing and holding similar Olympiads in the future.

4. Results and Discussion

4.1. Activities of the Centre for Testing and Diagnostics of Knowledge of the Lviv Polytechnic University in the knowledge control and assessment system

In Ukraine, despite the war, the reform of the content of higher education in accordance with international standards continues. During the signing of the agreement on accession to the Bologna Declaration, Ukraine assumed the following obligations:

- definition of standards of academic degrees and standards of education quality assurance;
- improving the functioning and innovative development of education;

- improving the quality and accessibility of education while preserving national achievements and traditions.

The priority should be to ensure the professional and personal development of a specialist, whose qualifications and individual qualities should meet the standards of higher education, the needs of the contemporary information society and the rapid development of the labor market.

The concept of industry-specific training and the National Doctrine of Education Development in Ukraine provide for the creation of a favorable environment for high school students for successful social and vocational self-determination, which allows them to get acquainted with specific professions and professional activities in practice.

The creation of the Centre for Testing and Diagnostics of Knowledge at Lviv Polytechnic National University in April 2004 was an important step dictated by the requirements for the development of a system for diagnosing the quality of education and a system of tests to determine the compliance of the level of education with state standards within the implementation of the State Program "Education" ("Ukraine of the 21st century"). The Centre for Testing and Diagnostics of Knowledge functions as a university non-profit unit and carries out its activities in the field of diagnosing the knowledge of university entrants, graduates of pre-university training courses using special test tasks, actively works towards creating a reliable toolkit for diagnosing students' knowledge and skills by the test control method. As a structural unit of the Lviv Polytechnic National University, the Centre for Testing and Diagnostics of Knowledge has the following structure (Fig. 1).
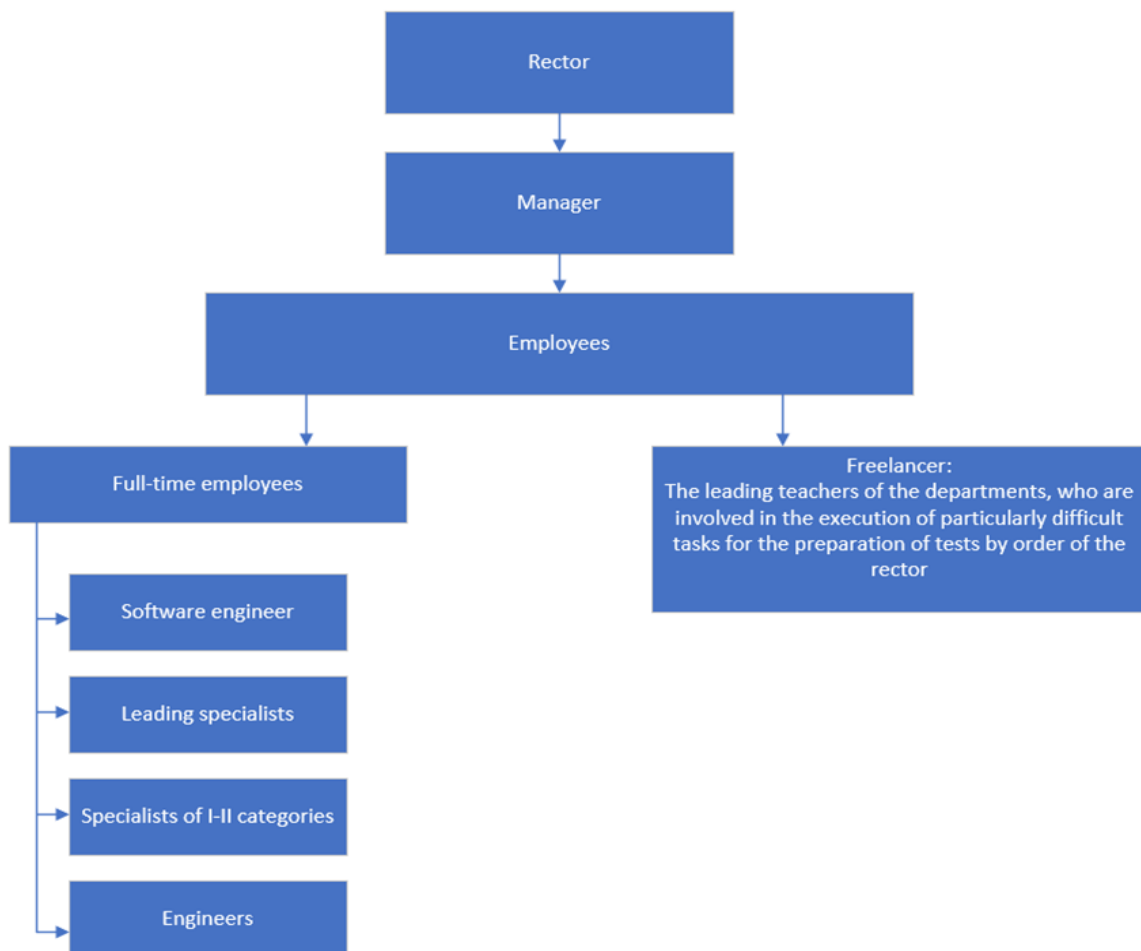

Figure 1: Structure of the Centre for Testing and Diagnostics of Knowledge

New requirements for the content of higher education standards and the need to objectify the control of students' knowledge in the conditions of module-rating technology determined the further direction of work on the introduction of test control. The requirements of the time led to the activation of the problem of using tests, the composition and forms of test tasks, the development of the testing

procedure, the algorithm for processing the test results and their interpretation with the help of software tools that allow the testing process to be carried out automatically, using a minimum of resources.

Among others, one of the important tasks of the Centre is the organization and holding of student subject Olympiads. Participation in the subject Olympiad allows students to check their level of knowledge and ability to apply it to solve various non-standard problems, learn more about the University and specialties that can be acquired within the walls of the institution. As noted above, participation in the Olympiad contributes to objective argumentation in the entrant's motivation letter, where it is necessary to reflect interest in studying at the Lviv Polytechnic, as well as academic achievements and other types of activities.

In general, the whole process of organizing subject Olympiads involved the following stages (Fig. 2).

For the organization of the subject Olympiads, it was decided to use the modular Object-Oriented Dynamic Environment Moodle, which has a sufficient set of tools and made it possible to administer the environment for the chosen model of the Olympiads.

To participate in subject Olympiads, participants had to independently sign in at http://ctdz.lpnu.ua page. It should be noted that one-time registration made it possible to participate, if desired, in all relevant Olympiads.
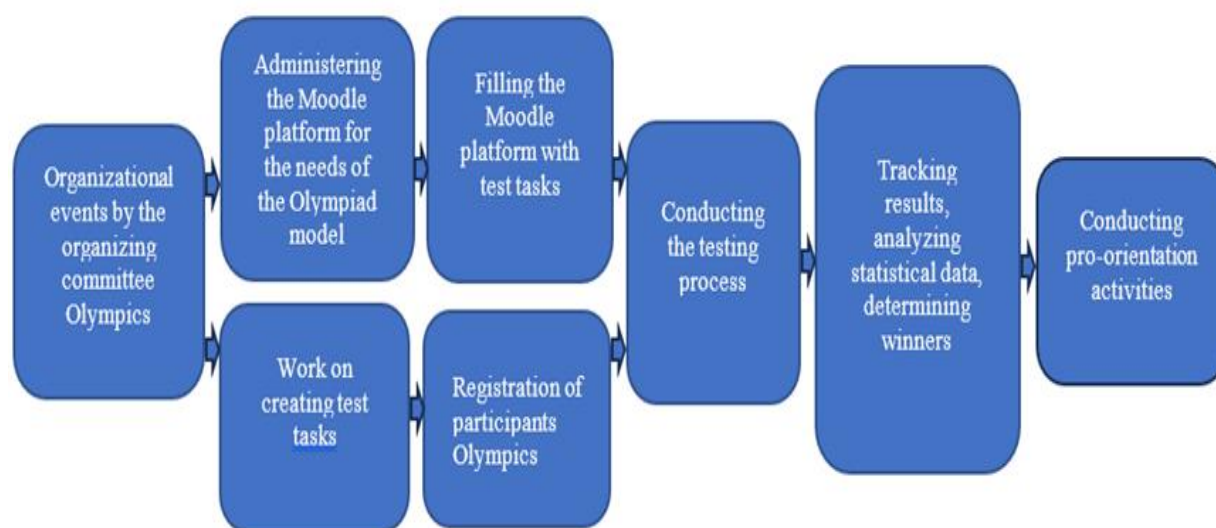

Figure 2: Stages of organization of subject Olympiads "Future with the Polytechnic"

The Olympiads were held in two rounds. This year, the first round was held online due to the threat of missile strikes and the pandemic. The second round was held in person, as all safety measures were provided:
- First round (distance) – January – February 2023;
- II round (in person) – March 2023.

Both rounds of the Olympiad were held using computer equipment and visiting the page http://ctdz.lpnu.ua, where at the specified time the subject Olympiad participant, having previously successfully registered, accessed the Olympiad page with his/her login and password and could pass the test during the specified time of the Olympiad.

The test tasks were developed by leading teachers of the Lviv Polytechnic on the basis of the school curriculum of institutions of general secondary education, which were presented in various formats and levels of complexity, which made it possible to evaluate the participant of the Olympiad according to his/her chosen discipline at all levels of Bloom's Taxonomy.

The model of the Olympiad provided for the participant to take the test in a specially created environment with the use of computer technology, where tasks of different types and different levels of complexity were placed according to the chosen subject (Table 1).

Table 1

Analysis of the structure of the typical subject Olympics test

№	Question type	Ease index	Standard Deviation	Evaluation at random	Assigned weight	Effective weight	Differentiate	Distinguishing efficiency
1	Identify missing words	51,79 %	23,15 %	25,00 %	12 %	11,42 %	78,28 %	80,39 %
2	Identify missing words	51,79 %	18,90 %	25,00 %	8 %	6,30 %	39,91 %	41,74 %
3	Subplies (Closed)	40,00 %	17,10 %	0,00 %	20 %	10,87 %	47,70 %	49,13 %
4	Identify missing words	72,32 %	24,11 %	19,64 %	8 %	9,42 %	78,31 %	81,08 %
5	Subplies (Closed)	38,57 %	42,58 %	0,00 %	5 %	9,91 %	78,01 %	88,61 %
6	Multivariate question	85,71 %	36,31 %	25,00 %	2 %	4,43 %	45,10 %	68,77 %
7	Identify missing words	73,63 %	25,19 %	23,44 %	26 %	17,94 %	73,26 %	84,29 %
8	Identify missing words	40,82 %	23,01 %	14,29 %	7 %	7,65 %	59,33 %	67,54 %
9	Multivariate question	35,71 %	49,72 %	25,00 %	2 %	6,05 %	62,60 %	80,44 %
10	Multivariate question	71,43 %	46,88 %	25,00 %	2 %	5,44 %	52,78 %	65,88 %
11	Multivariate question	7,14 %	26,73 %	25,00 %	2 %	3,74 %	44,31 %	100,00 %
12	Subplies (Closed)	14,29 %	25,20 %	0,00 %	6 %	6,84 %	49,05 %	65,76 %

4.2. Evaluation and Statistics of Test Results

In discussions about the relevance of holding Olympiads, educators come to a common conclusion that the student Olympiad, as a kind of competition, is an excellent mental stimulus for acquiring new skills. The benefit of conducting such intellectual competitions lies in quality training, which is an effective way of generalizing knowledge, which affects the further result. Participation in Olympiads not only broadens one's horizons and improves abstract and logical thinking, but also improves creative abilities.

Tracking the statistical data of the "Future with Polytechnic" subject Olympiads, it should be noted that the Olympiad was quite popular among school graduates. The total number of registered participants who expressed their desire to participate in the Olympiads, successfully registered and passed testing in the first rounds was 1520 people.

Popularity by disciplines among the participants of the first round was distributed as follows (Fig. 3).

The most popular disciplines among the Olympiad participants were Mathematics, 361 participants expressed their desire to participate in the Olympiad from the specified discipline, Ukrainian language – 296 participants, English – 304 participants, and History of Ukraine – 227 participants. Somewhat less

popular were disciplines such as Chemistry – 151 participants, Physics – 109 participants. The least popular were Economics and Public Administration – 41 participants and Computer Science – 31 participants.
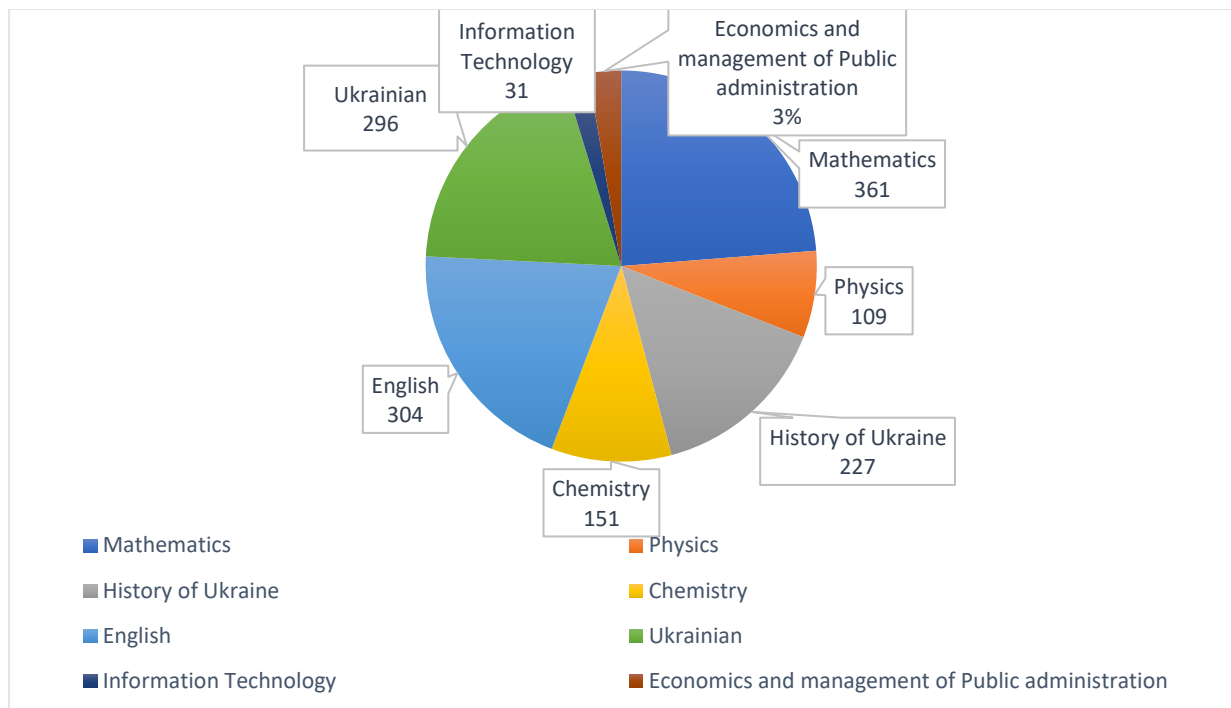

Figure 3: Popularity of disciplines among the participants of the first round

According to the results of the first round of subject Olympiads, the overall average score of the participants by subjects was as follows (Fig. 4).

Figure 4: Overall average score of the participants by subjects

The highest overall average score was among the participants of the Olympiad in the History of Ukraine and amounted to 85 points, while the participants of the Ukrainian language Olympiad had a slightly lower average score of 74. The participants in the Olympiad in Mathematics had a total average score of 72 points. Slightly lower results were observed in such disciplines as Economics and Public Administration – 67 points, Physics – 65 points and Chemistry – 57. Significantly lower overall average

scores were observed in the participants of subject Olympiads in English – 37 points and Computer Science – 33 points.

According to the results of the first round of subject Olympiads, the following number of participants were qualified for the second round (Fig. 5).
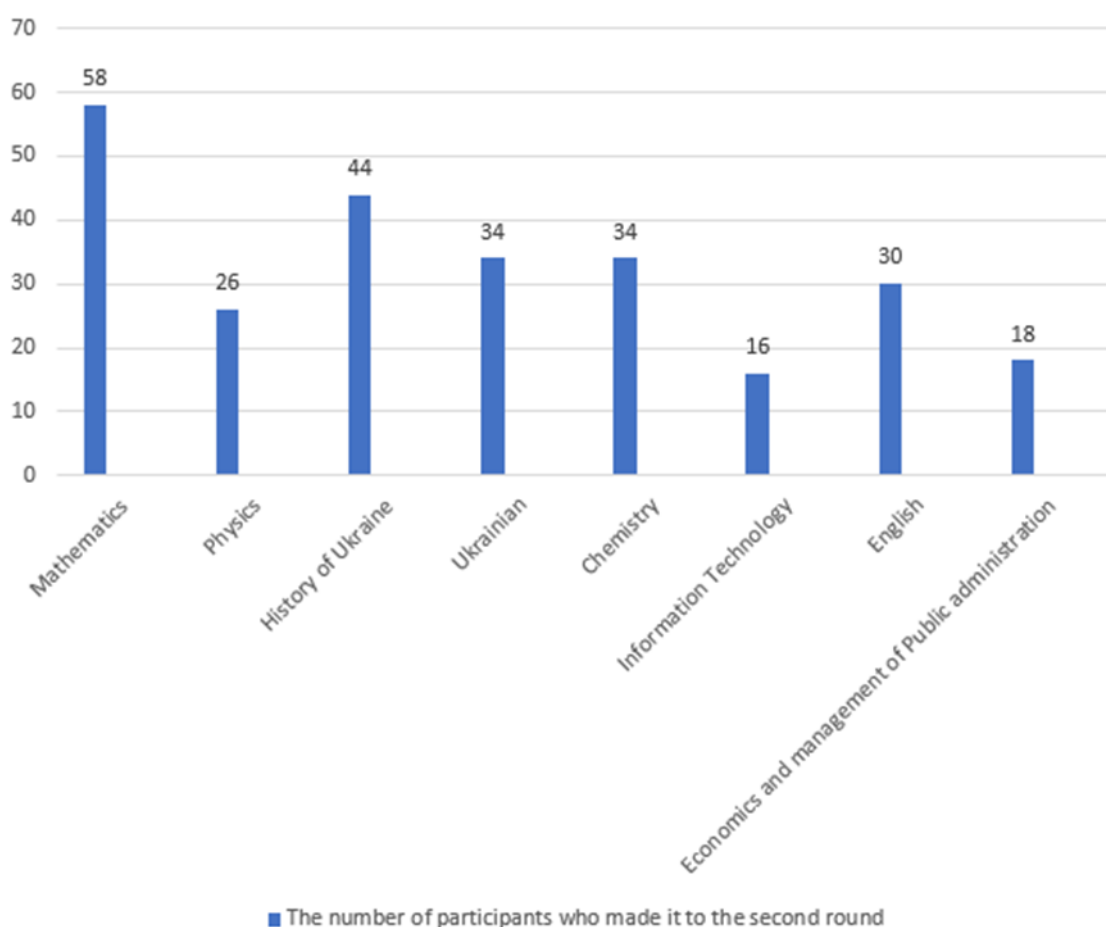

Figure 5: The number of subject Olympiad participants who passed to the second round

Thus, the following number of participants took part in the second round of the face-to-face Olympiad using the technical means of conducting subject Olympiads by disciplines: Mathematics – 58 people; History of Ukraine – 44 people; Ukrainian language – 34 people; Chemistry – 34 people; Physics – 26 people; English – 30 people; Economics and Public Administration – 18 people; Computer Science – 16 people.

This choice of subjects is explained by the fact that the National Multimedia Test of 2023 provided for:

1. Two compulsory subjects: Ukrainian language and mathematics.

2. The third subject − at the student's choice: history of Ukraine, foreign language (English, German, French or Spanish), biology, physics, chemistry.

A survey was conducted among the participants of the second round of subject Olympiads, aimed at determining the regions from which the participants came. As a result of the survey, we obtained the following data (Fig. 6).

As we can see, the largest number of subject Olympiad participants were from Lviv and Lviv Oblast. However, although the number was small, there were still representatives from other regions.

According to the conducted research of the second round of Olympiads in the "gender" category, we tracked the gender data of the statistics of the participants of the subject Olympiads. The obtained data were distributed as follows (Fig. 7): in the second round of the Olympiad in Mathematics, Physics, Computer Science, English, Economics and Public Administration, a larger number of male participants passed.

On the other hand, according to the number of participants who made it to the second round, the female gender leads in such subjects as History of Ukraine, Ukrainian Language and Chemistry.
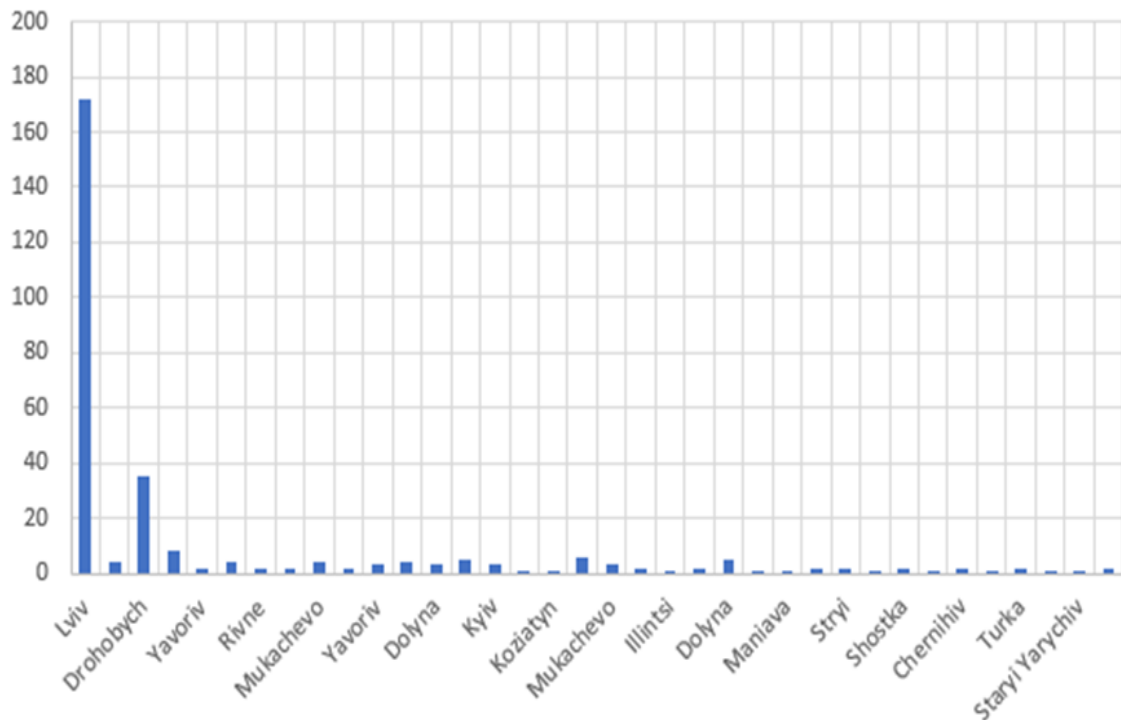

Figure 6: The results of the survey of participants of the second round of subject Olympiads by regional affiliation
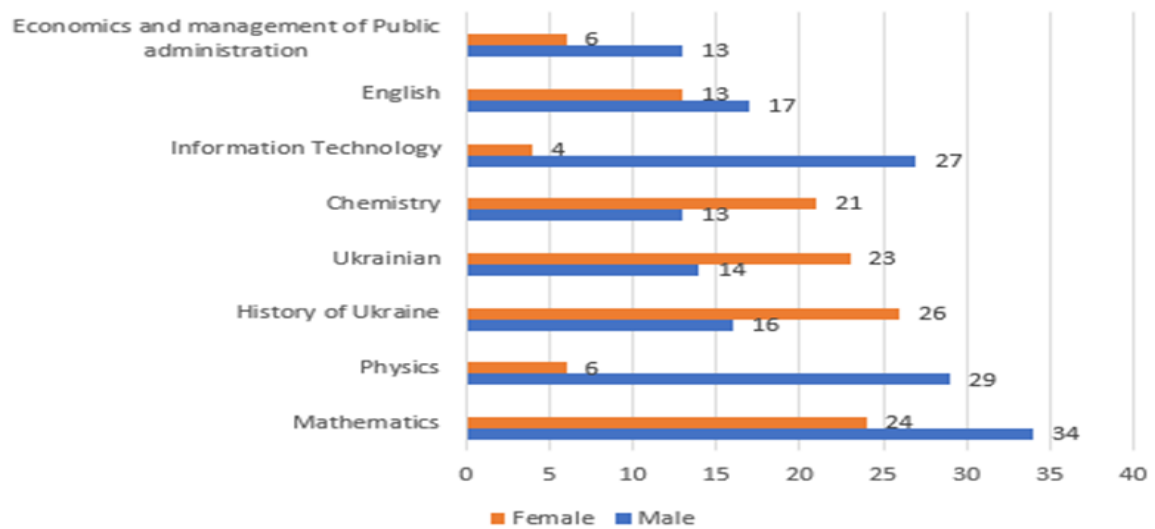

Figure 7: Data on gender statistics of participants who passed the 2nd round of gender statistics subject Olympiads

4.3. Analysis of the problem of conducting vocational orientation subject Olympiads

At Lviv Polytechnic National University, career orientation Olympiads were a permanent tradition, which annually allowed to identify talented young people and represent the university's capabilities. The usual model for conducting such Olympiads was an off-line format using printed test tasks, which allowed all events to be held within the university auditorium.

But the start of military operations in Ukraine and the introduction of martial law in 2022 forced the field of education to refuse to hold any events that would be accompanied by mass gatherings and would pose a danger to the participants of certain events.

Before the full-scale invasion in 2022, Lviv Polytechnic National University had already been ordered to organize and hold career orientation subject Olympiads, but the university was forced to abandon these events. However, in 2023, the Lviv Polytechnic, having already fully adapted to functioning during the period of martial law, decides to start work on the restoration of traditional career guidance events, in particular subject Olympiads. In the process of organization, there were numerous discussions regarding:

- the format of the I and II rounds of the Olympiads;
- consideration and selection of disciplines that would cover the subject Olympiads were carried out;
- variations of presentation of tasks for the I and II rounds of subject Olympiads were considered;
- methods of ensuring the objectivity of the assessment of the I and II rounds of subject Olympiads were discussed;
- the criteria for determining the winners of the 1st and 2nd rounds were determined;
- determination of regions from which representatives can be involved to participate in the Olympiad;
- the possibilities of ensuring the safety of the participants were assessed;
- procedures and algorithms of participants' and organizers' actions in the event of sounding air alarms were worked out;
- organizing the leisure time of the participants of the II round of subject Olympiads and their introduction to the features of the university and study prospects.

Having reached a consensus on the outlined discussion issues and choosing the above-described model of the Olympiad, the traditional vocational orientation subject Olympiad was successfully held.

Discussions about whether the Olympiads are relevant for those seeking education continue to this day. For Ukraine, this will continue to be a security issue in wartime conditions.

A comprehensive analysis of the organization, conduct and results of the Olympiad at the Lviv Polytechnic shows that students have a thirst for competition and a desire to show their real level of knowledge.

5. Conclusions

Thus, today it is important to carry out career guidance activities that allow finding promising young people and diagnosing knowledge with the help of objective assessment tools using computer technology. In addition, such career guidance measures will help entrants to a higher education institution make a conscious choice of a specific specialty and educational program in accordance with preferences, inclinations and abilities. A properly created professional environment for senior pupils allows them to open up opportunities for successful social and professional self-determination. Holding Olympiads within the walls of universities gives pupils the opportunity to get to know the institution itself, teachers, and also to test their knowledge during testing. The statistical analysis of the results of subject Olympiads showed the relevance and expediency of holding subject Olympiads, and made it possible to inform potential entrants about the possibilities and advantages of the Lviv Polytechnic National University as a higher education institution that forms the professional elite of the labor market of our state.

Regarding the prospects of the research, the problems related to the use of computer technology in career guidance work with schoolchildren, as well as ways of introducing professional trials into the practice of schoolwork, i.e. gaining practical experience in a specific type of professional activity, remain important. This is an opportunity to compare your intentions with the chosen profession, to assess what competencies should be mastered for successful self-realization in the chosen professional field.

6. Acknowledgements

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