

DOI: <https://doi.org/10.26565/2074-8922-2024-83-04>
УДК (UDC): 378:81'246.2

H. I. ZELENIN, DSc (Pedagogy), Professor,
Professor of the Department of Foreign Language Training,
European Integration and International Cooperation
e-mail: zelenin@karazin.ua ORCID ID: <https://orcid.org/0000-0003-1274-2311>
V. N. Karazin Kharkiv National University,
4, Svobody Square Kharkiv, 61022, Ukraine

BILINGUAL EDUCATION IS AN IMPORTANT COMPONENT OF THE EDUCATIONAL PROCESS AT HIGHER EDUCATIONAL INSTITUTIONS

The article conducts a thorough analysis of bilingual education within higher educational institutions. The article examines how bilingual education at universities can be advantageous for preparing specialists for the global job market. It specifically discusses the Council of Europe's concept of multilingual education and its application in higher technical education. The article highlights the importance of the Common European Framework of Reference (CEFR) in assessing students' language skills and the role of a language portfolio in evaluating their multilingual experiences.

This text discusses various language teaching approaches, including competency-based, interdisciplinary, cognitive, and activity-based methods, that aim to help students effectively learn professional terminology in multiple languages. The competency-based approach emphasizes the development of key communicative and professional skills necessary for successful performance in a multilingual environment. The interdisciplinary approach combines language skills with professional knowledge, enabling students to apply what they learn in various contexts. The cognitive approach focuses on improving learning awareness through mental processes, while the activity approach encourages independent work and enhances students' self-learning and teamwork skills.

Bilingual education is essential for helping students develop the skills needed for international projects and teamwork. It improves their intercultural communication and encourages innovative thinking. Higher educational institutions enhance students' language skills and professional competencies, preparing them to succeed in a competitive global workforce that values multilingual communication. By embracing bilingual education, institutions are essentially preparing their graduates for a future where adaptability and cross-cultural collaboration are paramount. This approach benefits both individual students and helps create a more inclusive global community.

KEY WORDS: *bilingual education, multilingualism, competence-based approach, interdisciplinary learning, cognitive approach, higher vocational education, globalization.*

In cites: Zelenin H. Bilingual education is an important component of the educational process at higher educational institutions. *Problems of Engineering Pedagogic Education*, (83), 42-49. <https://doi.org/10.26565/2074-8922-2024-83-04>

© Zelenin H.I., 2024



[Creative Commons Attribution 4.0 International \(CC BY 4.0\)](https://creativecommons.org/licenses/by/4.0/)

Problem statement

As academic mobility expands and summer schools, double degree programs, and partnerships with foreign institutions gain popularity, effective intercultural communication has become crucial. This need applies to interactions both between universities and their external stakeholders, and within the universities themselves. Facilitating these communications can significantly enhance collaboration, understanding, and the overall quality of educational offerings. As such, it is imperative that universities prioritize the development of strategies and frameworks that promote these crucial intercultural exchanges. Insufficient quality of cultural and humanitarian

innovations leads to unrealized potential of academic mobility and intercultural interaction. Multilingualism is essential in today's information society, with about 75% of the global population speaking two or more languages. Consequently, multilingualism is a natural phenomenon and a subject of study for a large number of researchers. Multilingualism is the ability of individuals and groups to use multiple languages regularly in daily life.

In today's globalizing world, there is a desire for openness and intercultural interaction. The mastery of foreign languages becomes significant in both everyday personal and professional life of a person.

Literature review

Research in the field of multilingualism is conducted by representatives of various scientific fields: philology, sociolinguistics, ethnology, neurophysiology, psychiatry, psycholinguistics. Social, pedagogical, cognitive, cross-cultural psychology, personality psychology and other branches of psychology address the problem of bilingualism and multilingualism today. Today, we are witnessing a notable surge in research and publications focusing on the fascinating subjects of bilingualism and multilingualism. This increasing interest is driven by scholars and experts from various scientific fields, each contributing their unique insights. As communities grow more diverse, understanding how language proficiency affects cognitive development, social dynamics, and cultural identity is more important than ever. Consequently, the intersection of these fields is enriching our understanding of language in both its practical

applications and theoretical frameworks. The increased interest in the problem has led to the founding of many specialized journals by reputable Western scientific publishing houses (International Journal of Bilingual Education and Bilingualism, International Journal of Multilingualism, International Multilingual Research Journal, Journal of Cross-Cultural and Interlanguage Communication (Walter de Gruyter), etc.). Gradually, "bilingualism" is being recognized as a separate science, since the phenomenon of bilingualism and multilingualism has an interdisciplinary character.

Currently, the most popular studies are related to the impact of bilingualism on executive functions [1,2], on learning strategies [3,4], on memory processes and mechanisms [5,6] and on learning new languages (Bice, Kroll, Degani, Dragoy, Virfel).

Purpose

The study aims to analyze bilingual education in technical universities and propose effective methods for its implementation. It will explore different methods of multilingual

education that enhance skills and cognitive activities to better prepare students for a global job market.

The statement of the main material

The Council of Europe and the European Union have different views on European multilingualism, but both aim to preserve linguistic diversity and promote multilingual education. The Council of Europe created the European Language Portfolio to

better describe individual multilingualism, highlighting different approaches to the topic.

The Council of Europe's concept of foreign language proficiency emphasizes a unique approach to multilingualism shaped by individual experiences, rather than just formal

education. The Council of Europe created a directive to assess foreign language proficiency using a method applicable to all European languages. Language proficiency is categorized into three macro-levels: A, B, and C. Level A is for basic users, divided into two sublevels: A1 (survival level) and A2 (pre-threshold level). The Council of Europe's concept of multilingual education includes a language portfolio [7] that tracks individual multilingual competence. This approach considers a person's overall language experiences, not just their formal training.

B - self-sufficient language proficiency (independent user): B1 - threshold level; B2 - threshold advanced level. C - proficient user: C1 - professional proficiency level; C2 - proficient proficiency level [8]. Each level is connected to specific traits that show how well a person has mastered listening, speaking, reading, and writing skills. These levels show a person's skills and their ability to communicate and understand language in different situations. Understanding this hierarchy can provide valuable insights into how individuals develop their language skills over time. Ultimately, these levels serve as a framework for assessing one's overall communication competence.

The Council of Europe considers various individual experiences with language, whether used at home or in society, and recognizes that these skills can be developed through direct contact or formal learning. In interaction, speakers use different components of their competence necessary for successful communication with a particular interlocutor. Communicators are able to switch from one language to another in the process of speech interaction. Possessing a large stock of international words, they can understand written and oral messages in several languages.

In both cases, the goal of the multilingual mode is to ensure effective communication in the national language, both overall and for individual speakers. This regime is significant internationally, as it facilitates interactions between various national languages and supports supranational activities. This topic is particularly pertinent to the realm of higher education within Ukrainian society, especially when considering the significant transformations that are currently taking place as a result of the Bologna process. These changes aim to enhance the quality and accessibility of higher education in Ukraine,

ensuring that it aligns more closely with European standards [9]. The implementation of these reforms reflects the country's commitment to improving its educational system and fostering greater integration with the European Union. As these initiatives progress, they will undoubtedly continue to influence the landscape of Ukrainian higher education.

As far as higher education is concerned, the objective tendency to use not one but several different languages in the educational process, together with the conscious orientation towards such use and its stimulation, are conditioned here not only by situational (primarily political or economic) reasons, but by deeper and more significant circumstances, in particular, ontological, sociocultural, historical ones. On the agenda of the majority of national educational systems, including the Ukrainian one, is put forward as one of the main and urgent tasks of its transnationalization, that is, its withdrawal to a level that would allow graduates of Ukrainian universities to freely and without any restrictions to apply their knowledge and skills not only in their own country, but also abroad, joining the global process of division of labor - on an equal footing with representatives of other countries and regions of the world.

There are reasons to see the higher education system as the key link through which, under certain circumstances, it may be possible to make adjustments to the language situation and reformat it in accordance with the changed conditions of national-cultural and linguistic existence of Ukraine as a sovereign state. The importance of education in general and higher education in particular in the modern world cannot be overemphasized. The educational sphere and, especially, the "product" it produces, has a tremendous impact on all spheres of life without exception. Higher education institutions are not without reason considered as a key organization in the reproduction of human potential of the nation. The trend of turning higher education into a significant factor of innovative development of both the national economy and the socio-political organization of society as a whole is gaining momentum.

Higher education serves as a crucial catalyst for the advancement of the national economy, fostering not only economic growth but also shaping the cultural and spiritual

values that resonate with the historical context of a nation [10]. By cultivating an educated populace, it creates a workforce equipped to meet contemporary challenges, while also instilling a sense of national identity and unity. This educational foundation is essential for developing concepts that align with the aspirations and values of society, ensuring that progress is both sustainable and reflective of the people's heritage. Ultimately, higher education molds the fabric of a nation, intertwining economic development with cultural enrichment and spiritual depth. It is it as a social institution, endowed with the ability to renew itself with a higher dynamic than other institutions, by adopting theoretical scientific knowledge (cognitive product) of the highest standard, has the opportunity to become the core of national and state development in a progressive scenario, the locomotive of which is modernization.

Modernization of education is not a one-step action, but a process, which, in addition to being characterized by the duration of time, is, moreover, of a complex nature, providing for bringing in line with the new - "modern" - conditions and circumstances, if not all parts of the educational process without exception, then the vast majority of them, starting with the philosophy of education, the principles of its organization and functioning, the content of education, the organizational foundations of the educational process, providing it at all levels of education.

From the socio-philosophical point of view, modernization of education acts as a means of preparing the new generation for optimal socialization in the conditions of transition to a new type of social organization, which combines elements of post-industrial society, information society, and is also under the powerful influence of processes and phenomena directly or indirectly caused by globalization.

Modernization of education should not be understood as a mechanical replacement of the old, traditional with the new - whether borrowed or formed in the national educational space. It provides for a synthesis of traditional and innovative, oriented towards achieving a qualitatively higher level of education.

The world is organized in such a way that it is impossible to avoid changes in social life. The key feature of the modernization

process should be considered social changes as such, i.e. not changes that occur naturally, under the influence of the time factor, but changes that occur in an intensive mode, in a relatively short period of time. Modernization of education, as in any other sector, therefore implies an increase in the degree of dynamism of introduction of all innovations that appear in this area.

Education's dynamics involve more than just rejecting the various methods and forms that have historically shaped it. It entails creating a constructive dialogue that values the positive aspects of past educational practices while embracing new innovations. This approach creates a richer educational experience by combining the strengths of traditional and modern methods. Encouraging this interaction allows education to honor its past while adapting to future needs.

Bilingual education is becoming more popular and recognized, especially among different ethnocultural groups in vocational fields. This movement highlights the importance of facilitating language acquisition while also providing practical skills in a professional context. The increasing interest in bilingual education shows a growing recognition of the benefits of multilingualism in our interconnected world. As such, this trend is reshaping educational practices and career opportunities across diverse communities.

Modern scientists, technical graduates, and motivated students show interest in bilingual education based on pragmatics and practicality [11,12,13].

It should be noted that pragmatism and expediency from the point of view of linguodidactics assume the realization of scientific and educational, professional and general educational tasks with the use of bilingualism: 1) to acquire new professional knowledge and skills; 2) to improve professional skills, respectively, to raise the level of qualification; 3) to participate in international cooperation in the sphere of high technologies, in interethnic scientific, technical and educational projects [14].

Bilingual education for Ukrainian students in technical universities involves a comprehensive exploration of grammar, vocabulary, and textology - primarily from a comparative perspective. It also includes engaging in research activities across both

general technical fields and specialized disciplines, utilizing one of the world's prominent foreign languages.

Methodologists and practitioners offer several approaches to the process of organizing multilingual education in a university environment [15]:

- The *competence approach* is inextricably linked with the introduction of competences in the educational process and with the formation of foreign language communicative competence as the main goal of foreign language teaching [5; 6]. The competence approach allowed unifying the requirements to the learning process and to the planned learning outcomes. Within the framework of the competence approach, the goal of the proposed model of multilingual teaching is formulated, the components of competence (general speech, professionally-oriented speech and integrative competence) and indicators for assessing the results of multilingual teaching are identified.

- The *interdisciplinary* or *interdisciplinary approach* implies the integration of components of different disciplines. Within the framework of interdisciplinary approach, on the one hand, we integrate in one teaching model the content component of two different language disciplines - English and Spanish, on the other hand, when teaching English, we integrate the content components of the general discipline "Foreign Language" and a special discipline (e.g., "Design"), respectively.

- The *cognitive approach* is based on the assumption that language, like any other information, can be mastered by a person through cognitive (cognitive) operations. The cognitive approach involves a detailed analysis of the topic on the part of the learner, followed by a practice and skill building phase. Within the framework of the proposed methodology, the student should have an understanding of the didactic usefulness of the exercises and functional application of the studied material in professional activity.

- The *activity-based approach* to the organization of the learning process implies an increase in the role of the subject of training, his/her awareness of responsibility for the result of training. The activity approach implies the transition from the goal of forming knowledge, skills and abilities in the discipline to the goal of forming the ability to learn, from the study and discussion of theoretical

concepts to their practical implementation in the course of practice, from "spontaneous learning activity of the student to its purposeful organization", from the individual form of work to pairs of students, from the individual form of work to pairs of students. from the individual form of work to pair and group work. In the developed methodological model of multilingual teaching, the teacher acts as a moderator of the learning process, who encourages active independent work of the student to perform learning activities, as well as organizes the learning process through the format of pair or group work.

On the basis of scientific and methodological works and our own experience we will define the principles of multilingual education organization in the conditions of technical university:

- Principle of integrativity assumes not only interrelated language teaching, but also the integration of professionally-oriented content and general.

- Principle of basic learning strategies implies shifting the students' attention from the content of learning to the learning actions necessary for mastering the material.

- Principle of soft-skills-dependent organization of learning and cognitive activities shifts the focus from working on the formation of hard skills (mastering language material) to the development of soft skills on the part of the learner, which, in turn, will directly lead to the mastering of hard skills provided by the program.

- Principle of contextual afferentation, formulated by us on the basis of the analysis of works on neurophysiology, means that the teaching material should be structured and designed in such a way that the learner's mind has a full understanding of the instructions for working with this material.

- Principle of feedback afferentation - the learner's awareness of the fact that he or she has achieved a local learning goal as a result of applying a certain learning strategy, for example, successful mastering of a new list of words (formation of phonetic and lexical skills) as a result of applying certain basic learning strategies.

- Principle of minimizing intralanguage interference refers to the selection and structuring of learning content and consists in identifying language elements, the mastery of which implies the formation of similar, and

therefore interfering, skills, and distancing these elements from each other during learning.

These principles ensure effective bilingual education in the conditions of technical universities, contributing not only to the linguistic development of students, but also to their professional training. This approach allows students not only to master two languages at a high level, but also to apply this knowledge in professional activities, which is especially important for participation in international projects and cooperation in the field of high technology.

Bilingual education enhances students' cognitive flexibility and critical thinking skills, which are crucial for their intellectual growth. In addition to these cognitive benefits, it also equips students with the vital ability to effectively navigate and adapt to a range of linguistic and cultural contexts, thereby broadening their worldview. This adaptability fosters greater understanding and appreciation of diverse cultures, ultimately preparing students for success in an increasingly interconnected global society. Thus, the advantages of bilingual education extend beyond mere language proficiency, encompassing a holistic approach to learning that benefits students in multifaceted ways. This adaptability is increasingly important in our globalized world, where interactions often occur across diverse languages and cultural backgrounds. As individuals learn to communicate effectively in multiple languages, they become more open-minded and skilled in collaborating with others from different backgrounds. Ultimately, bilingual education plays a crucial role in fostering a sense of global citizenship among students and preparing them to tackle the myriad challenges

present in our increasingly interconnected world. By gaining proficiency in multiple languages, engineering graduates not only broaden their communication skills but also gain access to a wealth of information sources, including scientific publications, technical resources, and specialized materials that may not be widely available in their native language. This expanded access is invaluable as it contributes to a deeper mastery of their chosen academic disciplines while simultaneously enhancing their research capabilities. As a result, graduates are better equipped to engage with diverse perspectives and collaborate on a global scale in their professional endeavors.

It should also be emphasized that bilingual education plays a crucial role in nurturing students' development of essential competencies, including critical thinking, intercultural communication, and innovative thinking. These competencies are not just beneficial; they are increasingly indispensable in addressing complex professional challenges that arise in a rapidly evolving labor market. As industries and job requirements continue to transform, the ability to think critically and communicate across cultures becomes paramount for future success. Ultimately, equipping students with these skills prepares them to thrive in diverse and dynamic work environments.

Therefore, bilingual education in technical universities not only enhances students' professional and linguistic competencies, but also shapes their readiness to work effectively in a global professional environment where knowledge of several languages and cultural backgrounds becomes an integral part of success.

Conclusion

In today's global society, successfully cooperating internationally and promoting mutual understanding requires more than just knowing a single foreign language. Proficiency in multiple languages is essential for better engagement with diverse cultures and perspectives. Effective communication in multiple languages is crucial for building relationships and promoting collaboration in our interconnected world. Therefore, embracing a multilingual approach is vital for thriving in our ever-evolving world. Learning

several languages at the university level seems to be the most effective. During university training, students show a strong motivation to learn new languages, explore different cultures, and adopt diverse ways of thinking, along with a willingness to communicate in academic and informal settings.

The analysis of bilingual learning highlights the importance of deeply understanding two or more languages. Modern reality highlights the importance of being bilingual in various contexts, such as

intercultural, scientific, social, and professional activities. This skill is essential for success in scientific, industrial, social, and political fields.

Developers of higher education curricula face the challenge of integrating bilingualism into professional training. Bilingual teaching is crucial in engineering universities to better prepare students for their future careers.

Successful bilingualism in various fields will enhance the intellectual and creative potential of engineering graduates, fostering

better professional, social, interethnic, and intercultural communication.

Future research in bilingual education at technical universities could focus on: developing multilingual programs, exploring cognitive and psycholinguistic aspects, and assessing how bilingual education affects professional skills. These research perspectives can enhance the theory behind bilingual education and improve its effectiveness in preparing specialists for a globalized world.

References

1. Anderson, P. (2002). Assessment and development of executive function (EF) during childhood. *Child Neuropsychol*, 8(2), 71–82. DOI: <https://doi.org/10.1076/chin.8.2.71.8724>
2. Abdelgafar, G. M., Moawad, R. A. (2015). Executive function differences between bilingual arabic-english and monolingual arabic children. *J. Psycholinguist. Res*, 44, 651–667. DOI: <https://link.springer.com/article/10.1007/s10936-014-9309-3>
3. Bialystok, E., Feng, X. (2009). Language proficiency and executive control in proactive interference: Evidence from monolingual and bilingual children and adults. *Brain Lang.*, 109 (2-3), 93–100. DOI: <https://doi.org/10.1016/j.bandl.2008.09.001>
4. Leikin, M. (2013). The effect of bilingualism on creativity: Developmental and educational perspectives. *Int. J. Biling.*, 17(4), 431–447. DOI: <https://doi.org/10.1177/1367006912438300>
5. Janus, M., Bialystok, E. (2018). Working memory with emotional distraction in monolingual and bilingual children. *Front. Psychol.*, 9:1582. DOI: <https://doi.org/10.3389/fpsyg.2018.01582>
6. Gangopadhyay, I., Davidson, M. M., Weismer, S. E., Kaushanskaya, M. (2016). The role of nonverbal working memory in morphosyntactic processing by school-aged monolingual and bilingual children. *J. Exp. Child Psychol.*, 142, 171–194. DOI: <https://doi.org/10.1016/j.jecp.2015.09.025>
7. European Language Portfolio: propositions for elaboration / I. Christ et al. Strasbourg: Council of Europe Press, 1997. 120 p. <https://www.coe.int/en/web/portfolio/elp-related-publications>
8. Common European Framework of Reference for Languages: learning, teaching, assessment / Council of Europe. Cambridge: Cambridge University Press, 2000. 260 p. <https://www.coe.int/en/web/common-european-framework-reference-languages>
9. Bryntseva, O. (2020). Foreign languages as means of students' professional mobility development. *Pedagogy of forming a creative personality in higher and secondary schools*, 68(1), 212-216. DOI: <https://doi.org/10.32840/1992-5786.2020.68-1.43> (in Ukrainian).
10. Liu, X., Nie, J. (2024). The influence of bilingualism and bidialectalism on executive control: evidence from a short-term language switching training paradigm. *International Journal of Bilingual Education and Bilingualism*, 27(10), 1324–1341. DOI: <https://doi.org/10.1080/13670050.2024.2344098>
11. Zeynali Hamied, R., Modirkhamene, S. (2024). EFL learners' short-term and long-term memory: does learning additional languages matter? *International Journal of Multilingualism*, 1–15. DOI: <https://doi.org/10.1080/14790718.2023.2294955>
12. Šifrar Kalan, M., Muñoz-Basols, J., Robles-García, P., Strawbridge, T., Sánchez-Gutiérrez, C. (2024). The impact of multilingualism and proficiency on L2 vocabulary knowledge: contrasting high and low multilinguals. *International Journal of Multilingualism*, 1–24. DOI: <https://doi.org/10.1080/14790718.2024.2314626>
13. Gartzarena, M., Villabona, N., Olave, B. (2023). In-service teachers' multilingual language teaching and learning approaches: insights from the Basque Country. *Language and Education*, 38(2), 203–217. DOI: <https://doi.org/10.1080/09500782.2023.2176714>

14. Lasagabaster, David. (2000). The effects of three bilingual education models on linguistic creativity. *International Review of Applied Linguistics in Language Teaching*, 38(3-4), 213-228. DOI: <https://doi.org/10.1515/iral.2000.38.3-4.213>
15. Kemp, C. (2007). Strategic processing in grammar learning: Do multilinguals use more strategies? *International Journal of Bilingualism*, 4(4), 241–261. URL: <https://eric.ed.gov/?id=EJ838465>

The article was received by the editors 05.09.2024

The article is recommended for printing 07.10.2024

Г. І. ЗЕЛЕНІН, д-р пед.наук, професор,
професор кафедри іншомовної підготовки, європейської інтеграції та міжнародного
співробітництва
e-mail: zelenin@karazin.ua ORCID ID: <https://orcid.org/0000-0003-1274-2311>
Харківський національний університет імені В.Н. Каразіна,
майдан Свободи, 4, м. Харків, 61022, Україна

БІЛІНГВАЛЬНА ОСВІТА - ВАЖЛИВА СКЛАДОВА ОСВІТНЬОГО ПРОЦЕСУ У ЗАКЛАДАХ ВИЩОЇ ПРОФЕСІЙНОЇ ОСВІТИ

У статті проведено ґрунтовний аналіз розвитку білінгвальної освіти в закладах вищої освіти та розглядається, які вона має переваги в процесі підготовки фахівців для глобального ринку праці. Окремо обговорюється концепція багатомовної освіти Ради Європи та її застосування в контексті вищої освіти. У статті підкреслюється важливість Загальноєвропейських рекомендацій з мовної освіти (CEFR) в оцінюванні мовних навичок студентів і роль мовного портфоліо в оцінюванні їхнього багатомовного досвіду.

У роботі обговорюються різні підходи до викладання мов у контексті білінгвальної освіти, зокрема компетентнісний, міждисциплінарний, когнітивний та діяльнісний, які мають на меті допомогти студентам ефективно вивчати професійну термінологію кількома мовами. Компетентнісний підхід наголошує на розвитку ключових комунікативних та професійних навичок, необхідних для успішної діяльності в багатомовному середовищі. Міждисциплінарний підхід поєднує мовні навички з професійними знаннями, дозволяючи студентам застосовувати вивчене в різних контекстах. Когнітивний підхід фокусується на покращенні усвідомлення навчання через розумові процеси, тоді як діяльнісний підхід заохочує самостійну роботу та розвиває навички самонавчання студентів.

Автор наголошує, що білінгвальна освіта має важливе значення для того, щоб допомогти студентам розвинути навички, необхідні для міжнародних проєктів та командної роботи. Це покращує їхню міжкультурну комунікацію та заохочує інноваційне мислення. Технічні університети покращують мовні навички та професійні компетенції студентів, готуючи їх до успіху в конкурентному світовому ринку праці, де цінується багатомовне спілкування. Запроваджуючи білінгвальну освіту, навчальні заклади, по суті, готують своїх випускників до майбутнього, де адаптивність і міжкультурна співпраця мають першорядне значення. Такий підхід приносить користь як окремим студентам, так і допомагає створити більш інклюзивну глобальну спільноту.

КЛЮЧОВІ СЛОВА: *білінгвальне навчання, багатомовність, компетентнісний підхід, міждисциплінарне навчання, когнітивний підхід, вища професійна освіта, глобалізація.*

Конфлікт інтересів

Автор заявляє, що конфлікту інтересів щодо публікації цього рукопису немає. Крім того, автор повністю дотримувався етичних норм, включаючи плагіат, фальсифікацію даних та подвійну публікацію.

Стаття надійшла до редакції 05.09.2024

Стаття рекомендована до друку 07.10.2024