Olena Novobranova

MA, Chemistry Instructor, Metropolitan Community College, Missouri, USA, https://orcid.org/0009-0000-0081-4344

THE IMPORTANCE OF THE CREATION OF AN ENGLISH-UKRAINIAN GLOSSARY OF CHEMICAL TERMS FOR INTRODUCTORY CHEMISTRY COURSES IN COLLEGES OF THE UNITED STATES

Abstract. Chemistry is an essential subject for students pursuing careers in STEM (Science, Technology, Engineering, and Mathematics) fields. However, for non-English speaking students, the technical language used in chemistry can be challenging to understand. The creation of an English-Ukrainian glossary for chemical terms for Introductory Chemistry courses in colleges in the United States can help these students overcome this challenge. Since the beginning of the full-scale invasion of Ukraine, many Ukrainian families have been forced to leave their homes. The largest percentage of these families were those with children of various ages. Many of them went abroad, including to the United States of America. School-age children, as well as prospective students, were unable to fully prepare for admission to schools, colleges, and universities because this relocation to another country with a different language of instruction was unplanned. In most cases, these children did not have sufficient language preparation to study all subjects, especially the natural sciences, in English. This led to children having difficulties with subjects such as physics, chemistry, biology, etc., because to begin studying these sciences, it is first necessary to learn the basic terminology of these disciplines in English.

Keywords: English-Ukrainian glossary, chemical term, Introductory Chemistry, General Chemistry, Organic Chemistry, Biochemistry, STEM, chemical concepts.

Problem statement. The Russian invasion causes a huge relocation of Ukrainian families with children around the world. Most children especially find safe countries where the English language is primary. Most of them were not ready to continue their education in schools, colleges, and universities because of the low level of speaking, writing, reading, and understanding of the foreign language. Chemistry is a difficult subject for the students and it’s a challenge to understand it even under common surroundings. To learn this science is necessary in schools. If students choose STEM or health professions in the future, Chemistry is one of the most important parts of the education process in colleges and universities. The different sources include only translation of the simple chemical terms from English.
into Ukrainian but these glossaries neither have a clarification of these determinations nor voice pronunciation. That’s why it was necessary to create some special vocabulary of the chemical terminology that covers the Chemistry program in the educational institutions of the United States of America.

**Literature analysis.** According to the Institute of International Education's Open Doors Report, in the academic year 2019/2020, 1,075,496 international students were studying in the United States. 11,345 Ukrainian students were studying in the United States across all fields of study [4].

There is a graph that describes the total number of Ukrainian students in US Colleges from 2019 until 2022 academic years [5].

![Graph 1. The number of Ukrainian students in the US Colleges](image)

The academic year 2020/2021 was a pandemic year.

A study published in the Journal of Chemical Education found that non-native English-speaking students experience language-related difficulties in chemistry courses. In particular, the study found that these students may struggle with reading and understanding technical texts, as well as with expressing their ideas and writing lab reports.

According to the National Science Foundation, international students in STEM fields (which includes Chemistry) have higher graduation rates than their US citizen counterparts. However, non-English speaking students may face additional challenges related to language proficiency, cultural adjustment, and social integration.

**The purpose of the article:** to clarify the importance of the creation of the English-Ukrainian glossary of chemical terms for Introductory Chemistry courses in colleges in the United States.

**Presentation of the main material.** High school and college students from non-English speaking countries, such as Ukraine, Russia, Moldova, and some
European countries, often struggle to understand the technical language used in introductory chemistry courses. This is because chemistry has a specialized vocabulary that is often unfamiliar to non-native speakers of English. To understand the concepts being taught in chemistry classes, students need to have a strong grasp of the technical language used in the subject.

Because of the Russian invasion in February 2022, many Ukrainian families relocated to the United States of America finding more safe living places. Nearly half a million Ukrainian refugees have come to the U.S., according to the Department of Homeland Security. More than 178,000 individuals have arrived at U.S. ports of entry and been processed as part of Uniting for Ukraine since the program launched in April 2022, according to DHS [4,5]. Additionally, more than 319,000 Ukrainians have been processed into the U.S. outside of Uniting for Ukraine since March 24, 2022, DHS said. Approximately 450 thousand Ukrainian children moved to the USA with their families. That’s why it’s important to create some special resources for Chemical education that will help them to understand and memorize school, college, or university scientific information faster [6].

One way to address this challenge is by creating an English-Ukrainian glossary for chemical terms. This glossary would provide translations of key terms and concepts used in Introductory Chemistry courses. Students could use this glossary as a reference when studying, allowing them to better understand the material being taught in class.

We propose to create a special glossary that includes some parts such as Ukrainian translation of the chemical terms from the English language, translation of the explanation in the Ukrainian language, and the QR-codes for each term (in the English language) that Ukrainian students who are studying in English-speaking countries can use to hear the correct English pronunciation.

<table>
<thead>
<tr>
<th>Glossary term</th>
<th>Transcription (US spelling)</th>
<th>Explanation in English</th>
<th>Ukrainian term</th>
<th>Explanation in Ukrainian</th>
<th>QR-code to listen the pronunciation in English</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absolute zero</td>
<td>/æbsəluːt ˈzɜəroʊ/</td>
<td>The coldest temperature possible. Absolute zero (0 K or -273 °C or -459 °F) is a temperature at which molecular motion stops. Lower temperatures do not exist.</td>
<td>Абсолютний нуль</td>
<td>Найнижча можлива температура. Абсолютний нуль (0 К або -273 °C або -459 °F) — це температура, при якій рух молекул припиняється. Нижчих температур не існує.</td>
<td><img src="https://via.placeholder.com/150" alt="QR-code" /></td>
</tr>
</tbody>
</table>

Fig. 1. The main sections of the English-Ukrainian glossary of the chemical terms

Note: systematized by the author
The creation of an English-Ukrainian glossary for chemical terms would be particularly useful for students studying from the Introductory Chemistry textbook by Nivaldo J. Tro and Karen Timberlake. These textbooks are widely used in colleges across the United States, and non-English-speaking students must have access to a comprehensive glossary of key terms used in the textbooks [3].

The benefits of creating an English-Ukrainian glossary for chemical terms go beyond just helping non-English speaking students in the United States. This glossary could also be a valuable resource for students in other countries where English is not the primary language of instruction in chemistry classes. It could help to promote international collaboration and facilitate the exchange of scientific knowledge across different cultures and languages.

**Conclusions.** The creation of an English-Ukrainian glossary for chemical terms for Introductory Chemistry courses in colleges in the United States is an important step towards helping non-English speaking students succeed in their studies. This glossary can be a valuable resource for students in other countries as well, promoting international collaboration and scientific exchange. With the creation of this glossary, non-English speaking students will have access to the tools they need to succeed in their studies and pursue careers in STEM fields.

**References:**