

SECTION 2. CHEMICAL TECHNOLOGIES

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2.1 Current issues related to the study of chemistry at school

Abstract. The article provides an analysis of the participation of graduates of Ukrainian schools in the period 2017-2023. in External independent testing and National multi-subject testing. The expediency of conducting educational events in the format of Olympiads for high school students has been analyzed and substantiated.

Keywords. External independent testing, National multi-subject testing, LMS Moodle

INTRODUCTION

Many educational ombudsmen, scientists, teachers, parents and politicians pay attention to the problems of educational activity in society every year. Complicated issues are extremely difficult to solve. The involvement of schoolchildren in the study of natural sciences, in particular chemistry, is particularly urgent today. Recent events that have shaken the world community, starting with covid and the harsh invasion of Russian troops on the territory of Ukraine, further affected the interest of schoolchildren in preparing and passing in the formats of External independent testing (EIT) and national multi-subject chemistry testing (NMT). The analysis of information sources [85-90] showed that the percentage of applicants who pass trial entrance exams in natural sciences decreases every year. It should be warned that there may come a time when students will lose interest in studying such essential subjects as chemistry and physics, which will significantly affect the development of industrial, agricultural, food, machine-building and other sectors of human activity. For the successful and rapid recovery of Ukraine after the victory over the Russian aggressor, the need for specialists in natural sciences will be extremely high. The involvement of Ukrainian youth in the reconstruction of our state will contribute to its successful prosperity.

Taking into account the above, it becomes necessary for teachers of the higher school to create certain familiarization events for schoolchildren in order to interest them in choosing future professions, which, in particular, are related to the study of chemistry at school.

MAIN PART

Events related to the 2020 covid brought significant changes to the global educational process. This also affected educational orientations in Ukraine, in particular natural sciences. While monitoring the selection of entrants to take the entrance exams in the subject "Chemistry", it is worth noting that not so many people want to compete for their knowledge in the chemistry profile. The analysis of information sources [85-90] showed that the number of registered graduates to participate in external examinations and pass entrance exams in chemistry in the period 2017-2023 has a tendency to decrease (Fig. 1).

In 2017, the number of those wishing to take the Chemistry EIT was about 25,000. A sharp decrease in the number of registered participants, by almost 38%, was observed from 2017 to 2019. This becomes clear, since in 2018 new conditions for admission to medical specialties were published on the website of the Ministry of Health of Ukraine [91]. Among the specialized subjects, entrants were offered the right to choose between biology and chemistry (the second competitive subject). Entrants began to give preference to taking the final exam in biology, which resulted in a further decrease in the number of registered participants until 2021. Compared to 2017, their number decreased by 48.64% in 2021.

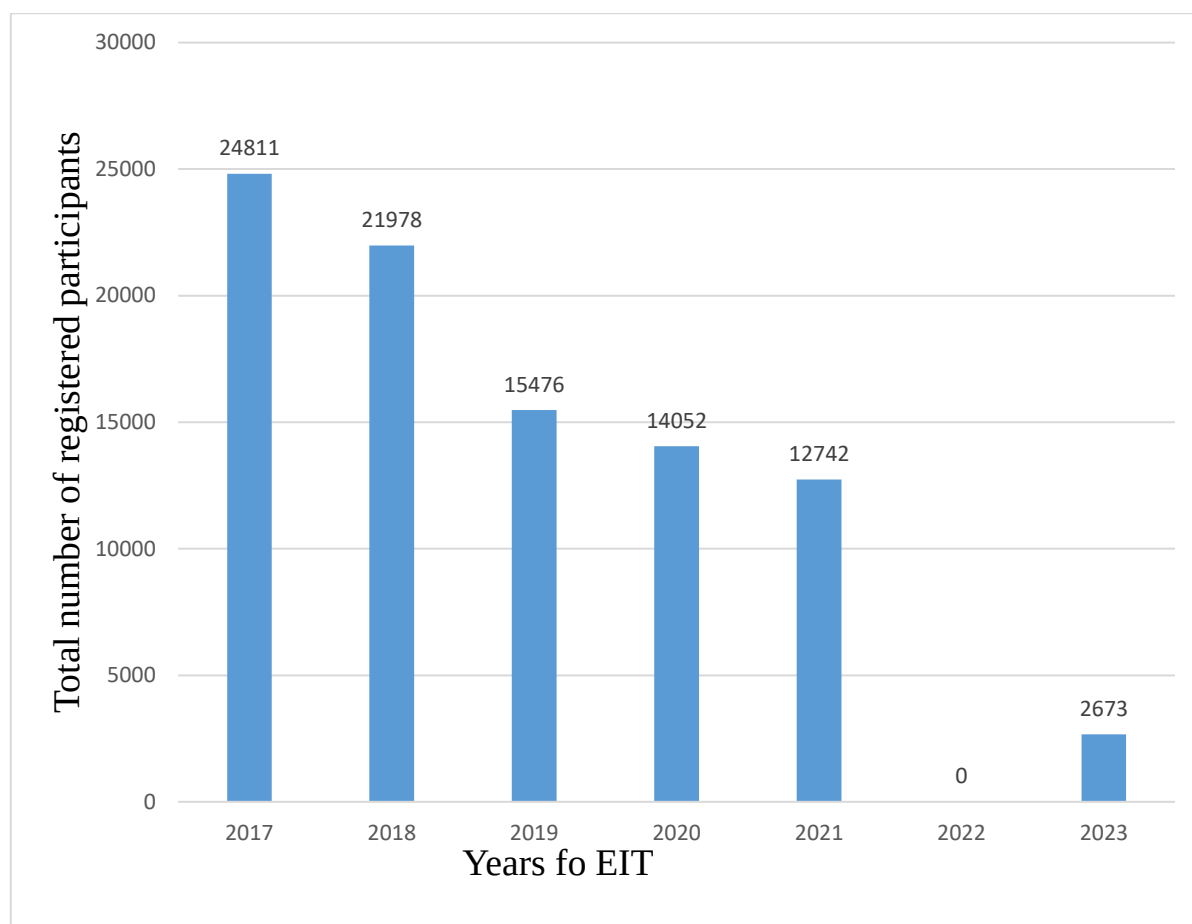
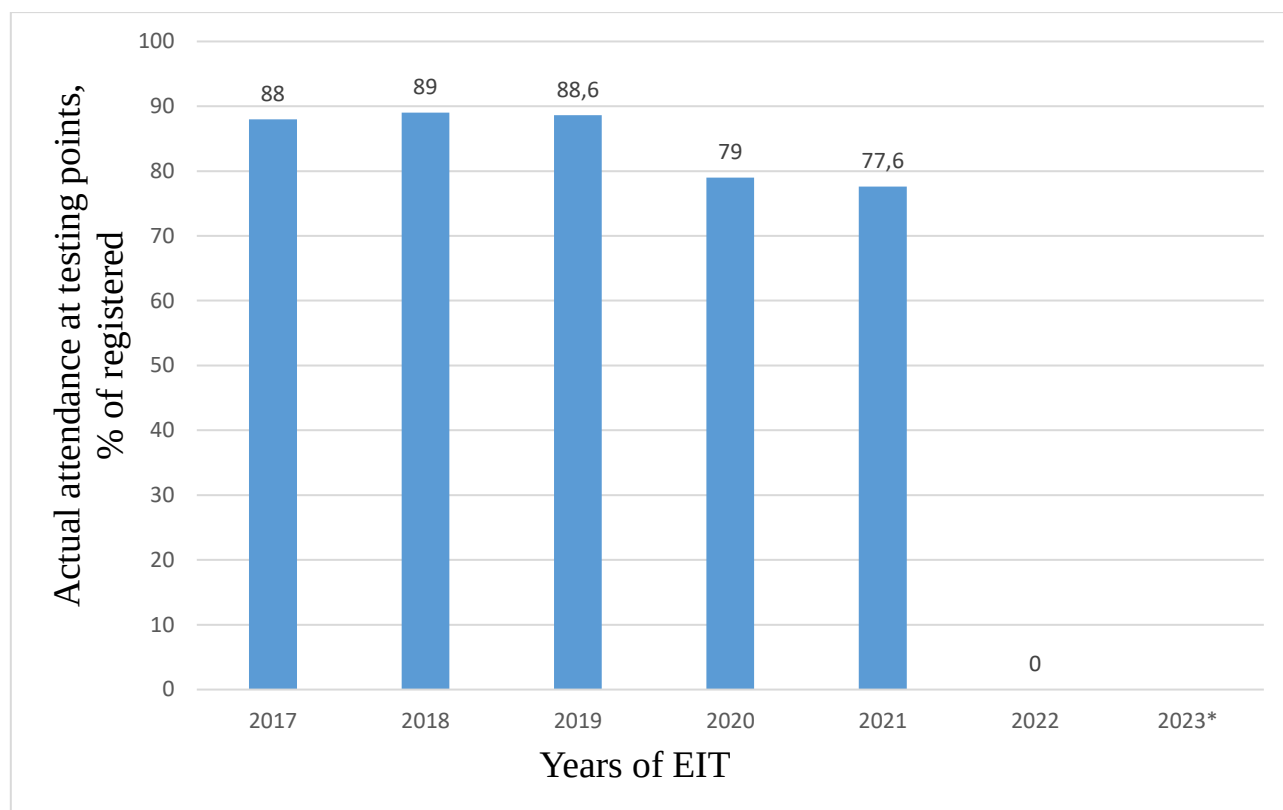


Figure 1. Participation of entrants in the EIT in "Chemistry"
in the period 2017-2023.

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Analyzing the actual presence of applicants during the entrance tests in the main session of Chemistry EIT in the period 2017-2021 shows their decrease by approximately 10% in 2021 compared to 2017-2019 (Fig. 2) [85-90]. This can be

explained by the lack of applicants for testing due to the introduction of quarantine measures caused by covid.



*- data not provided

Figure 2. Actual participation of entrants in the EIT in “Chemistry”
in the period of 2017-2023.

In 2022, the admission of applicants to higher educational institutions was based on the results of the NMT, which did not contain tasks on the subject "Chemistry". The year 2023 was special in terms of the number of those willing to take the test in chemistry. Chemistry was chosen by the least number of participants, as many as 2,673 people, among the optional subjects at the NMT [90]. This can be justified by conducting the educational process for students of graduation classes mainly in the online format, the difficulty of conducting full-fledged classes in the occupied territories, the lack of electricity, and poor Internet connection. Despite the small number of NMT participants who chose "Chemistry", 26 of them received 200 points [92].

If we analyze the percentage of participants who did not overcome the threshold, "passed/failed" the final examination in "Chemistry", then no clear regularity is observed (Fig. 3). The different number of tasks of the EIT in 2017-2021, the maximum number of test points, and the threshold score „passed/failed” can explain this (Fig. 4) [85-89].

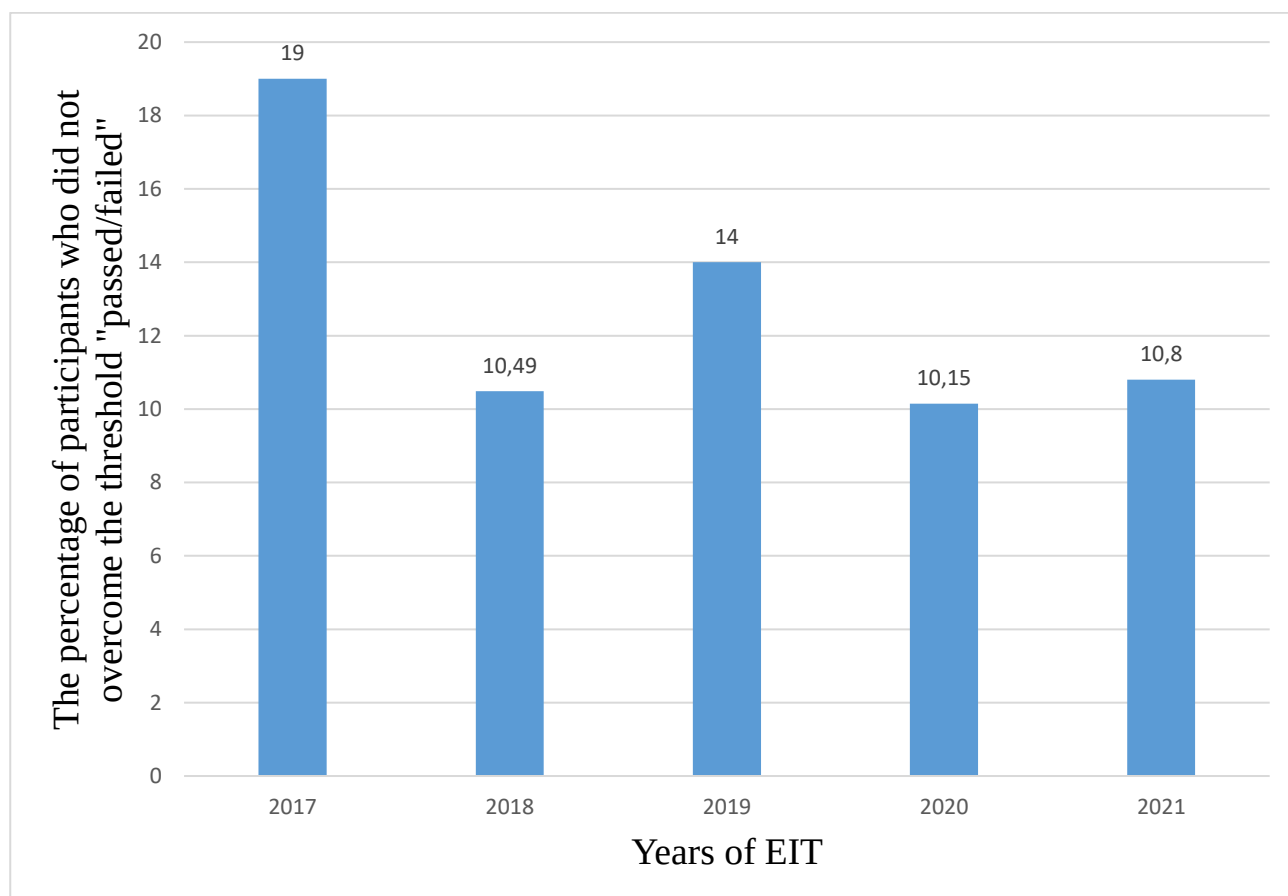


Figure 3. The percentage of participants who did not overcome the threshold "passed/failed" when taking the EIT in "Chemistry" in the period 2017-2023.

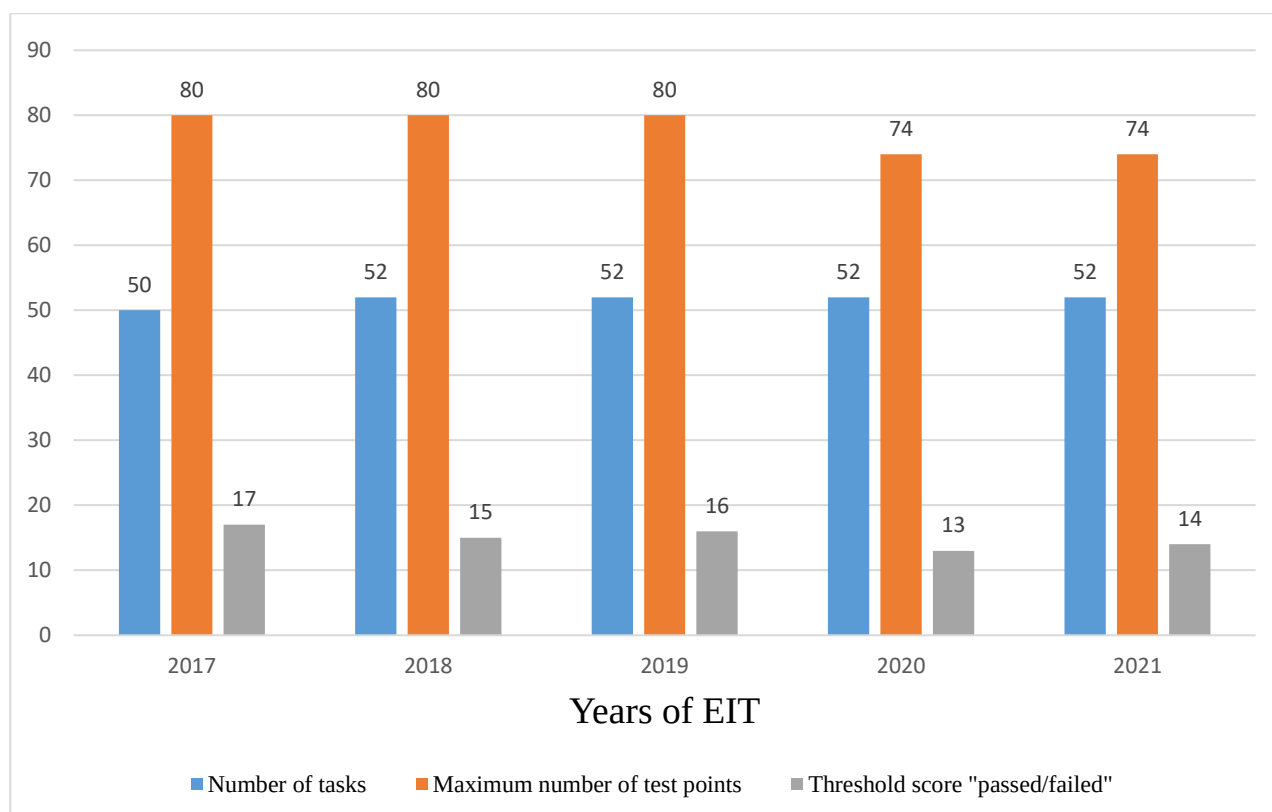


Figure 4. The number of tasks, the maximum number of test points and the threshold score "passed/failed" during the EIT in "Chemistry" in the period 2017-2023

The invasion of Russian troops on the territory of Ukraine prompted an even greater urgency regarding the organization and reorganization of the educational process at school, because school education is the most important factor in the further economic and social progress of Ukrainian society, especially in the post-war period. Since the beginning of the war, the number of children who continued their education in Ukrainian schools has significantly decreased due to their relocation and continued education in foreign educational institutions. Many teachers in their scientific publications cite scary statistics regarding the number of dead students starting from February 24, 2022 [93, 94]. Undoubtedly, the war had a negative impact not only on school education, but also on educational activities in higher education. Educators were faced with the urgent question of ensuring a stable and uninterrupted educational process, which is seen as a perspective in the school-university tandem. In particular, the National University "Lviv Polytechnic" started holding subject Olympiads "Future

with Polytechnic" for students of grades 10-11. They took place in two rounds. At the Institute of Chemistry and Chemical Technologies, such an event was in the field of "Chemistry". Thus, on February 4, 2023, the first round of the Olympiad using the Moodle platform was held online. 154 participants took part in it. All were awarded the corresponding certificate (Fig. 5).



Figure 5. Template of certificate of participants of the 1st round of the "Future with Polytechnic" Olympiad (section "Chemistry")

34 participants, winners of the first round, were invited to participate in the second round, which took place in March of the same year [95]. The active organizers of such an event were scientific and pedagogical workers of the university's Department of Physical, Analytical and General Chemistry, professor Pavlo Shapoval, associate professor Lilianna Oliynyk, associate professor Zoryana Komarenska, and associate professor of the Department of Chemistry and Technology of Inorganic Substances - Roksoliana Bukliv.

The second round of the Olympiad "Future with Polytechnic" for students of grades 10-11 in the field of "Chemistry" took place in a face-to-face format at the Student Library of the National University "Lviv Polytechnic". Ukrainian schoolchildren demonstrated their chemistry erudition during testing on the Moodle

platform, as in the first round. The test tasks contained 14 questions of various levels of difficulty, the content of which corresponded to the current programs:

- Chemistry curricula for grades 6-9 (State standard of basic and comprehensive general secondary education, 2011) approved by the Order of the Ministry of Education and Science of Ukraine dated 06.07.2017 No. 804;
- Chemistry curriculum (standard level) for grades 10-11 of secondary schools, approved by the Order of the Ministry of Education and Science of Ukraine dated 10/23/2017 No. 1407.

If the student successfully passed the test, he could score a maximum of 100 points. For this, he needed to give the correct answer to:

- 6 questions of 5 points each;
- 4 questions of 7 points each;
- 3 questions for 9 points each;
- 1 question for 15 points (problem).

Among the 14 proposed Olympiad tasks, 13 were multiple-choice and 1 was matching. There was only one attempt to work on each question. With the help of the "Moodle" system, each participant received a task in a different number sequence and a different letter answer. It took 60 minutes to complete them. Since the Olympiad took place during the period of martial law in Ukraine, in the event of an air raid, all participants had the opportunity to evacuate to the shelters provided in the premises of the Lviv Polytechnic.

16 high school students actually took part in the second round of the "Future with Polytechnic" Olympiad in the field of "Chemistry". Each of the 16 participants answered all 14 questions. Therefore, the percentage of correct answers for each question turned out to be different (Fig. 6).

The analysis of the test results shows that in each block of questions some of them were difficult to solve. The highest percentage of them is among the questions that were evaluated with 5 points. It is worth noting that almost a third of the participants managed the task of 15 points.

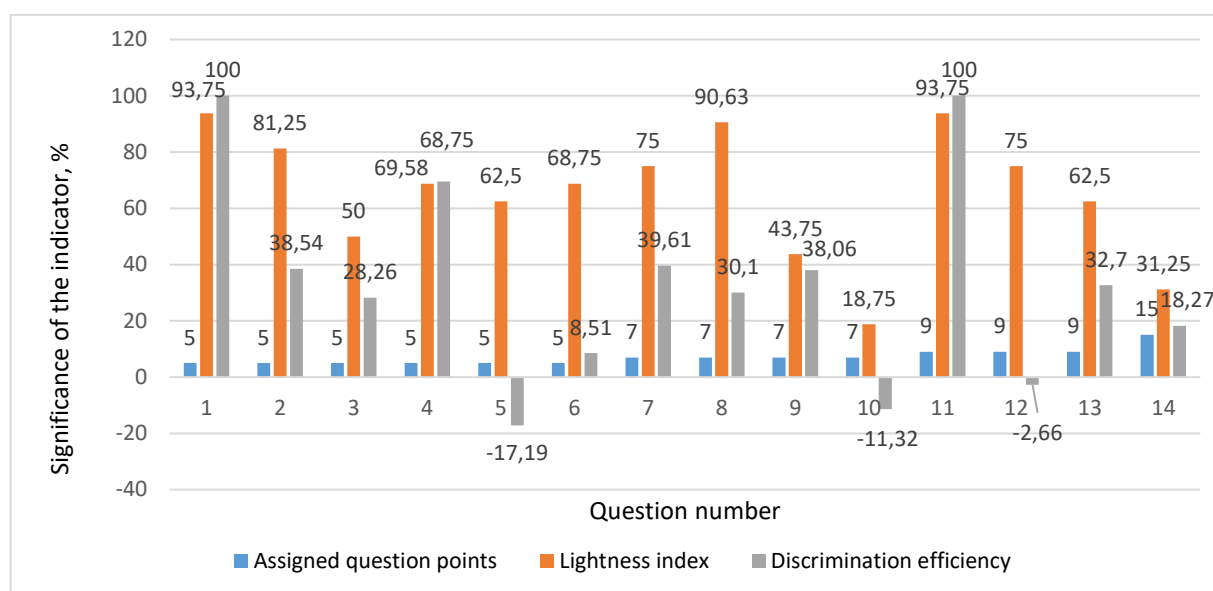


Figure 6. The results of tasks performed by students of grades 9-11 in the second round of the "Future with Polytechnic" Olympiad in the field of "Chemistry"

According to the results of the chemistry competition, the range of points obtained was from 86 to 18 [95]. In order to support the interest of the graduates in the study of natural sciences and their active participation in the Olympiad, the winners who received the highest points were presented with diplomas and valuable gifts to all the schoolchildren present.

CONCLUSION

The participants of the educational process, in particular the students of the final classes, need special and careful information about the expediency of studying chemistry and the need for specialists who have relevant chemical knowledge and will be able to solve various issues that are now acutely arising as a result of Russia's hostile aggression. The actualization and motivational emphasis of teachers on the systematic study of natural sciences at school in combination with their comprehensive work with scientific and pedagogical workers of higher educational institutions will contribute to overcoming the emerging crisis in society regarding the understanding and desire to study them as soon as possible. In order to achieve the goals set for teachers and students, during educational activities, it is advisable to combine face-to-face and distance learning forms, as well as to use the entire available arsenal of distance learning tools.