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Socialisation of student youth in social networks

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Abstract. Social networks have become a part of the daily life of students, they influence the development of views, values and identity, which can have an impact on students' social connections, so research is an urgent task that contributes to understanding this influence. The purpose of the study was to investigate the impact of social networks on various spheres of life of modern students. In order to investigate the issues of socialisation of young people in social networks, the study used generalisation and analytical method. As a result, the importance of developing strategies aimed at strengthening the positive impact of social networks on students was highlighted. It was revealed that changing social norms and creating an atmosphere of open and decent communication in an online environment can help improve students' socialisation in the virtual world. It was noted that the protection of privacy and the development of critical thinking are important for ensuring the security and information competence of social network users. The importance of developing media literacy and skills in verifying the truthfulness of information in the process of socialisation of students was noted. Strategies that promote the development of virtual space and improve interaction in social networks were outlined. The paper analysed aspects of positive socialisation of students in the digital age that help them solve problems and cope with the challenges of the online environment. The results of scientific research can contribute to a better understanding of how social networks affect young people, and help researchers develop programmes and strategies aimed at supporting the positive aspects of this impact and reducing possible negative consequences

Keywords: Facebook; Instagram; relationships; virtual educational environment; communication

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INTRODUCTION

Social networks play an important role in students' daily lives, influencing the socialisation of young people. Social media can affect young people because of the challenges they face online, such as the amount of information they consume and how they perceive it. Understanding this impact can help develop strategies to improve student

socialisation in the digital world. This aspect may include promoting healthy and constructive online communication, developing critical thinking skills for a more informed perception of information, and support in dealing with specific situations that arise on social media, such as cyberbullying or the spread of fake news.



O. Maltseva (2020) noted that in the last decades of the 20th century and at the beginning of the 21st century, information technologies began to actively influence various aspects of human life. According to her findings, the Internet plays a key role in this process, turning into “virtual reality”. According to the researcher, its impact on personal development is so significant that many scientists consider the new information environment to be an important factor in socialisation, along with space, nature, and society. The researcher defines socialisation as a complex process of assimilation of social experience, including knowledge about the surrounding world, interpersonal relationships, society values, models of social behaviour, etc. The result of this process is the adaptation of the individual to the social environment, which should be studied in more detail in the framework of students’ socialisation in social networks.

Researchers of changes in the process of socialisation in modern society, J. Guhin *et al.* (2021), note that socialisation, i.e., the process of transferring values, norms, traditions, and social roles from one generation to another, occurs in the context of various influences and transformations. Researchers point out that traditional means of socialisation, such as family, religion, and education, have undergone changes due to new social, technological, and cultural influences. In particular, researchers note the influence of media, the Internet, and public networks on the socialisation of modern generations. The researchers also note the importance of the question of the place of school education in the socialisation process and the challenges associated with changes in it. It is necessary to investigate in more detail the aspects of this issue to identify the features of student socialisation conditions in the new realities.

E. Bidegain *et al.* (2023) note that youth actively use social media to interact and build their identity. Researchers suggest that students create and discuss their own identity based on common interests, beliefs, and values that they collectively recognise on the Internet. In modern society, according to researchers, social networks play a leading role in the ability to promote cultural integration, mutual understanding, and establishing social ties among young people. It is worth carefully studying the aspects of this issue and the impact of social networks on the socialisation of modern students.

N. Umanets (2020) points out that the Internet, social networks, and other aspects of information and digital development of humanity influence the development of the worldview and values of the younger generation. The researcher notes that along with the opportunities offered by informatisation, there are risks for the socialisation of young people. Among them, the researcher notes the abuse of personal information, cyberbullying, the influence of disinformation and fake news. These aspects can lead to negative consequences for the psychological state and social development of young people, so the role of parents, teachers, and other adults in accompanying young people in the digital environment is important. The researcher is convinced that the education of digital literacy and active

dialogue can help young people reduce the risks of information socialisation and preserve life guidelines. It is necessary to investigate in more detail the impact of informatisation on the socialisation of modern youth, in particular students. O. Stelmakh (2022) focused on how social media can affect the social, psychological, and academic spheres of students’ lives. It is important, according to the researcher, that social networks can be both a useful tool for students and a factor that introduces certain challenges and risks. The researcher draws attention to the importance of students’ conscious and informed use of social networks.

Despite a number of publications on this issue, it is still necessary to investigate in more detail the features of student socialisation, including through social networks. The actual problem is how to ensure a balance between the positive and negative consequences of using social networks by students. Positive aspects may include increasing the availability of information for training and community support, while negative aspects may include the risks of loss of privacy and network dependency. The purpose of the study was to investigate how social media affects the development of social connections, beliefs, and values in students.

MATERIALS AND METHODS

This study used the analytical method and the method of generalisation to investigate the process of socialisation of student youth in the context of modern digital development and active use of social networks in more depth and detail. These methods helped to consider the information received, analyse the positive and negative aspects of the impact of social networks on students, and develop specific strategies to improve this impact.

During the study, the tabular method was used to create tables. The paper also used a comparative method to contrast the opinions of various researchers about the socialisation of young people, and to compare their own research results with those of other scientists. The systematisation method was used, which highlighted the positive and negative aspects of the impact of social networks on the student community. Due to the method of analysis that was used in the study, key aspects of the research topic were highlighted; in particular, important trends and dependencies that previously could have gone unnoticed were identified. The use of the analysis method in research work established certain patterns in the field under study. The analytical method allowed considering both positive and negative aspects of the use of social networks in the interaction and development of social relations among modern students. Based on the analytical method, the influence of these networks on the educational process and academic activities of students, and their self-determination and reflection on the Internet, was studied. The analytical method examined how students use social networks to receive social support and ensure psychological well-being, disseminate information, and actively participate in various initiatives. An important aspect that was identified based on the analysis was the identification of situations of dependence

on the Internet and distraction from the educational process that may arise as a result of the use of modern social networks among young people.

Using the method of synthesis, key aspects and an overview of the impact of these networks on various aspects of students' lives and development were provided. The generalisation presented these results in a more organised and structured form, which contributed to a better understanding of information and ensured the consistency of research. Based on the generalisation method, strategies for improving the impact of social networks on students were highlighted, in particular:

- changes in social norms, which is stimulated by communication with young people, the spread of positive examples in social networks;
- privacy, which is ensured by the provision of security tools; dependence and lack of communication links proper, which is corrected by stimulating physical activity and offline initiatives;
- expanding students' horizons; supporting the skills of differentiating the real and virtual world; promoting the assimilation of information.

The use of the generalisation method contributed to the disclosure of important aspects of students' adaptation to the digital environment and identified the main areas of further actions in the field of social interaction in social networks to ensure a positive impact on their socialisation and personal development.

RESULTS

Contemporary young people, in particular students, not only acquire education and academic knowledge, but also interact, exchange information, discuss current issues, and support each other through social media. This aspect expands the possibilities of their self-realisation and creates additional spaces for the development of a young person's own identity. However, it should be borne in mind that this virtual socialisation can lead to negative consequences, so students need to understand how to balance their social media activities and academic responsibilities to ensure the harmonious development of identity and social skills.

Students are the most active social group in the information society and are most exposed to uncontrolled social influences and negative spontaneous socialisation. In the context of their education and social development, an important aspect is observed: the role of the family, cultural institutions and higher education institutions in the process of socialisation decreases, while the influence of modern mass communication media, especially the Internet, increases. Self-education, self-control, and self-realisation of students are becoming increasingly important. This context requires a review of approaches to social support and student education. It also highlights the relevance of research on the impact of media, in particular the Internet, on the process of student socialisation and notes the need to adapt the content, forms, and methods of social work in the cyber environment (Saiapina & Mukhina, 2022).

The essence of student identity arises and improves through active interaction with various socio-cultural and academic influences that accompany students throughout their studies in higher education institutions. This process involves perception and adaptation to the learning environment, interaction with the community of students and teachers, understanding personal values and learning goals. Thus, student identity is the result of a complex social construct that affects students' perception and self-determination in the context of higher education (Weidman *et al.*, 2014). Just as student identity is formed through higher education, students' socialisation and development of their social skills now also take place in a different, virtual world – in social networks. Modern students use a variety of online platforms to communicate, share information, and in the process they build their virtual identity and socialise with their peers.

Socialisation is a complex and lengthy process that involves accepting and understanding the social norms, values, roles, and skills necessary for successful integration of the individual into society. This process, according to current research, is not completed at a certain stage, but continues throughout a person's life. It is important to consider that socialisation is influenced by various factors, including cultural, social, and contextual aspects. This process involves interacting with various social agents, such as family, school, peers, media, and other institutions (Gauvain & Parke, 2010). Each of these agents has an important influence on the development of personality and determining its place in society. Due to rapid changes in the modern world, including the role of the Internet and social networks, socialisation has become more diverse and complex.

Among the main motives that lead students to use social networks are entertainment, fighting loneliness, communicating with friends and acquaintances, receiving news and accessing various information materials, such as articles and books. In particular, the most important motivations for students are entertainment and communication. It is important to note that this choice is conditioned by their confidence in the security and privacy of these networks, and a high level of social activity (Fathi *et al.*, 2020). Many students use social media to communicate and interact with others, and this can affect various aspects of their social life. This can be a distraction from academic responsibilities, a routine of learning, and it can also occur due to a lack of daily communication with people of the opposite sex, which is an important part of student life. However, some students also support the idea of using social media in their studies and consider creating online groups to discuss materials, share information, and interact with fellow students as a useful learning tool. This approach is perceived by students as successful and useful (Malik, 2023).

Modern social networks, including Facebook, are key components of the process of socialisation of students in the modern information society. They not only facilitate communication between young people, but also influence

their perception of the world and the development of their own identity. Students actively use Facebook to share information, establish new connections, and build social networks. However, it is important to note that this process is also accompanied by a number of problems. One of them is the issue of privacy and security of information, since the information that students share on social networks can fall into dishonest hands or be misused. There may also be questions about the impact of social media on students' mental health, in particular, in the form of stress or negative effects on well-being. Facebook and modern social networks play a significant role in students' socialisation, helping them build social relationships and shape their identity, but it is important to constantly study and understand the impact of these networks on the younger generation and develop strategies to ensure their safety and mental comfort in this digital environment (Barkhuus & Tashiro, 2010).

Students, especially those representing Generation Z, may be vulnerable to the influence of age-related stereotypes that are present in the online environment. This can affect their behaviour and interactions with other social media users. Such stereotypes can influence their decisions, other users' perceptions, and even influence their judgments about their own competence (Wijenayake *et al.*, 2021). This highlights the importance of students' education and awareness of the impact of stereotypes and the need to develop critical thinking about the information they receive on social networks. Based on the data obtained from the study, it became clear that virtual social networks have an important impact on the student community and their social behaviour (Table 1). This influence manifests itself in the context of students' socialisation, i.e. in the formation of their social skills, communication with peers, and the development of stereotypes and values.

Table 1. Impact of social media on the student community

Impact aspects	Positive impact	Negative impact
Communication and social relations	Social networks help maintain and expand students' social contacts. They can make new friendships, maintain old acquaintances, and connect with peers from different parts of the world.	Increasing the time spent in online communication to the detriment of offline social relationships.
Training and academic activities	Students can use social networks to learn, share educational materials, collaborate on projects, etc.	Distraction from learning, especially if students spend a lot of time watching news or visiting entertainment pages.
Impact of image and self-identification	Social media can influence how students create and maintain their image. They can share photos, statuses, interests, etc., which affects their self-esteem and perception of themselves and others.	Students may become too dependent on evaluating their image and self-esteem based on the reactions and preferences of other social media users. This can lead to unstable self-esteem and self-doubt.
Social support and psychological well-being	Social networks can be a place where students seek support in difficult moments, share their thoughts and feelings.	Negative comments or criticism can affect the psychological state of students.
Access to information	The Internet provides students with the opportunity to access a large number of resources, which helps them deepen their knowledge and develop skills.	Significant time spent on social media can cause Internet addiction and distraction from your studies and academic activities.
Dissemination of information and activity	Social networks can be a platform for spreading information about current events and promoting activism among students.	Social media activism can contribute to the spread of cyberbullying and online attacks. Students may be the target of this negative phenomenon, which can affect their mental and emotional state.

Source: compiled by the authors

The overall impact of social media on students and their social behaviour depends on individual characteristics, attitudes to network use, and the ability to self-regulate. This impact can be both positive and negative, so it is important to find a balance between using social media and other aspects of student life. With the help of social networks, modern students can discuss academic issues, share educational resources, receive support from peers, and even establish professional contacts. However, such virtual socialisation can also have its own problems, such as the risk of losing privacy, Internet addiction, and the impact of image on students. Social networks, as part of the digital environment, can be not only a means of communication and entertainment, but also a source of information and can carry certain risks, such as access to negative content (violence, pornography, etc.) and the risk of becoming

dependent on social networks and the Internet in general. Excessive use of social networks can contribute to social maladaptation and desocialisation of young people, and dependence on virtual communication. Therefore, it is important to teach young people and children how to use the network safely. This can be achieved through actions both on the part of parents and with the support of the state. In addition, the media can contribute to this process by displaying social advertising that highlights the dangers of excessive Internet use (Lisovych, 2022).

Virtual space can become an important means for socialisation of young people, especially in war conditions. Social networks and other online resources provide access to information, communicate with peers and others, and find support and resources to adapt to difficult conditions. The use of virtual space can also have negative aspects, such

as the risks of online addiction and the negative impact of information on the network. Therefore, it is important to balance the use of these resources to support socialisation and protect against possible threats (Boichuk *et al.*, 2023). The modern information landscape, in particular, the information war in Ukraine, has a significant impact on the socialisation of young people. In this context, there is a threat of loss of life guidelines and one's own ideals, since the information space is full of various messages and views. Young people who face a clash of different information sources and discussions may feel lost in this flow of information. This impact can cause psychological stress and frustration, as young people try to understand and assess the situation in the country and the world, but often face disagreements and misinformation. This is especially true for the military conflict in Ukraine, where many young people are experiencing uncertainty and a threat that af-

fects their psychological state. A change in the worldview among young people may be a consequence of this process. They move from a carefree life to experiencing a threatening present and an uncertain future. This can lead to changes in their values, beliefs, and life priorities (Yurchenko, 2019). The information war in Ukraine affects the socialisation of young people, creating complex challenges and opportunities. Understanding this impact is important for further research and development of strategies to support young people in the context of information conflict. Understanding the dynamics and impact of information aspects on the socialisation process can help develop effective methods and tools to support students and young people in adapting to new conditions. Strategies to increase the positive impact of social media communication on students are essential to ensure the sustainability and positive development of youth in the digital age (Table 2).

Table 2. Strategies to increase the positive impact of social media communications on students

Aspect	Strategies
Changing social norms	<ol style="list-style-type: none"> 1. Open and decent communication with students about social norms and standards. 2. Popularisation of positive examples in social networks. 3. Education of students about cultural and ethical behaviour in social networks.
Privacy and security	<ol style="list-style-type: none"> 1. Encouragement of students to properly manage their privacy. 2. Support for online security and privacy campaigns. 3. Provision of access to privacy protection tools.
Addiction and lack of communication	<ol style="list-style-type: none"> 1. Encouragement of physical activity and offline communication. 2. Use of networks to organise real events and meetings. 3. Development of initiatives to involve students in various offline activities.
Problems related to limited information flow	<ol style="list-style-type: none"> 1. Stimulation of the expansion of the range of information. 2. Introduction of critical thinking and information evaluation skills. 3. Development of multicultural communities in social networks.
Virtual reality and the real world	<ol style="list-style-type: none"> 1. Support for virtual and real-life separation skills. 2. Encouragement of participation in offline events and communication. 3. Use of networks to learn and improve skills in real life.
Assimilation of information	<ol style="list-style-type: none"> 1. Development of media literacy and information verification skills. 2. Popularisation of sources that confirm the truthfulness of information. 3. Conduct training on critical research and analysis of information. 4. Create more diverse sources of information for students.

Source: compiled by the authors

The above strategies can promote the positive impact of social media on students and at the same time reduce the risk of negative consequences. Despite the fact that social networks have their own characteristics, correctly chosen strategies can help students implement a more conscious and effective approach to their use, which will contribute to their social development and personal growth.

DISCUSSION

Modern student socialisation covers two important components: classroom learning and interaction in the virtual space of social networks. This dual nature of student socialisation expands opportunities for the development of students' identity and social skills. It is important to analyse the views of researchers on the issues of social relationships in the digital environment of students and compare them with the results of this study. This will help to identify common and distinctive aspects in understanding the impact of social

networks on students, and identify the possibility of applying these studies in the practice of improving the effectiveness of the educational process and socialisation of students.

C.B. Cazden (2017) examined socialisation and its role in parenting and education. The researcher emphasised the importance of communication and interaction in the process of socialisation of children and students. The researcher suggests that interaction with other people, especially in the context of learning, affects the development of communication skills and social competence of young people. There is a need to develop communicative competence as a key element of socialisation, and the role of teachers in contributing to this process. According to the researcher, socialisation plays a significant role in education and upbringing, and it is necessary for the development of personality and achieving academic and social success of young people. Comparing the results of this study, it is worth noting that the process of socialisation in the student

environment is now largely transferred to the digital environment to social networks, which is the result of digital progress of humanity and provides students with new and wider opportunities for social activity.

E. Gallardo-Echenique *et al.* (2020) point out that despite the widespread use of digital technologies among young people, certain social media, such as Facebook, Instagram, and WhatsApp, remain central to student audiences. Researchers note that social networking on these platforms can have a significant impact on students' socialisation, relationships, and perception of the world. Comparing with the results of this study, it is worth noting that modern students use these social networks for socialisation and perceive their academic and social environment through the prism of the digital space.

R. O'Carroll & T. Rooney (2020) emphasise the importance of understanding the impact of social networks, in particular Facebook, on the younger generation. They argue that this social platform is becoming a significant aspect of Generation Z socialisation and influencing their social skills and behaviour. Young people, according to the researchers, use Facebook for a variety of purposes, including connecting with friends and family, expressing their own personality, finding information, and interacting with communities. However, the researchers emphasise that there are both positive and negative aspects to this process. Among the positive aspects are the possibility of increasing social interaction and joint activities, while the negative consequences can be privacy violations and the development of dependence on social networks (O'carroll & Rooney, 2020). In comparison with the results of the study, it is important to note that the impact of social networks such as Facebook on young people, in particular students, is significant in modern society. However, it is important to understand that socialisation through the Internet is an integral part of the development of digital technologies and society as a whole.

The impact of Facebook use on students' socialisation and academic performance was investigated by S. Ainin *et al.* (2015). According to the researchers, there was a positive link between the academic performance of students in Malaysia and their use of Facebook. Researchers suggest that students who use Facebook more tend to perceive their academic work as more successful. Comparing with the results of this study, it is worth noting that the use of social networks, including Facebook, carries both positive and negative manifestations of influence on the socialisation of students. T. Balamurugan & M. Aravinthan (2023) note that social networks are becoming increasingly popular among students, even in rural areas, as young people have the opportunity to use these networks to access educational resources, connect with peers, and entertainment. Researchers point to the positive impact of social media on the academic and social aspects of student life, but there are also risks associated with the use of social media, such as loss of concentration during training and the possibility of conflicts. It is noted that social networks affect student

life and they can have both a positive and negative impact on students' learning and social adaptation, which is worth agreeing with when comparing the results of this study.

G.M. Talaue *et al.* (2018) argue that social media has become an essential part of students' lives and takes up most of their free time. The researchers also argue that social media can have both a positive and negative impact on student performance, with the positive aspects being the ability to find useful information and communicate with peers, which promotes socialisation and friendship. However, the researchers emphasise that students should be personally responsible for their time on social media, as excessive use of them can distract from their studies and other important tasks. Comparing the results of this study with the data obtained as a result of investigating this issue, it is worth noting that social networks are indeed one of the leading communication tools for modern youth, including students, so young people need critical thinking skills on self-awareness to control the negative aspects of the impact of social networks and digital media.

S. Thanuskodi (2023) explored the use of social media among undergraduate students. The researcher argued that undergraduate students actively use social media for various purposes, including sharing information, communicating with peers, supporting learning, and socialising. Students use social networks to gain access to up-to-date information and resources, and to interact with their classmates and teachers. The researcher points out the importance of effective use of social media in the educational process and the possibility of using them as a tool to improve the quality of education and promote the academic growth of students, which will contribute to the overall socialisation of young people. Comparing with the results of this study, the use of social networks among students contributes not only to the goals of socialisation, but also to the educational process of students.

The influence of social networks on the socialisation of students is the subject of study by many scientists in the modern world. An analysis of various studies and opinions of researchers shows that this influence has both positive and negative aspects. The positive aspects of using social media include the possibility of increasing the accessibility of educational resources and learning tools, facilitating communication and community between students and teachers, and developing digital literacy skills. Social media can promote the exchange of ideas and collaborative learning. However, there are also negative aspects. These include a tendency to break away from school and poor academic performance due to too much time spent on social media. There is also a risk of negative content and online bullying affecting the mental health of students.

CONCLUSIONS

The impact of social networks on students' socialisation is multifaceted. It is important to understand that effective use of these platforms in the educational process can improve information perception, develop social skills, and promote

academic growth. However, students should be aware of possible negative consequences and take measures to avoid them. To achieve a balance between the benefits and negative aspects of using social media in the educational process, it is important to develop digital literacy and develop critical thinking in students. As a result of the study, the impact of social networks on the student community was considered, in particular, the positive and negative aspects of communication and social relations through social networks, the impact of the use of networks on the learning and academic activities of students, the impact of image and self-identification, obtaining social support and psychological well-being through social networks, and the dissemination of information and activity. The study also highlighted aspects of Internet addiction and distraction from the educational process due to the use of social media among young people.

The use of strategies to enhance the positive impact of social media communication on the student community contributes to increasing the level of socialisation of young people in the virtual world. These strategies aim to improve the quality of social media interactions and have the po-

tential to improve both students' psychosocial status and their overall learning and communication performance. Changing social norms can contribute to a more open environment supported on social media. Privacy protection and security allow students to feel safe and confident in an online environment. Developing critical thinking skills and digital literacy can make them more educated consumers of online information. Such strategies help students to better master the virtual space and interact effectively with other social media participants. They open up opportunities for establishing positive relationships, expanding social ties, and improving the quality of socialisation of students in the digital age. Future researchers should pay attention to how students build their public image on social media and how this affects their self-identification, which can reveal the depth and diversity of this phenomenon.

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CONFLICT OF INTEREST

REFERENCES

- [1] Ainin, S., Naqshbandi, M.M., Moghavvemi, S., & Jaafar, N.I. (2015). Facebook usage, socialization and academic performance. *Computers & Education*, 83, 64-73. doi: 10.1016/j.compedu.2014.12.018.
- [2] Balamurugan, T., & Aravinthan, M. (2023). *Impact of social networking sites among college students with special reference to rural areas in India*. Pennsylvania: IGI Global. doi: 10.4018/978-1-6684-7123-4.ch095.
- [3] Barkhuus, L., & Tashiro, J. (2010). Student socialization in the age of Facebook. In *CHI '10: Proceedings of the SIGCHI conference on human factors in computing systems* (pp. 133-142). New York: Association for Computing Machinery. doi: 10.1145/1753326.1753347.
- [4] Bidegain, E., Arroyo-Sagasta, A., Diaz, K., Zuberogoitia, A., Anton, E., & Rozas, I. (2023). Youth, social networks and identity: A cross-border study from the Basque country. *Catalan Journal of Communication & Cultural Studies*, 15(1), 101-122. doi: 10.1386/cjcs_00080_1.
- [5] Boichuk, O., Lyebedyeva, Yu., Stadnyk, M., Mishchuk, A., & Shcherbin, L. (2023). Effectiveness of virtual space in the socialization process of teenagers (under martial law). *Amazonia Investiga*, 12(63), 266-276. doi: 10.34069/AI/2023.63.03.25.
- [6] Cazden, C.B. (2017). *Communicative competence, classroom interaction, and educational equity: The selected works of Courtney B. Cazden*. New York: Routledge.
- [7] Fathi, L., Kaldi, A., & Sarokhani, B. (2020). *Sociological analysis of the use of virtual social networks among students (case study: Students of Tehran University)*. *Journal of Iranian Social Development Studies*, 12(45), 37-54.
- [8] Gallardo-Echenique, E., Bullen, M., & Castillo, A. (2020). Peruvian undergraduate students' usage of digital technology in academic context. In *2020 IEEE world conference on engineering education (EDUNINE)* (pp. 1-5). Bogota: IEEE. doi: 10.1109/EDUNINE48860.2020.9149522.
- [9] Gauvain, M., & Parke, R.D. (2010). Socialization. In M.H. Bornstein (Ed.), *Handbook of cultural developmental science* (pp. 239-258). New York: Psychology Press. doi: 10.4324/9780203805497.
- [10] Guhin, J., Calarco, J.M., & Miller-Idriss, C. (2021). Whatever happened to socialization? *Annual Review of Sociology*, 47, 109-129. doi: 10.1146/annurev-soc-090320-103012.
- [11] Lisovych, A. (2022). *The influence of Internet communications on the social behavior of Ukrainian youth*. In *Psychosocial resources of the personal and social development in the era of globalization: Materials of the international scientific and practical conference* (pp. 102-105). Ternopil: Western Ukrainian National University.
- [12] Malik, M.A. (2023). *Social networking sites: Impact on academic and social life of college students in Kashmir*. *International Journal of Indian Psychology*, 11(1), 282-289.
- [13] Maltseva, O. (2020). Cybersocialization as a special kind of socialization of the individual. *Bulletin of Luhansk Taras Shevchenko National University. Pedagogical Sciences*, 2(2), 190-199. doi: 10.12958/2227-2844-2020-2(333)-2-190-199.
- [14] O'Carroll, R., & Rooney, T. (2020). Uses and gratifications of Generation Z within social networks: A dialectical investigation into the Facebook domain. *Journal of Promotional Communications*, 8(1), 1-27. doi: 10.21427/8trc-g695.

- [15] Saiapina, S.A., & Mukhina, V.V. (2022). [The state of research on the problem of socialization of student youth in higher education institutions](#). *Topical Issues of Modern Science and Education*, 8, 89-97. Sloviansk: Donbas State Pedagogical University.
- [16] Stelmakh, O. (2022). Peculiarities of social networks influence on students. *Theory and Practice of Social Systems Management*, 2, 92-100. [doi: 10.20998/2078-7782.2022.2.07](#).
- [17] Talaue, G.M., AlSaad, A., AlRushaidan, N., AlHugail, A., & AlFahhad, S. (2018). The impact of social media on academic performance of selected college students. *International Journal of Advanced Information Technology*, 8(4/5), 27-35. [doi: 10.5121/ijait.2018.8503](#).
- [18] Thanuskodi, S. (2023). Usage of social networking sites among post graduate students. In *Research anthology on applying social networking strategies to classrooms and libraries* (pp. 1052-1070). Pennsylvania: IGI Global. [doi: 10.4018/978-1-6684-7123-4.ch057](#).
- [19] Umanets, N.A. (2020). [Risks of socialization of young people in the conditions of informatization of social environment](#). *Personal Spirituality: Methodology, Theory and Practice*, 96(3), 244-255.
- [20] Weidman, J.C., DeAngelo, L., & Bethea, K.A. (2014). Understanding student identity from a socialization perspective. *New Directions for Higher Education*, 2014(166), 43-51. [doi: 10.1002/he.20094](#).
- [21] Wijenayake, S., Hu, J., Kostakos, V., & Goncalves, J. (2021). Quantifying the effects of age-related stereotypes on online social conformity. In C. Ardito, R. Lanzilotti, A. Malizia, H. Petrie, A. Piccinno, G. Desolda & K. Inkpen (Eds.), *Human-computer interaction – INTERACT 2021: 18th IFIP TC 13 international conference* (pp. 451-475). Cham: Springer. [doi: 10.1007/978-3-030-85610-6_26](#).
- [22] Yurchenko, V.I. (2019). Problems of socialization of children and youth in the context of information warfare. *Bulletin of Psychology and Pedagogy*, 24, 176-179. [doi: 10.33120/SPCOEIProceedings-2019](#).

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Соціалізація студентської молоді в соціальних мережах

Анотація. Соціальні мережі стали частиною повсякденного життя студентської молоді, вони впливають на формування поглядів, цінностей та ідентичності, що може містити вплив на соціальні зв'язки студентів, тому дослідження є актуальним завданням, яке сприяє розумінню цього впливу. Метою дослідження було вивчення впливу соціальних мереж на різні сфери життя сучасної студентської молоді. Для того, щоб вивчити питання соціалізації молодих людей у соціальних мережах, у науковій роботі застосовано узагальнення та аналітичний метод. У результаті проведеного дослідження висвітлено важливість розробки стратегій, спрямованих на підсилення позитивного впливу соціальних мереж на студентську молоддь. Виявлено, що зміна соціальних норм і створення атмосфери відкритого та гідного спілкування в онлайн-середовищі можуть сприяти поліпшенню соціалізації студентів у віртуальному світі. Звернено увагу на те, що захист приватності та розвиток критичного мислення важливі для гарантування безпеки та інформаційної компетентності користувачів соціальних мереж. Наголошено на важливості в процесі соціалізації студентської молоді розвивати медійну грамотність та навички перевірки правдивості інформації. Окреслено стратегії, що сприяють освоєнню віртуального простору та покращенню взаємодії в соціальних мережах. Проаналізовано аспекти позитивної соціалізації студентської молоді в цифрову епоху, які допомагають вирішувати завдання та справлятися з викликами онлайн-середовища. Отримані результати наукового дослідження можуть сприяти кращому розумінню того, як соціальні мережі впливають на молоддь, а також допоможуть науковцям у розробці програм та стратегій, спрямованих на підтримку позитивних сторін цього впливу та зменшення можливих негативних наслідків

Ключові слова: Facebook; Instagram; відносини; віртуальне освітнє середовище; спілкування

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The effectiveness of a 3D interactive learning environment as a mechanism for sharing and retaining knowledge

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Abstract. The purpose of this study was to develop recommendations for the use of 3D interactive technologies in the educational process to improve the learning of students. The experiment involved 200 students of the same age in two different groups who interacted with immersive or conventional technologies. The task was divided into four stages. In modern world, immersive technologies are constantly evolving, allowing for effective learning and thus the creation of a 3D learning environment. This study covered the significance of 3D interactive environments in the learning process, which affect the long-term retention of knowledge by students. The study analysed the perception and satisfaction of education through interactivity. The potential benefits of introducing 3D interactive learning environments into the educational process were identified. It was proved that interactive 3D learning environments can be an effective way of transmitting and storing information for such reasons as engaging students, visualising material, adapting to individual needs, preserving the information provided, and evaluating the result. The obtained findings helped to determine the effectiveness of understanding, sharing, and retaining knowledge in 3D interactive learning environment. It was established that the use of 3D learning environments helps to increase the interest and activity of students in the learning process. New opportunities are opening for visualising complex concepts and effective learning in a variety of fields. A significant aspect is that the potential of 3D learning environments as an innovative means of transferring and preserving knowledge is significant, and the impact on students is positive. The practical significance of the work is to determine the effectiveness of using interactive 3D technologies in the educational process, which contribute to increasing students' interest, activity and long-term retention of knowledge

Keywords: educational resources; educational platforms; non-formal education; computer graphics; STEAM education

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INTRODUCTION

In modern rapidly evolving world, educational institutions and companies are constantly looking for new teaching methods that would be effective and engaging for students. One such type of innovative approach is the use of 3D interactive learning environments (ILEs). In turn, 3D technologies enable students not only to see the material but also to interact with it, which makes the learning process more engaging and effective. They enable a better understanding of the material by visually demonstrating complex concepts and functions. The use of 3D interactive environments can considerably increase the level of learning and retention of knowledge. They allow students and pupils to feel like active participants in the learning process, not just passive observers. However, despite all the benefits, there are certain challenges to using 3D interactive learning environments. Technical limitations, accessibility for all categories of users, and effectiveness in preserving knowledge are just a few of them. Therefore, the question of the effectiveness of 3D interactive learning environments as a mechanism for sharing and retaining knowledge requires a more in-depth analysis and assessment of the impact on the learning process. This issue has received considerable attention among researchers, and there is a sizeable number of relevant studies.

P. Chatwattana *et al.* (2020), X. Sun & E. Ch'ng (2024) found that the effectiveness of the educational process depends on the methodology of teaching and self-cognition, self-government techniques, classroom techniques, and learning environment. Virtual learning implements the idea of imperceptible organic merging of learning methods with a person's physical environment as a useful logical consequence of the full computerisation of life, the introduction of mobile devices and wireless communication. According to G. Bozzelli *et al.* (2019), virtual reality (VR) significantly improves the methodology for sharing and retaining knowledge, provides valuable empirical experience to each participant in the educational process, creating conditions for the personalised and comprehensive development of experimental skills close to reality. Technology also complements the use of immersive learning environments based on real-world simulations and considerably improves the quality of learning.

To unlock the potential of technology as a thinking tool, G.J. Harkema & A. Rosendaal (2020), F. Tian & S. Kim (2024) joined a team of teachers and experts in film studies in the field of university education, VR, and conducted an empirical study. It was found that this reality can make the learning process more interesting, encouraging the active involvement of students. Simulated environments can also motivate them and stimulate the learning process. X. Pan *et al.* (2024) supplemented the above opinion and found that VR devices are designed to become smaller, easier to use, and more accessible to a wider audience. This evolution has enabled the population to enjoy immersive virtual experiences, as well as provide

interactive and realistic content. In this regard, VR has become one of the most popular forms of media for various fields of study.

B. Zhang *et al.* (2022) created a new contextual interactive 3D game (3DCG) in a virtual game environment (GVE) based on a unique virtual platform called Terf. Terf helped to observe and record data related to conversations and user behaviour. They have a positive potential for motivating students from different cultures to take part in teamwork and facilitate the exchange of their cultural and linguistic knowledge. The robots use assumptions, and therefore they can localise interactions with the surrounding space and sense their movements. This assumption is embedded in the robot's sensor selection and hard-coded into its cognitive architecture (Georgeon *et al.*, 2024).

Z. Gong *et al.* (2024) note that VR can be used from a psychological standpoint and reduce its cultural impact on creativity through targeted exposure. It was found that there is a considerable impact of immersive technologies on the development of human behaviour and thinking. According to K. Griffin (2023), immersive virtual experiences can be achieved through autonomous cognitive and biometric systems, exercise, and behavioural tracking tools, as well as emotion recognition and situational awareness algorithms. M. Grupac *et al.* (2023) and A. Sudiarno *et al.* (2024) focused on deep learning tools, cloud computing, visual image and ambient sound processing, which are based on immersive 3D VR technology, predictive modelling, and machine vision algorithms. Accordingly, technology was found to help create immersive, photorealistic virtual spaces (Lin *et al.*, 2022).

The purpose of this study was to investigate and analyse the learning outcomes of higher education students who used 3D interactive technologies in comparison with conventional teaching methods. The hypothesis of this experiment was to interact with immersive technologies that increase the level of attention. The following tasks were set to fulfil this purpose:

- to review the literature and previous studies on the use of 3D interactive learning environments and to determine whether they have advantages and limitations in the transfer and retention of knowledge;
- to compare the effectiveness of 3D interactive learning environments with other teaching methods in terms of knowledge acquisition and retention;
- to investigate the impact of using 3D interactive environments on students' motivation, interest, and involvement in the learning process;
- to identify recommendations based on the findings obtained to optimise the use of innovative technologies for their maximised effectiveness in education.

MATERIALS AND METHODS

In this study, an experiment was conducted to investigate the effectiveness of 3D interactive learning environments

as a mechanism for sharing and retaining knowledge. The study used such types of immersive technologies as virtual and augmented reality (AR). 200 participants were selected, who were divided into two groups: control (100 people) and experimental (100 people). The participants of the experiment were 10-11 years old, 55% of whom were boys and 45% – girls. The two groups had the same tasks, but the experimental group interacted with immersive technologies, while the control group interacted with conventional ones. All the standards set out in the Declaration of Helsinki (2013) were followed during the study.

The task encompassed four distinct stages to comprehensively evaluate the impact of immersive technologies on cognitive and social aspects among participants. In Stage I, both groups engaged in a demanding attention and concentration task within a virtual tour, focusing on locating specific objects. Specifically, at the first stage of the experiment, the mind map method was used to search for objects during a virtual tour of the museum for the experimental group and to view images in a textbook for the control group. Evaluation criteria include the number of words by level: low (0-5 words), sufficient (6-10 words), high (11-15 words). Stage II involved inducing emotional responses through an experiment “Creating Your Own Rainbow”, measuring participants’ physiological reactions like pulse and blood pressure within the virtual environment. The second stage involved measuring the blood pressure after the experiment using a tonometer and the pulse using a heart rate monitor. The results are based on the generally accepted norms of blood pressure and pulse levels for children aged 10-11 years. The pressure level was defined as follows: optimal 110-119/60-69 mmHg, normal 120-130/70-80 mmHg, and elevated 131-139/81-89 mmHg. The pulse rate indicates that the optimal one is 65-69 beats per minute (bpm); normal 70-75 bpm; and elevated – 76-85 bpm.

Stage III assessed memory and cognitive abilities using virtual environments compared to traditional methods, specifically testing knowledge retention on the topic of “Numbers: Actions with Numbers”. According to the third stage, the test items were assessed according to the following criteria: low level included 0-4 correct answers, sufficient level – 5-8 correct answers, high level – 9-12 correct answers. Finally, Stage IV simulated social interaction in a virtual scenario on road safety, examining how immersive technologies influenced participants’ communication dynamics and emotional reactions throughout the interaction. In the fourth stage, a list of six questions was compiled about the interaction between participants in the educational process and two degrees (low and high) of joint activity were determined using yes/no answers. 3-6 negative answers meant a low degree of social interaction, and 0-3 negative answers meant a high degree. According to the purpose of the study, the results of the performance of students of the control and experimental groups at each stage were evaluated.

RESULTS

Features of 3D interactive learning environment in the modern world

The latest technologies are gaining popularity in education every year. Modern gadgets, including computers, tablets, and mobile phones with round-the-clock internet access, are essential for modern society. Education is directly linked to modern computer technology. Multimedia devices and communication technologies are nowadays increasingly used in the educational process. At the same time, the rapid development of technology is challenging the education system, while 3D (three-dimensional) technology is a modern trend in educational technology that meets all the requirements of modern education (Lee & Wu, 2024). Interactive 3D learning environments can be a highly effective way to share and retain information for a variety of reasons.

1. Involvement of students. The environment can engage students more than conventional teaching methods. They allow simulating real-life situations, making learning more engaging and dynamic.

2. Visualisation and materialisation. Thanks to the 3D function, students can see abstract concepts in a specific format. For instance, one can investigate the molecular structure of a compound or study historical events in a virtual reconstruction.

3. Adaptation to individual needs. The 3D learning environment can be customised to suit the individual characteristics of students.

4. Information security. Through interactive simulations and exercises, learners or students can better retain information and actively engage with the content and help consolidate knowledge.

5. Assessment opportunities. 3D learning environments can also provide students with new opportunities to assess their knowledge. For instance, one can use virtual tests and monitor students’ reactions in real time.

There are methods such as anaglyph, which use colour images intended for the left and right eyes to achieve the stereo effect (3D) of a conventional stereo pair of images. To achieve this effect, one needs to wear special glasses that have special light filters instead of dioptrics: the left eye is red, the right eye is blue, or a stereo image is a combination of stereo paired images where the red channel contains the image for the left eye and the blue channel contains the image for the right eye. Red and blue anaglyph glasses allow creating the illusion of a 3D image using colour coding (Bekele, 2019).

The use of 3D technologies in education allows diversifying classes, as well as making the learning process effective. The use of 3D content makes it possible to visually explain the material to students, encourages the study of individual elements from the entire structure, adds interactive educational content, including tests, 3D videos, modelling, a virtual laboratory, interactive tasks, games, text, images, and hyperlinks (Table 1).

Table 1. Key aspects of the effectiveness of 3D interactive learning environments

Aspects	Feature	Challenges
Visualisation of complex concepts	Improvement of understanding by visualising and manipulating 3D objects	High demands on graphics hardware and software
Development of spatial thinking	Promotion of the development of spatial thinking skills through work with 3D models	Not all subjects require spatial thinking
Cost of development	Ability to create unique and effective learning content	High maintenance and development costs
Technical requirements	Use of modern technologies for learning	High hardware and internet connection requirements
Obstacles to adaptation	Possibility of individual adaptation for each student	Not all students adapt equally well to innovative technologies
Teacher training	Improvement of teachers' skills through training in innovative technologies	Additional resources and preparation time
Active involvement of students	Engagement through interactive tasks, simulations, and games	Need to train participants in the educational process in innovative technologies
Engagement and motivation	Increase in motivation through gamification elements (achievements, rewards)	Possible development of dependence on gamification incentives
Personalised training	Adaptation of content to the individual needs of students	Excessive costs of developing personalised materials

Source: compiled by the authors

3D interactive learning environments are an effective mechanism for sharing and retaining knowledge due to a range of key factors that enhance both the learning process and the retention of material. The key signs of 3D ILEs' effectiveness include the following.

1. Visualisation and spatial understanding. 3D models allow creating complex concepts, which is vital in industries where spatial understanding is critical (medicine, architecture, engineering). Students can zoom, rotate, and otherwise interact with three-dimensional models, which helps them understand the material better than two-dimensional images or textual explanations.

2. Interactive and active learning. Stimulates the active involvement of higher education students in the learning process, which contributes to a better learning experience. Therefore, instead of passively listening to lectures, students are actively involved in solving problems, simulations, and games, which stimulates critical thinking and better retention of information.

3. Simulation of real-life situations. 3D ILEs allow creating realistic simulations that reproduce real conditions and situations. Higher education students can train in a safe environment that allows them to repeat tasks

without risk, practice skills, and apply theory in practice.

4. Customisation of learning. ILEs allow the learning process to be adapted to the individual needs of higher education students, who can learn at their own pace, receive feedback, and revise the material as many times as necessary to master it.

5. Multimedia approach. The combination of sound, text, video, and 3D graphics makes learning more effective. Multimedia content activates a variety of sensory channels, which helps to improve information retention.

6. Motivation and engagement. Interactivity and gamification increase the motivation of students. Game elements, such as achievements, rewards, and levels, make the learning process more interesting and encourage participants to engage in activities.

7. Better retention and application of knowledge. Interactive and active learning contributes to better long-term retention of knowledge. Practical exercises, simulations, and revision allow students to better retain material and apply knowledge in different contexts.

A 3D learning environment is an innovative technological platform that combines elements of VR, AR, and interactive graphics to create an immersive learning experience (Table 2).

Table 2. Main types of 3D learning environments

No.	Types	Feature
1	VR	The use of VR headsets allows students to immerse themselves in a virtual environment that simulates real-life learning scenarios. They can interact with objects and situations created using computer graphics.
2	AR	AR allows superimposing virtual objects on the real world, which creates interactive learning scenarios. For instance, a student can use a smartphone or tablet to explore virtual objects that are projected onto a real environment.
3	Personalised training	Thanks to data analytics and artificial intelligence, 3D learning environments can provide personalised learning materials and tasks that meet the individual needs and knowledge level of each student.
4	Simulations and visualisations	These environments allow recreating complex scenarios and simulating real-life situations, which facilitates learning in areas that require hands-on experience, such as medicine, engineering, or aviation.

Source: compiled by the authors

3D learning environments often have interactive elements that allow students to interact with virtual objects, solve problems, and engage with virtual partners or instructors. Thanks to the Internet, 3D learning environments can be accessed by students from all over the world, allowing them

to learn in an online community and communicate with colleagues and teachers from different countries. Immersive technologies are a relatively new tool in education. They cannot completely replace conventional teaching methods, but they can qualitatively complement learning (Table 3).

Table 3. Comparison of immersive and conventional learning technologies

Feature	Immersive technologies	Conventional technologies
Engagement and motivation to learn	High due to its visuality and interactivity	Low due to dependence on the teachers and the methods themselves
Technical requirements	Need for software and special equipment	Basic school equipment
Customisation of learning	As technologies are adaptive, customisation is high	Limited to standard applications
Practical experience	Significant due to simulations providing a sense of reality	Relatively limited in terms of practical classes and laboratory work/workshops
Social interaction	May be limited to a virtual environment	High due to personal communication and activity
Acquisition of the material	Deep due to active involvement	Subject to change, depends on independent activity
Accessibility	Depends on the availability of technology	Accessible to all
Individualisation	Ability to adapt to the needs of the individual	Limited, there may be one programme for all
Activity and orientation	High due to the presence of interactive elements	Probability of passivity

Source: compiled by the authors

Generally, immersive technologies are practice-oriented, facilitate practice, make it easier to understand, and make the learning process interesting. The principal idea behind immersive technologies is to increase the presence, interaction, and engagement of users in virtual or unified (real and virtual) environments. Immersive technologies help to improve the quality of the educational process, make it more interactive, adaptable, and engaging for students; expand learning opportunities and promote better understanding. The use of immersive technologies greatly expands the capabilities of modern professionals in the field of education. VR and AR technologies entail a change in the role of teachers, who create new virtual environment projects, develop scenarios for interacting with visual interactive materials, and help improve the efficiency of the educational process. Immersive technologies have such a component as objective reality (OR), in which the user is located and which they perceive in their senses. It is a world that exists independently of them and their consciousness – AR. Users can add virtual content to the real world using their smartphone camera. In other words, the camera captures the real world and complements it with virtual objects. The AR application works with 3D models, text, images, animations, and videos. VR is a fully simulated reality that uses digital technology to allow users to see, hear, and feel completely differently. To enter VR, users must wear fully enclosed goggles (headsets). Immersive technologies have a massive potential for modernising primary education and making learning more interactive, interesting, and engaging for younger students.

Advantages of 3D technology:

1. Equipping teachers with high quality teaching materials that save time in explaining complex concepts.
2. Visualisation of difficult topics for learning.
3. Incorporating processes and objects in 3D (three-dimensional models) into conventional learning tools, which helps to attract innovation and motivate the learning process.

4. Promoting the systematisation of information.

5. Help in acquiring more knowledge and a positive impact on academic performance.

Notably, immersive technologies are characterised by diversity. A distinctive feature of VR environments is that they produce the effects of image change and presence in real time through sight, hearing, touch, and other senses. AR images reflecting the real world are supplemented with virtual elements. Furthermore, AR will pay more attention to improving the existing environment, while VR helps to fully immerse the student in it. An example of 3D technology is the Magic Planet multimedia digital sphere, which is used for teaching and learning about Earth sciences. Such a technology allows observing the phenomena and processes in their dynamics, which are usually studied in university programmes. The sphere resembles a computer with over 150 programs connected to a projector with a convex lens on which a ball is placed (Klopp et al., 2023). The projector glows inside the ball, and the image rotation around the axis of the ball is simulated using a special program.

There are programs to simulate the images of planets in the sky by controlling the rotation speed, animation speed, as well as to simulate polar inversion. Furthermore, a PC is connected to the Internet, and the digital world works in real time, so scientists and students can observe the origin of hurricanes in certain parts of the world. Panoramic imaging technology is also incorporated into the learning process, allowing 3D models of objects of assorted colours to be created. There is even a special classroom, The Seer, where practical and experimental research in the humanities and sciences is conducted. Moreover, in the modern world, there is a technology called “live 3D sticker” (Tatlow, 2024). For creating demonstrations and illustrations – they have great prospects for use in the modern educational process. The use of various online 3D services to develop didactic materials not only facilitates the teaching of various language activities, but also

allows for individual approaches and enhances students' independent work.

Zooburst is a service for creating 3D books that help the author to fulfil their ideas for creating their space through illustrations, tests, and sounds. 3D books cannot be downloaded to a computer and can only be used online (Tai, 2023). There is a mode that allows interacting with the book using gestures. For instance, pages can be turned simply by waving a hand in front of the book. Virtual tours are a multimedia way to express the surrounding space. Virtual tours are based on panoramas and have an interactive display that differs from conventional photographs. This means that when viewing a panoramic photo, the user can see only the part of the image that interests them at the moment, and if necessary, they can zoom in to see the details. By completing a series of communication exercises, students can easily find themselves anywhere. 3D technologies are aimed at improving the process of learning the necessary educational material, but they do not replace teachers or lecturers. Teachers using modern digital technologies, including 3D technologies, can spend more time encouraging real-life communication and doing exercises. The progress in the development of 3D technologies observed today opens massive opportunities for the future of humanity and allows entering a new technological era. They are the most effective way of learning: learning is provided by personal experience and practical activities.

The current trend in learning is no longer dependent on details or memorisation. There have been considerable changes in the way students learn and absorb educational materials. E-learning content focused on visualisation and storage of information not only modernises lessons, but also helps to track the effectiveness of classes. Based on the above information, it is worth highlighting recommendations for the use of 3D interactive environments in the educational process to improve the learning of knowledge by students:

- selecting the right content – using 3D ILEs for complex and abstract topics that are difficult to understand when using conventional teaching methods (engineering structures, architectural designs);
- interactivity and active learning – the use of interactive elements such as simulations, virtual laboratories, practical tasks, games, and testing (adaptation of educational material to the individual needs and level of knowledge of the student, and therefore it is worth determining the complexity of tasks or providing additional resources for those who need more time to learn the material);

- multimedia approach – a combination of texts, audio, video, and 3D models to create a multisensory learning experience (e.g., using video instructions alongside 3D models to explain complex processes);

- feedback and assessment – feedback and self-testing should be provided for students (interactive tests with automatic feedback after each question);

- collaboration and communication – drafting a scenario for opportunities to work together and discussing virtual projects in groups (group projects in architecture, where students work together to create 3D models of buildings);

- training of each teacher – proper training of teachers to work with 3D ILEs (advanced training courses for teachers, including training in 3D software and interactive methods);

- regular content changes – recommendations on learning content and technologies to keep them relevant and interesting. Example: updating virtual laboratories to reflect the latest research and technological advances;

- integration with other teaching methods – using 3D ILEs with other conventional and modern teaching methods to achieve an integrated approach;

- effectiveness analysis – regular analysis of the effectiveness of using 3D ILEs to adjust teaching strategies (e.g., student surveys, performance analysis, and research to assess the impact of 3D ILEs on learning).

Using educational 3D modelling, one can transform an ordinary lesson into a journey into another world. AR facilitates the “immersion” into the subject of study during classes, moving from the entire structure to individual elements, from complex to simple or vice versa. One of the key features of 3D modelling technology is that it can be taught and learned through personal experience in many areas that may be difficult or impossible, while 3D technology can be invisible, visible, inaccessible, and accessible.

Experimental study of the effectiveness of 3D interactive learning environment

The experimental study involved two groups: a control group and an experimental group, which included 200 participants. The experimental group used immersive technologies in the learning process, while the control group used conventional technologies, as presented in Table 4. The experiment included 4 stages of research and determination of the level of effectiveness of the 3D interactive learning environment as a mechanism for the sharing and retention of knowledge.

Table 4. Analysis of learning technologies used in the experiment

Stage	Immersive technologies	Conventional technologies
I	A virtual tour of the museum with interaction	Viewing of images of the museum in the textbook
II	3D model for creating a rainbow	Using the equipment for the experiment
III	Virtual game	Workbook with test tasks
IV	3D model of traffic and relevant signs	Discussion of the situations depicted in the textbook

Source: compiled by the authors

The first stage of the experiment was a test of attention and concentration. Participants in two groups had to search for historical objects. The experimental group took a virtual tour of the facilities. The control group viewed images of the same objects in a textbook. Afterwards, both

groups were tasked with describing the museum's exhibits, using the mind map method to find as many words as possible. Based on the results, according to the evaluation criteria, comparative Table 5 was compiled, which shows the number of participants of the respective level.

Table 5. Results of the first stage of the experiment

Group	Results		
	Low	Sufficient	High
Experimental	22	36	42
Control	22	57	21

Source: compiled by the authors

Based on the results of the first stage of the experiment, it was found that the use of VR, specifically the virtual museum, helped to achieve a prominent level of learning among the majority of participants in the experimental group. The majority of the control group showed a sufficient level of performance. The low level in both groups was the same.

The next step was to analyse the emotional response of the students. The participants of the educational process were given an experiment "Create Your Own Rainbow". The experimental group looked at a 3D model of a rainbow, which was represented by a 3D object consisting of a

set of points in 3D space connected by various geometric objects such as lines. The control group used equipment such as a container of water, a small mirror, a piece of paper, and a flashlight. The task was to review an experiment performed by a teacher. After the experiment was completed, the purpose of this stage was to measure physiological parameters (pulse, blood pressure). The results of the comparison, based on the generally accepted norms of blood pressure and pulse levels for students, are presented in Table 6, which shows the number of participants in the respective indicator.

Table 6. Results of the second stage of the experiment

Physiological indicators	Results					
	Control group			Experimental		
	Optimised	Normal	Enhanced	Optimised	Normal	Enhanced
Pulse	20	41	39	19	40	41
Pressure	20	76	4	22	68	10

Source: compiled by the authors

According to the results obtained, immersive methods have shown success and effective involvement of students in the learning process, increasing their motivation to learn the subject. The students were interested in the experiment and were excited about the process and the results.

The third stage was testing the memory and cognitive abilities of the students. After studying the topic "Numbers. Actions with Numbers", the task was to assess the knowledge of the control group with test tasks that included arithmetic operations, comparing numbers, solving problems, and working with decimals. For the experimental group, students played a virtual game where participants receive virtual money to buy goods from a store. They had to choose the goods so that their total amount did not exceed the corresponding amount of money. Accordingly, students had to score 12 correct answers. These tasks helped to assess the level of understanding of the material and identify areas that demand more attention from students. The results are presented in Figure 1.

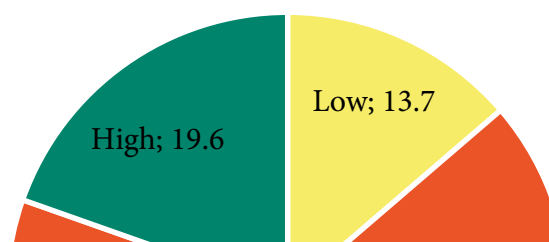


Figure 1. Research results from the third stage of the experiment
Source: compiled by the authors

The last stage was the analysis of social interaction between participants in the educational process to compare VR and conventional technology. The control group discussed the situations depicted in the textbook in relation to the topic of road safety. The experimental group was offered a 3D model of traffic and corresponding signs. Af-

ter completing the task, the control groups were asked six questions about social interaction:

1. Have you discussed situations with your classmates?
2. Did your classmates help you explain the points that you did not understand?
3. Do you agree that it is important to follow the traffic rules?
4. Did you receive any additional materials or advice on road safety from the teacher after completing the tasks?
5. Do you think that these tasks were necessary and did not help you better understand the traffic rules?
6. Have you discussed with your parents why it is important to follow the traffic rules after completing the tasks?

The results of the survey are presented in Figure 2.

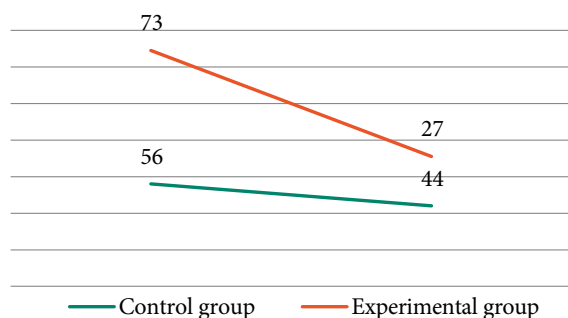


Figure 2. Results of the fourth stage of the experiment
Source: compiled by the authors

These questions helped to assess the extent to which students interact with classmates, teachers, and parents during and after assignments. Based on testing, it was found that learning with conventional technology showed higher social interaction than immersive learning.

According to the four stages of the experiment, it was found that the use of 3D learning environments increases the interest and activity of students in the learning process, as it opens new opportunities for visualising complex concepts and effective learning in various fields of knowledge. Notably, the potential of 3D learning environments as an innovative tool for sharing and retaining knowledge is significant, and their impact on students is positive. There are certain shortcomings, including social interaction, that need to be improved and worked on.

DISCUSSION

Today, there is an ongoing debate among modern researchers about the effectiveness of 3D interactive learning environments as a mechanism for sharing and retaining knowledge. The discourse mainly focuses on the advantages and disadvantages of using 3D technologies in the educational environment.

E.S. Abowardah *et al.* (2019) find that 3D technologies play a key role in the delivery of educational content. Using 3D visualisation technology, students can go beyond static images and textbook descriptions to immerse themselves in a dynamic and interactive learning environment. This

opinion is supported in the present study, noting that the use of 3D models, simulations, and VR can help explore complex details, manipulate objects, and observe phenomena that are difficult to understand. This process sparks curiosity, encourages active involvement, and fosters a better understanding of complex concepts. According to F. Canet & S. Sánchez-CastilloView (2024), one of the key advantages of 3D experiments is their ability to engage students and promote active learning. The immersive nature of 3D visualisation brings the motivational component to a more profound level, making the learning process more enjoyable. Clearly, students take an active part in virtual experiments and manipulate objects in a 3D environment, becoming more involved in their learning journey. This active involvement leads to increased motivation, better knowledge retention, and a higher level of understanding.

J. Hu (2024) focused on the technologies that continue to change the educational environment, with 3D experiments standing out as a powerful tool for changing the learning experience. With the ability to engage students, develop a better understanding and bridge the decommunization gap between theory and practice, 3D experiments have massive potential for both teachers and students, using platforms such as Airbook, where teachers discover a world of engaging and interactive educational resources to develop their teaching strategies. Notably, the study continues the researcher's thought and highlights that 3D modelling can be used to create interactive models to illustrate various scientific and technical principles. Students can interact with these models, change parameters, and observe the results, making learning more engaging and informative. Thanks to 3D technologies, distance learning has become more effective and interactive. C. Girvan & T. Savage (2019) provide examples of the practical use of 3D technologies: students can visit virtual laboratories regardless of their physical location, attend virtual tours and interactive classes, and immerse themselves in the learning process. The findings support the assumption that 3D technologies not only contribute to better information absorption, but also develop key skills for the future, such as critical thinking, problem solving, creativity, and innovative thinking. As L. Jiang (2024) suggests in his study, this prepares students for the challenges of the modern world, in which digital technologies play an important role.

The results of the study show that there are many advantages of using 3D learning environments, but despite the many benefits, the integration of 3D technologies into the educational process also faces challenges, such as the need for relevant equipment and the need to train teachers and students to work with the latest technologies. However, as M. Wahid & S. Muslim (2019) point out, the possibility of using such technologies in education is worth the cost of solving these problems. The effectiveness of 3D technologies in education opens a wide range of opportunities to improve the quality and efficiency of the educational process. This not only provides a better understanding of the learning materials, but also motivates students to take an

active part in learning and encourages creative and innovative thinking. There are also negative aspects to organising a 3D learning environment. According to C. Price & A. Archer (2022), these include many aspects, namely: technical limitations, as in the modern world, many students still have limited access to the necessary equipment and Internet connection, which makes it difficult to take part in a 3D learning environment; lack of necessary skills to perceive 3D learning, which makes it impossible to engage with the learning material; distracted attention, as virtual technologies can be distracting, especially if students are not experienced in its use.

S. Segear *et al.* (2024) highlight negative trends and thus continue the previous opinion of the above-mentioned researchers. They believe that the problems in 3D learning environments are frequent fatigue of students, especially when such learning requires prolonged concentration or movement, and lack of social interaction. The latter is a very common problem, as in some cases virtual learning does not allow for personal interaction with the participants in the learning process, which can affect their social development. The findings of the study were confirmed by the studies of X. Pan *et al.* (2024) and M.Z. Iqbal *et al.* (2021), which highlight that developing and maintaining a 3D learning environment can require considerable software, hardware, and staff training costs, and some 3D platforms may have complex or inconsistent interfaces that can make them difficult for users to navigate and use. All the above problems and shortcomings can be solved by improving technology and raising user awareness.

Implementing a 3D learning environment today can be challenging for several reasons. Firstly, creating 3D environments requires considerable knowledge and skills in computer graphics, programming, design and engineering, from object design to functional programming, which is a lot of work. Some 3D learning environments require powerful hardware for graphics and data processing. As T. Sparrow *et al.* (2024) point out, this can make it difficult to access for users with disabilities. Secondly, R. Spick & J. Walker (2019) identify the creation of an intuitive and user-friendly interface in a 3D environment as a major challenge. It is necessary to ensure convenient navigation, clear interaction with objects and other users. Developing and maintaining a 3D learning environment can be a costly process, especially if one needs to use specialised software or hire a professional designer or developer. Thirdly, according to M. Camilleri (2024), despite these challenges, the development and use of 3D learning environments has great potential to engage learners, enhance learning, and create interesting and engaging educational experiences. To ensure effective learning, it is important to consider learning principles when designing a 3D learning environment. This may require collaboration with educators and education specialists.

The findings have revealed a new perspective on the organisation of 3D learning environments, which enables the creation of a high-quality, efficient, and effective

learning environment using innovative virtual technologies. For this, one can employ such technologies as VR, AR, interactive 3D models. Generally, these types of 3D learning environments allow students to learn the necessary educational material in an exciting way. The integration of the latest technologies into 3D learning environments can improve the process and concept of learning in general. 3D interactive learning environments enhance the process of knowledge sharing and retention through interactivity, gamification, customisation of learning, visualisation, simulation of real-life scenarios, and a multimedia approach. They promote active learning, critical thinking, and long-term retention of information, making them an effective tool in modern education.

The reliability of the findings obtained was influenced by the data and information obtained as a result of the study. The study was also based on the authoritative opinions of contemporary researchers. Certain aspects of this issue have not been studied, as 3D learning technologies are still under development and are constantly being improved.

CONCLUSIONS

3D interactive learning environments enhance the process of sharing and retaining knowledge through interactivity, gamification, customisation of learning, visualisation, simulation of real-life scenarios, and a multimedia approach. They promote active learning, critical thinking, and long-term retention of information, making them an effective tool in modern education. To improve learning through 3D interactive learning environments, a comprehensive approach should be employed, including content adaptation, active student engagement, feedback, collaboration support, and regular updating of learning materials. It is also important to provide teachers with proper training and continuously analyse the effectiveness of these technologies in the learning process.

The findings presented in this study prove that investigating the effectiveness of 3D learning environments for schoolchildren can have such consequences in the modern world as the process of improving the learning of educational materials. In this study, an experiment was conducted to investigate the effectiveness of 3D interactive learning environments as a mechanism for sharing and retaining knowledge. The hypothesis was proved, which noted the positive impact of interaction with immersive technologies, which increases the level of attention. 3D environments can contribute to better learning by visualising information. This study helped to assess how students interact with classmates, teachers, and parents during and after homework. Based on the tests, it was found that learning using conventional methods demonstrates a higher level of social interaction than immersive learning. According to the 4 stages of the experiment, it turned out that the use of a 3D learning environment increases the interest and effectiveness of students in the learning process, as it creates new opportunities for visualising complex concepts and conducting effective training in various fields of knowledge.

Notably, the potential of 3D learning environments as an innovative tool for knowledge transfer and preservation is significant, and its impact on learners is positive.

The study confirmed that 3D modelling can turn an ordinary activity into a journey into another world. AR makes it easier to move from the entire structure to individual elements, from complex to simple or vice versa. One of the key features of 3D modelling technology is that it can be taught and learned directly. The use of 3D learning environments contributes to the retention of students' knowledge, but further research in this area is needed, considering individual needs and capabilities. As a promising area of research, studies can investigate the impact of using 3D environments on the development of certain skills, such as spatial thinking, creativity, and problem

solving. A limitation of this study was the results dependent on a concrete learning environment, its features and resources. Another limitation of this study included the insufficient use of 3D in the modern educational process to improve the acquisition of the learning material and the formation of students' knowledge. A promising area of research is the development and ways of incorporating 3D technologies into the educational process by any accessible means.

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CONFLICT OF INTEREST

REFERENCES

- [1] Abowardah, E.S., Khalil, M., & Ramadan, M. (2019). Sense of place attachment to the architectural academic library: Toward an interactive learning environment. *International Journal of Design Education*, 14(2), 43-69. doi: [10.18848/2325-128X/CGP/v14i02/43-69](https://doi.org/10.18848/2325-128X/CGP/v14i02/43-69).
- [2] Bekele, M.K. (2019). Walkable mixed reality map as interaction interface for virtual heritage. *Digital Applications in Archaeology and Cultural Heritage*, 15, article number e00127. doi: [10.1016/j.daach.2019.e00127](https://doi.org/10.1016/j.daach.2019.e00127).
- [3] Bozzelli, G., Raia, A., & Ricciardi, S. (2019). An integrated VR/AR framework for user-centric interactive experience of cultural heritage: The ArkaeVision project. *Digital Applications in Archaeology and Cultural Heritage*, 15, article number e00124. doi: [10.1016/j.daach.2019.e00124](https://doi.org/10.1016/j.daach.2019.e00124).
- [4] Camilleri, M. (2024). Metaverse applications in education: A systematic review and a cost-benefit analysis. *Interactive Technology and Smart Education*, 21(2), 245-269. doi: [10.1108/ITSE-01-2023-0017](https://doi.org/10.1108/ITSE-01-2023-0017).
- [5] Canet, F., & Sánchez-Castillo, S. (2024). Understanding how immersive media enhance prosociality: A systematic literature review and meta-analysis. *Communication Research*. doi: [10.1177/00936502241247534](https://doi.org/10.1177/00936502241247534).
- [6] Chatwattana, P., Kuntama, K., & Phadungthin, R. (2020). [A 3D-interactive virtual classroom with a virtual learning environment](https://doi.org/10.1016/j.wte.2020.100000). *World Transactions on Engineering and Technology Education*, 18(4), 387-392.
- [7] Declaration of Helsinki. (2013). Retrieved from <https://www.wma.net/what-we-do/medical-ethics/declaration-of-helsinki/>.
- [8] Georgeon, O.L., Lurie, D., & Robertson, P. (2024). Artificial enactive inference in three-dimensional world. *Cognitive Systems Research*, 86, article number 101234. doi: [10.1016/j.cogsys.2024.101234](https://doi.org/10.1016/j.cogsys.2024.101234).
- [9] Girvan, C., & Savage, T. (2019). Virtual worlds: A new environment for constructionist learning. *Computers in Human Behavior*, 99, 396-414. doi: [10.1016/j.chb.2019.03.017](https://doi.org/10.1016/j.chb.2019.03.017).
- [10] Gong, Z., Gonçalves, M., Nanjappan, V., & Georgiev, G.V. (2024). Priming uncertainty avoidance values: Influence of virtual reality stimuli on design creativity in ideation. *Computers in Human Behavior*, 158, article number 108257. doi: [10.1016/j.chb.2024.108257](https://doi.org/10.1016/j.chb.2024.108257).
- [11] Griffin, K. (2023). Interactive 3D geo-visualization systems, deep learning-based image classification algorithms, and virtual navigation and simulation modeling tools across web3-powered metaverse worlds. *Linguistic and Philosophical Investigations*, 22, 230-246. doi: [10.22381/lpi22202314](https://doi.org/10.22381/lpi22202314).
- [12] Grupac, M., Machcinik, S., & Negoianu, A.E. (2023). Immersive engagement and geospatial mapping technologies, deep learning and neural network algorithms, and visual perception and data mining tools in metaverse interactive and extended reality environments. *Linguistic and Philosophical Investigations*, 22, 196-212. doi: [10.22381/lpi22202312](https://doi.org/10.22381/lpi22202312).
- [13] Harkema, G.J., & Rosendaal, A. (2020). From cinematograph to 3D model: How can virtual reality support film education hands-on? *Early Popular Visual Culture*, 18(1), 70-81. doi: [10.1080/17460654.2020.1761598](https://doi.org/10.1080/17460654.2020.1761598).
- [14] Hu, J. (2024). Individually integrated virtual/augmented reality environment for interactive perception of cultural heritage. *Journal on Computing and Cultural Heritage*, 17(1), article number 9. doi: [10.1145/3631145](https://doi.org/10.1145/3631145).
- [15] Iqbal, M.Z., Mangina, E., & Campbell, A.G. (2021). Exploring the real-time touchless hand interaction and intelligent agents in augmented reality learning applications. In *2021 7th international conference of the immersive learning research network (iLRN)* (pp. 1-8). Eureka: Institute of Electrical and Electronics Engineers. doi: [10.23919/iLRN52045.2021.9459415](https://doi.org/10.23919/iLRN52045.2021.9459415).
- [16] Jiang, L. (2024). Exploration of virtual reality technology enabling diversified teaching models of civics and politics. *Applied Mathematics and Nonlinear Sciences*, 9(1). doi: [10.2478/amns-2024-1034](https://doi.org/10.2478/amns-2024-1034).

- [17] Klopp, M., Dörringer, A., Eigler, T., Bartel, P., Hochstetter, M., Weishaupt, A., Geirhos, P., Abke, J., Hagel, G., Elsebach, J., & Rossmann, R. (2023). Development of an authoring tool for the creation of individual 3D game-based learning environments. In *Proceedings of the 5th European conference on software engineering education* (pp. 204-209). New York: Association for Computing Machinery. [doi: 10.1145/3593663.3593689](https://doi.org/10.1145/3593663.3593689).
- [18] Lee, S.M., & Wu, J.G. (2024). Preparing teachers for the future: Microteaching in the immersive VR environment. *ReCALL*. [doi: 10.1017/S0958344024000089](https://doi.org/10.1017/S0958344024000089).
- [19] Lin, V., Yeh, H.C., Huang, H.H., & Chen, N.S. (2022). Enhancing EFL vocabulary learning with multimodal cues supported by an educational robot and an IoT-based 3D book. *System*, 104, article number 102691. [doi: 10.1016/j.system.2021.102691](https://doi.org/10.1016/j.system.2021.102691).
- [20] Pan, X., Lin, Q., Ye, S., Li, L., Guo, L., & Harmon, B. (2024). Deep learning based approaches from semantic point clouds to semantic BIM models for heritage digital twin. *Heritage Science*, 12, article number 65. [doi: 10.1186/s40494-024-01179-4](https://doi.org/10.1186/s40494-024-01179-4).
- [21] Price, C., & Archer, A. (2022). Resemiotization: Tracing the movement of resources in landscape architectural design trajectories. *Visual Communication*, 22(1), 152-173. [doi: 10.1177/14703572221118583](https://doi.org/10.1177/14703572221118583).
- [22] Segear, S., Chheang, V., Baron, L., Li, J., Kim, K., & Roghayeh, L. (2024). Visual feedback and guided balance training in an immersive virtual reality environment for lower extremity rehabilitation. *Computers & Graphics*, 119, article number 103880. [doi: 10.1016/j.cag.2024.01.007](https://doi.org/10.1016/j.cag.2024.01.007).
- [23] Sparrow, T., Bain, K., Kimber, M., & Wilson, A.S. (2024). Visualising heritage: Using 3D immersive technologies to innovate, document and communicate rich narratives for HS2. *Internet Archaeology*, 65. [doi: 10.11141/ia.65.7](https://doi.org/10.11141/ia.65.7).
- [24] Spick, R., & Walker, J. (2019). Realistic and textured terrain generation using GANs. In *CVMP '19: Proceedings of the 16th ACM SIGGRAPH European conference on visual media production* (pp. 1-10). New York: Association for Computing Machinery. [doi: 10.1145/3359998.3369407](https://doi.org/10.1145/3359998.3369407).
- [25] Sudiarno, A., Sari Dewi, R., Widyaningrum, R., Murtaja Dzaky, A.M., & Supriatna, A.Y. (2024). Investigating the future study area on VR technology implementation in safety training: A systematic literature review. *Journal of Safety Science and Resilience*, 5(2), 235-248. [doi: 10.1016/j.jnlssr.2024.03.005](https://doi.org/10.1016/j.jnlssr.2024.03.005).
- [26] Sun, X., & Ch'ng, E. (2024). Evaluating the management of ethnic minority heritage and the use of digital technologies for learning. *Journal of Cultural Heritage Management and Sustainable Development*. [doi: 10.1108/JCHMSD-03-2023-0024](https://doi.org/10.1108/JCHMSD-03-2023-0024).
- [27] Tai, N. (2023). Applications of augmented reality and virtual reality on computer-assisted teaching for analytical sketching of architectural scene and construction. *Journal of Asian Architecture and Building Engineering*, 22(3), 1664-1681. [doi: 10.1080/13467581.2022.2097241](https://doi.org/10.1080/13467581.2022.2097241).
- [28] Tatlow, S. (2024). Authenticity in sound design for virtual reality. In *History as fantasy in music, sound, image, and media* (pp. 161-183). New York: Routledge. [doi: 10.4324/9781003291725](https://doi.org/10.4324/9781003291725).
- [29] Tian, F., & Kim, S. (2024). LEAPSE: Learning environment affordances for 3D human pose and shape estimation. *Transactions on Image Processing*, 33, 3285-3300. [doi: 10.1109/TIP.2024.3393716](https://doi.org/10.1109/TIP.2024.3393716).
- [30] Wahid, M., & Muslim, S. (2019). Assessment of media learning based on learning virtual reality in industrial work practices in SMK. *Humanities & Social Sciences Reviews*, 7(3), 446-453. [doi: 10.18510/hssr.2019.7365](https://doi.org/10.18510/hssr.2019.7365).
- [31] Zhang, B., Goodman, L., & Gu, X. (2022). Novel 3D contextual interactive games on a gamified virtual environment support cultural learning through collaboration among intercultural students. *Sage Open*, 12(2). [doi: 10.1177/21582440221096141](https://doi.org/10.1177/21582440221096141).

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Ефективність 3D інтерактивного навчального середовища як механізму обміну та збереження знань

Анотація. Метою даного дослідження була розробка рекомендацій щодо використання 3D інтерактивних технологій у навчальному процесі для покращення засвоєння матеріалу студентами. В експерименті взяли участь 200 студентів одного віку у двох різних групах, які взаємодіяли з імерсивними або традиційними технологіями. Завдання було поділено на чотири етапи. У сучасному світі імерсивні технології постійно розвиваються, що дозволяє ефективно навчатися, а отже, створювати 3D навчальне середовище. Це дослідження висвітлює значення інтерактивних 3D-середовищ у навчальному процесі, які впливають на довготривале збереження знань студентами. У дослідженні було проаналізовано сприйняття та задоволеність освітою через інтерактивність. Визначено потенційні переваги впровадження 3D інтерактивних навчальних середовищ в освітній процес. Доведено, що інтерактивні 3D навчальні середовища можуть бути ефективним способом передачі та зберігання інформації з таких причин, як залучення студентів, візуалізація матеріалу, адаптація до індивідуальних потреб, збереження наданої інформації та оцінка результату. Отримані результати допомогли визначити ефективність розуміння, обміну та збереження знань у 3D інтерактивному навчальному середовищі. Встановлено, що використання 3D навчальних середовищ сприяє підвищенню зацікавленості та активності студентів у процесі навчання. Відкриваються нові можливості для візуалізації складних понять та ефективного навчання в різних галузях. Важливим аспектом є те, що потенціал 3D навчальних середовищ як інноваційного засобу передачі та збереження знань є значним, а вплив на студентів – позитивним. Практичне значення роботи полягає у визначенні ефективності використання інтерактивних 3D технологій у навчальному процесі, що сприяють підвищенню зацікавленості, активності та довготривалому збереженню знань студента

Ключові слова: освітні ресурси; освітні платформи; неформальна освіта; комп'ютерна графіка; STEAM освіта

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Psychological features of perception of artworks by people with different types of functional brain asymmetry

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Abstract. The relevance of the study is conditioned by the increased attention of modern psychology to individual personality traits and its decreased focus on the normativity of an individual. In the process of individual development, the contemplation of art allows a person not only to broaden their own worldview, but also contributes to cultural enrichment. The purpose of the study was an empirical investigation of the features of perception of works of art by persons with different types of functional brain asymmetry. The study was conducted using the method of standardised interviews with the subjects of two groups: the main group – people who do not have professional knowledge of art (N = 43), and the control group – students studying art history and fine arts as professional disciplines, and familiar with the rules for constructing composition in a picture (N = 30). The results were analysed using statistical criteria: the Kolmogorov-Smirnov test and the Fisher angular transformation criterion φ^* . As a result of the empirical study, there were no statistically reliable patterns in the perception of works of art in the general group, but significant differences were found in the features of perception of movement and its speed in works of art by persons with different types of functional/interhemispheric brain asymmetry, which indicates a nonlinear nature of perception, and the influence of cognitive phenotypes on the perception of works of art. The perception of artworks is an individual cognitive process that may differ between the author and the recipient of artistic creativity, and the author's intention may be misunderstood by the audience if the features of individual perception of a work of art, and the laterality of the personality, are not considered. The practical significance of the study lies in the possibility of applying its results in the process of professional training of students of art specialities, considering the specific features of the laterality of art recipients

Keywords: perception of artworks; functional/interhemispheric brain asymmetry; right-handedness; left-handedness; laterality; cognitive phenotype

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INTRODUCTION

The problem of individual features of world perception and specific personality characteristics is generally relevant in the modern multicultural world. First of all, this relevance is conditioned by the fact that interpersonal and individual differences can give rise to difficulties of interaction, conflicts and disagreements, for the solution of which it is

important to understand the difference in views and behaviour of a person and their worldview. Art helps to understand the diversity of the world and the range of views on it, as it expresses the individual characteristics of the author on the one hand, and helps to broaden the worldview of the recipients and the audience that perceives works of art on the other.



The individual psychological characteristics of a person involved in these processes are of paramount importance in the perception and at all stages of creating art objects (works of art, including fine art). Thus, the vision of the artist, the author, may not resonate with the audience or cause opposite emotions. Consideration of these psychological aspects will help bring the work closer to the viewer, and the recipients will better understand the individual aspects of the author's intention. This is especially true for the perception of movement, time, and space in works of fine art. In particular, in art history, it is accepted that the conventional depiction of natural movement is from left to right, but to convey difficult movement that is obstructed or difficult to experience, its reverse, mirror image is used (Bantinaki, 2021). However, in the process of individual perception of a work of art by a particular recipient, various errors and illusions of perception can occur, which makes it difficult for the viewer to understand the work of art. Such an individual psychological feature that can affect the process of perception is the functional asymmetry of the hemispheres of the human brain. This individual difference has been actively studied and has not lost its relevance for the last 50 or more years, and there are various terms for its definition, such as functional asymmetry, or interhemispheric asymmetry of the brain.

Functional/interhemispheric brain asymmetry refers to the neuropsychological and psychophysiological patterns of human and animal brain organisation, which are manifested in the dominance of one of the cerebral hemispheres – the right or left – in mental activity (Lugova *et al.*, 2020; Dehtiarenko & Kovylyna, 2023). This complex individual psychological property of the individual is a factor of many mental and psychophysiological reactions, which can affect various features and forms of human behaviour. In particular, in psychology, there are known studies of functional asymmetry in the field of sports activities and its impact on the performance of athletes in various sports (Korobeinikov *et al.*, 2018; Ulan & Shinkaruk, 2019). In addition, psychologists have actively investigated the influence of interhemispheric asymmetry on the learning process and its success (Vozniuk & Horobets, 2019; Borysenko, 2023). Special attention should be paid to the problem of the influence of interhemispheric asymmetry on a person's creative abilities, in particular, the ability to create and understand works of art (Kovaleva *et al.*, 2022). However, the relationship between the characteristics of perception of works of art

with the features of functional or interhemispheric asymmetry of the brain in psychology has not yet been studied. Therefore, the purpose of the study was to investigate the psychological features of the perception of movement and time in works of art by people with different types of functional asymmetry of the brain.

MATERIALS AND METHODS

To determine the specific features of perception of movement and time in works of art by subjects with different types of functional brain asymmetry, an empirical study was conducted, in which 43 volunteer respondents not related to art and 30 students of artistic specialities (fine arts, sculpture, design, restoration, etc.) of the state educational institution National Academy of Fine Arts and Architecture (NAOMA, Kyiv) took part, who formed the control sample. The age of the subjects ranged from 16 to 65 years, including 26 female respondents (60.4%) and 17 male respondents (39.5%). Among the main sample, according to the criterion of interhemispheric asymmetry, two groups of subjects were identified – right-handed (34 people) and left-handed (9 people). All survey participants were informed of where the information they provided would be used, and the survey was conducted in compliance with all ethical standards set out in the Declaration of Helsinki (Declaration of Helsinki, 2013).

The methods used in the study consisted of a standardised interview conducted individually in a mixed format by two experts during 2022-2023. The interview included questions based on famous paintings that depict movement, its speed and intensity. To test the hypothesis about the features of the individual's perception of movement and time, the proposed pictures were demonstrated to the subject in both normal and mirror images with a change in the direction of movement (from left to right and from right to left and vice versa). For demonstration to the participants, the works of famous authors were chosen, paintings depicting movement in a certain direction at a certain speed. These were the works of the following artists: (1) Ukrainian artist Ivan Repin's "Barge Haulers on the Volga" (Repin, 1873); (2) Pieter Bruegel the Elder's "The Parable of the Blind" (Bruegel the Elder, 1568); (3) "Attack (On the Line of Fire)" (Petrov-Vodkin, 1916). After viewing the paintings, respondents were asked to answer the following questions, expressing their subjective vision of the work:

1) Where is it harder for haulers to pull a barge? (Image A or B).



A



B

Figure 1. I. Repin “Barge Haulers on the Volga”. (1873)

Notes: A – original; B – mirror image

Source: Ukrinform (n.d.)

2) Where do blind people fall faster? (Image A or B).



A



B

Figure 2. P. Bruegel the Elder. “The Parable of the Blind”. (1568)

Notes: A – original; B – mirror image

Source: Jyvopys (n.d.)

3) Where do soldiers run faster? (Image A or B).

4) Where does the wounded commissar fall back more convincingly? (Image A or B).



A



B

Figure 3. K. Petrov-Vodkin. “Attack (In the Line of Fire)”. 1916

Notes: A – original; B – mirror image

Source: Pinterest (n.d.)

The results were processed in several stages. The *first* stage involved the primary processing of numerical data and the division of the subjects into groups. At the *second* stage, a mathematical and statistical analysis of the frequency of respondents' choices of each image was conducted. The *third* stage involved a statistical analysis of the respondents' choices by group. For further processing of the findings, mathematical statistics methods were used: single-sample criterion λ – Kolmogorov-Smirnov test and the Fisher angular transformation criterion φ^* . The Kolmogorov-Smirnov test was used to test the statistical hypothesis of randomness/non-randomness of the subjects' choices of certain images, and the Fisher angular transformation criterion was used to compare the numerical results of the two groups.

RESULTS AND DISCUSSION

A survey of the subjects about their perception of the direction of movement, its intensity and speed in the paintings showed that there were no obvious patterns in the subjects' choice of certain images. Based on their own subjective ideas, respondents chose images of movement from right to left or vice versa – respectively, from left to right. The total calculation of the percentage ratio between the subjects' choice of direct image, its mirror image and the inability to answer the questions asked showed that the incentive material of the study (presentation of works of art) affects the respondents' responses. Thus, for the first picture, the respondents of the main sample made almost the same number of choices of the original and mirror image (with the opposite direction of movement) 39.5% and 44.1%, respectively (Table 1).

Table 1. The number of responses of the main sample to the paintings presented (original, mirror image, and uncertain choice)

Presented paintings	Number of responses		
	Original image	Mirror image	Uncertain choice
Painting 1	17 (39.5%)	19 (44.1%)	7 (16.27%)
Painting 2	14 (32.5%)	21 (48%)	8 (18.6%)
Painting 3	20 (46.5%)	12 (27.9%)	11 (25.5%)
Painting 3.1	19 (44.1%)	16 (37.2%)	8 (18.6%)

Source: compiled by the author

As can be seen from Table 1, the number of choices of the original and mirror image is almost the same, the greatest difference in the direction of the original image can be stated in Painting 3, where the original image was chosen by almost half of the subjects – 20 people, which is 46.5% (Table 1). At the same time, regarding the same picture (“Death of the commissar”), the largest number of undecided people is observed – 11, which is 25.5%. The second question follows the same pattern and is labelled in Table 1 as Painting 3.1. A visual representation of the choices for each painting is made in the diagram of the distribution of the respondents' choices of original, mirror images, and undecided answers (Fig. 4). As can be seen from the diagram, there are a different number of definite (original and mirror image) and uncertain choices for

each painting, which indicates that there was no general pattern regarding the perception of movement and time in the above works of art. As a percentage, it can be observed that the first two pictures are dominated by the choice of a mirror image by the subjects, and the other two – on the contrary – are dominated by the choice of a direct one. However, the third image revealed the highest percentage of respondents who chose a direct image, and the largest percentage of those who did not decide on the choice. Such an unevenness in choices can be either natural or accidental. To explain this fact and determine a reliable conclusion about whether there are patterns in the choice of certain images by the subjects, a statistical analysis of the study data was carried out using the single-sample Kolmogorov-Smirnov criterion.

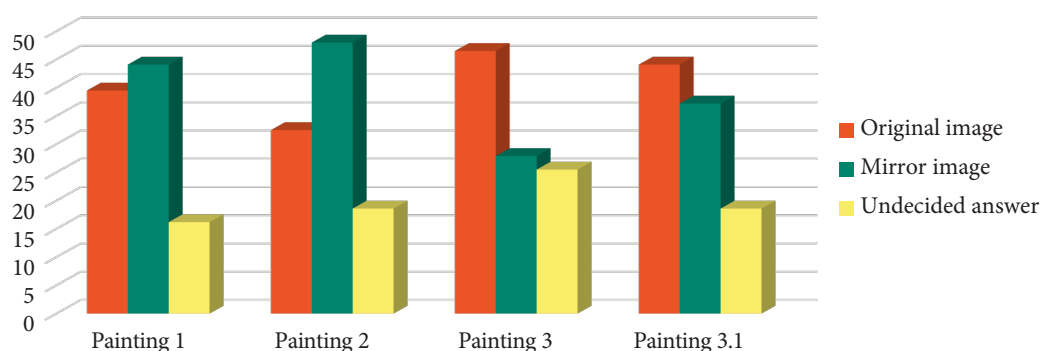


Figure 4. Diagram of the distribution of the choice of original, mirror images, and undecided response in the perception of works of art

Source: compiled by the author

To check whether there is a statistically reliable pattern in the respondents' choice of a certain direction of movement, a statistical analysis of the results of the frequency of selection of the proposed pictures was carried out, including a comparison of the results in the selected groups. To process the results of the study, the λ criterion was used – a single-sample Kolmogorov-Smirnov test to compare the theoretical distribution with the empirical one. As a result of applying this statistical procedure, the result of $d_{emp} = 0.03$ was obtained, which is not statistically significant (d_{cr} at $n = 123$ at the level of statistical significance $p \leq 0.05 = 0.123$). This indicates the absence of a statistically proven pattern in the choice of response numbers

by the subjects, indicating the direction and the speed of movement in the paintings under study. This fact can be explained by the subjectivity of respondents' perception of artworks, in particular, individual understanding of movement, space, time, and other aspects in the process of visual perception. To determine the features of perception of movement and time in works of art by respondents with different types of functional or interhemispheric asymmetry of the brain, the results of two groups – right-handed and left-handed subjects – were compared. Mathematical and statistical analysis of the results was performed using the Fisher angular transformation criterion φ^* , numerical data and percentages in both samples are shown in Table 2.

Table 2. Results of the study of the choice of direction of movement in works of art in groups of right-handed and left-handed respondents according to the Fisher angular transformation criterion φ^*

Groups	Selected a direct image	Selected a mirror image	Total
	Number of selections	Number of selections	
Right-handed subjects	46 (56.8%)	35 (43.2%)	81 (100%)
Left-handed subjects	2 (16.7%)	10 (83.3%)	12 (100%)

Source: compiled by the author

Analysis of the data using the Fisher angular transformation criterion φ^* showed that the result is in the zone of significance. Thus, $\varphi_{emp}^* = 2.796$, ($\varphi_{cr}^* = 2.31$ at $p \leq 0.01$) which means that the choice of left-handed subjects has significant differences from the sample of right-handers, i.e., the proportion of odd-digit selections (which in this study are original, not mirror images) is significantly higher in the sample of right-handers than left-handers. This indicates that the number of people with the studied trait in the first group, i.e., the group of right-handed people, prevails among the two groups surveyed. Thus, the null hypothesis can be rejected and the differences noted. This gives grounds to assert that among the right-handed subjects, a statistically significant number of people who choose

pictures with movement from left to right were determined than among the left-handed ones. Therefore, it can be concluded that the perception of movement in paintings from left to right is more characteristic of right-handed subjects, while the perception of movement from right to left is more characteristic of left-handed people. The next stage of processing the results of the study was to determine the differences in the fate of the subjects in the two groups by parameter *defined and undefined choices*. According to the parameter of certain and undefined choice, the subjects who could not determine the direction of movement and the passage of time were selected, so their choice was designated as undefined. The number of defined and undefined choices in both groups of subjects is shown in Table 3.

Table 3. Results of the study of the choice of direction of movement in paintings (defined and undefined choice) in groups of right-handed and left-handed respondents according to the Fisher angular transformation criterion φ^*

Groups	Defined choice	Undefined choice	Total
	Number of selections	Number of selections	
Right-handed subjects	107 (86.3%)	17 (13.7%)	124 (100%)
Left-handed subjects	12 (50%)	12 (50%)	24 (100%)

Source: compiled by the author

Result of $\varphi_{emp}^* = 3.641$, which is statistically significant at $p \leq 0.01$ ($\varphi_{cr}^* = 2.31$). This indicates that the number of undecided respondents is more significant in the left-handed Group, and the number of undecided respondents is significantly higher in the right-handed group. These results can be explained by the long-known psychological fact that among the characteristics of left-handed people, researchers note, among other things, that they are characterised by increased mobility and imperfect spatial orientation (Yair Pinto *et al.*, 2017). Thus, uncertainty with the choice

of direction of movement can be attributed to the reaction of confusion in the situation of the need to determine the direction of movement and perform orientation in space. The features of visual perception of left-handed people also often include distortion of the shapes and proportions of figures, mirror movements, which can also manifest itself in the mirror writing of left-handed children (Shkarban, 2018). This can explain the fact that among left-handed subjects, it is the mirror perception of the direction of movement in works of art that prevails.

Empirical studies by other researchers also indicate that lack of development or violation of spatial representations in left-handed children can cause difficulties in studying mathematics, geometry, and in their perception of other objects of the external environment (Shkarban, 2018). However, in the course of training, these points can be corrected, since special education can create a stereotype of the perception of works of art or any other objects. Thus, in the theory of art, it is traditionally customary to perceive the paintings from left to right, clockwise, so movement from left to right is considered more natural, respectively, movement in the opposite direction is perceived as more difficult (Pysanko, 1995). Foreign researchers (Bearden *et al.*, 2016;

Henrich *et al.*, 2022) call this phenomenon *cognitive phenotype*, which indicates the acquired and stereotyped origin of this skill. This is proved by the results of a study with students of art specialities who made up the control group of the study. The vast majority of students with relevant artistic experience during the study chose images in their original, rather than mirror form (from 80 to 96%), which indicates, on the one hand, the development of their professional worldview and experience in perceiving and creating art, and on the other – the possession of the necessary knowledge regarding the construction of the composition of artworks. The results of the selection of respondents from the control sample are presented in Table 4.

Table 4. Number of responses of respondents of the control sample based on the presented paintings (original, mirror image, and undefined selection)

Presented paintings	Number of responses		
	Original image	Mirror image	Uncertain choice
Painting 1	25 (83.3%)	5 (16.6%)	0
Painting 2	29 (96.6%)	0	1 (3.3%)
Painting 3	27 (90%)	1 (3.3%)	2 (6.6%)
Painting 3.1	27 (90%)	2 (6.6%)	1 (3.3%)

Source: compiled by the author

As can be seen from Table 4, the choice of images by students of art specialities is almost unanimous: the least unanimity is observed in Painting 1, where 83.3% of respondents chose the original image. Students showed the greatest unanimity in choosing the original image in relation to Painting 2, when none of the respondents in this sample chose a mirror image. The mirror image for all four paintings generally has a small number of choices (from 3.3 to 16.6%), and the number of undecided subjects is very low (from 0 to 6.6%). These data indicate the presence of an established cognitive phenotype in art students. This indicates the functioning of perceptual circuits, which is the result of their educational and professional activities.

In psychological science, there is a separate direction – the psychology of creativity and art, which studies various aspects of creativity and giftedness, and the specifics of creative perception and artworks in particular (Andrijauskas, 2022; Starr & Smith, 2023). Creative perception and perception of creativity are defined by the authors as close, but not identical cognitive processes. Perception, as a perceptual process, is a holistic reflection of objects and phenomena of the surrounding world in the recipient's mind during their direct impact on the sensory organs (Lugova *et al.*, 2020). It follows that the perception of creativity will occur during the impact on the human senses of works of art: visual, musical art, and the like. A certain image is developed in the human mind, associated with the object of perception: for example, when a person contemplates, listens to works of art, they perceive them, forming a certain image, emotional attitude to the work, etc. But creative perception is the process and result of constructing “a subjectively new image, which to a greater or lesser extent

modifies objects and phenomena of objective reality in a specific way”. According to some researchers in the field of creative psychology, in the process of creative perception, there may be such variants of its manifestation: the perception of a new object, when creativity must necessarily manifest itself, or the desire to find something unknown in the perception of familiar objects, new elements, signs, etc. (Moliaco, 2021). In the process of perception of art, both options can be involved, since artworks often constitute a completely new and previously unfamiliar phenomenon for the recipient, and also during repeated contemplation, a person can discover new layers of already known works and perceive them in a new way. The traditional view of the perception of art is based on psychological theories created in the 20th century, which note that the perception of space and movement in a picture occurs from left to right (Pysanko, 1995). Modern scientific studies do not confirm this fact, referring to changes in the individual psychological characteristics of recipients, which can affect the process of their perception of art (Ansorge *et al.*, 2022).

In addition, psychologists note that the process of perception of an artwork is a complex phenomenon, like any perception that, according to O. Lozova *et al.* (2023), “is not a mechanical assimilation of data stored on the retina”, but is at the same time “the construction of an image with a hierarchical structure”, since it consists in finding a block diagram corresponding to the configuration of shapes and colours obtained from the retina. And the more complex this configuration is, the greater the “perceptual uncertainty”, and therefore there are more variations for individual subjective perception and interpretation of an artwork (Lozova *et al.*, 2023). Individual and subjective psychological

features of the perception of artworks following the Danish psychologist Bjarne Sode Funch can be distinguished in the context of four approaches to their understanding: psychophysiological, cognitive, psychoanalytic, and existential (Funch, 1997). Among all these approaches, the *psychophysiological approach* reveals the influence on the process of perception of typological, innate individual properties associated with the nervous system, the human genotype, and therefore it is most difficult to carry out purposeful influence on them or develop them in the process of special training and upbringing. But they should be considered in the process of training, upbringing, and development of an aesthetic worldview of the individual. Features of this kind include the type of functional/interhemispheric asymmetry, which is congenital and the development of which is difficult to influence during life (Kovaleva *et al.*, 2022; Dehtiarenko & Kovylyna, 2023).

In studies of the process of perception in the context of interhemispheric brain asymmetry, patterns of perception are distinguished, which consist in the fact that the right hemisphere of the brain better perceives the left, and the left – the right visual field of a person (Harrison & Strother, 2020). This means that people with a certain type of functional asymmetry of the brain will perceive objects and phenomena differently. However, numbers, letters, words, and symbols, according to researchers, are better perceived when presented in the right field of view. In particular, O.V. Vozniuk & S.M. Horobets (2019) note in their study that “interhemispheric asymmetry reflects the overall asymmetry of space and time in the universe.” Thus, in the process of visual perception of space or its image on a plane, “a person’s gaze usually moves in the process of viewing a certain object from left to right, and the space in the same trajectory should increase the height of objects that fill this space, and their number and compositional complexity increases”. This feature of visual perception in psychology is called the “Gibson’s law of right-hand stimulation”, which is inherent in all forms of life on Earth.

Theory of perception by J. Gibson (1978) was developed in 1966 and was named *bottom-up processing*. It contradicts constructivist theories of perception, which assume that it occurs as a single-stage integral process. Unlike top-down perception, bottom-up perception is driven by sensory system data and does not require prior knowledge or training, but is mostly an innate process. This perception occurs at the moment of the here and now, when there is an impact on the human senses. For example, if an image of a single letter is seen on a screen, the eyes transmit information to the brain, and the brain simultaneously combines all this information into a single, holistic perception process (Levus & Kuchebo, 2021; Sedgwick, 2021). The researcher developed the idea of naturalising perception to understand it as a biological rather than logical function that evolved to control adaptive behaviour in the natural environment. However, he also uses this approach for *higher-order perceptual processes, spatio-temporal patterns of stimulation*, i.e., more

complex forms of perception (Warren, 2021). This is manifested in the fact that in the process of visual perception (for example, in the case of perception of art), the process occurs from bottom to top and from right to left, and more complex perceptual processes occur through microporesis and sensory information processed in the cerebral cortex (Gibson, 1978).

The theory of visual perception, which puts forward opposing ideas to Gibson’s theory, is the classical theory of *top-down processing*, which denies the innate nature of perception, and insists on the influence of previous experience and learning in the process of perception. One of the key elements of this concept is visual illusions (Gregory, 1997). According to the author, the previous experience gained in the environment, in a situation of limited sensory resources, helps to create an image even without the proper level of visual stimulation. This applies to cases where the brain makes unreliable predictions about reality, thus creating illusions. This suggests that human perception is not limited to recording information that enters the retina of the eye, the brain continues to process this information and eventually generates an image that is already present in the memory. Thus, based on previous experience, the brain chooses the patterns available to it and creates and constructs the perceived information (Gregory, 1997). According to the authors of this study, this concept is more consistent with the real situation of perception of artworks, since previous experience has a significant impact on the views and tastes of recipients, which can be observed in the example of the results of the main control sample in this study. However, the influence of psychophysiological mechanisms, which can also play a role in the process of holistic perception of art, cannot be excluded.

In addition, the type of functional asymmetry of the author of artistic or pictorial works can also significantly affect the process of their perception. However, the latest psychological research published by psychologists in 2024 shows the results of a survey among Instagram users (Røsvoll *et al.*, 2024), where a sample of more than 400 respondents showed that the perception of left – and right-handed artists, and the quality of their works, do not differ significantly, and indicates only individual psychological characteristics of the individual. To test what psychological characteristics determine the perception of works of fine art, namely, the visual perception of movement and time on canvas, the authors of this study developed and conducted an empirical study of this problem, where they confirmed their hypothesis.

Thus, the results obtained in the course of the study of the features of perception of works of art by persons with different types of functional brain asymmetry confirm the laterality of perception of paintings by representatives of different types of interhemispheric brain asymmetry. The attitudes of the individual regarding the perception of visual works of art that existed in traditional art, in particular, the tendency to perceive in the picture the movement from left to right as faster, and the movement from right

to left, respectively, as slower and more complex, did not confirm their relevance. However, a statistically significant difference was proved between the features of visual art perception in right-handed and left-handed subjects.

CONCLUSIONS

The perception of artworks is an individual psychological phenomenon, which may depend on various objective and subjective factors. Psychological theories and concepts consider the features of visual perception of space, movement, and its speed differently. The authors have identified two theories among the most famous psychological theories of perception that can be applied to the perception of works of art. The first is the “bottom-up” theory of perception, which emphasises biological and psychophysiological mechanisms as leading in the process of perception, and the second is the “top-down” theory of perception, which, on the contrary, considers perception to be an integral cognitive process, where the leading importance is not sensory stimuli and their coverage by the senses, but perception stereotypes, previous experience, the so-called cognitive phenotype, which determines the process of perception of art.

The perception of movement and its direction and speed in works of fine art traditionally occurs from left to right, but recently these features of perception have acquired new aspects and are no longer distinguished as leading ones. This is conditioned by the individual psychological characteristics of the subjects, in particular, the type

of interhemispheric asymmetry of the brain. As a result of an empirical study conducted with volunteers who do not have an art education and with students who study art professionally, it was proved that the perception of movement from left to right as more natural and rapid is inherent in people with right-hand dominance, while left-handers are more characterised by a mirror perception of movement in paintings, and undefined movement, when it is difficult for respondents to decide on a choice. These results are inherent in a group of people without an art education, but students who have studied the rules for creating a composition perceive it from left to right, regardless of the type of functional asymmetry of the brain. Such results can be explained by the cognitive phenotype, that is, the influence of professional experience and professional education on students' perception. Prospects for further research in this area are the study of cross-cultural features of the perception of artworks by representatives of various national communities.

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CONFLICT OF INTEREST

None.

REFERENCES

- [1] Andrijauskas, A. (2022). The sources of the psychology of art and its place among the disciplines that study art and creativity. *Arts*, 11(5), article number 96. doi: [10.3390/arts11050096](https://doi.org/10.3390/arts11050096).
- [2] Ansoorge, U., Pelowski, M., Quigley, C., Pesch, M.F., & Ledo, H. (2022). Art and perception: Using empirical aesthetics in research on consciousness. *Frontiers in Psychology*, 13, article number 895985. doi: [10.3389/fpsyg.2022.895985](https://doi.org/10.3389/fpsyg.2022.895985).
- [3] Bantinaki, K. (2021). On the narrative potential of depiction. *The Journal for the Philosophy of Language, Mind and the Arts*, 2(1), 73-90. doi: [10.30687/Jolma/2723-9640/2021/01/005](https://doi.org/10.30687/Jolma/2723-9640/2021/01/005).
- [4] Bearden, C.E., Winkler, A., Karlsgodt, K.H., & Bilder, R. (2016). Cognitive phenotypes and endophenotypes: Concepts and criteria. In V. Jagaroo & S. Santangelo (Eds.), *Neurophenotypes. Innovations in cognitive neuroscience*. Boston: Springer. doi: [10.1007/978-1-4614-3846-5_4](https://doi.org/10.1007/978-1-4614-3846-5_4).
- [5] Borysenko, L.L. (2023). Psychological manifestations of functional asymmetry of the human brain. *Perspectives and Innovations of Science. Series “Pedagogy”, Series “Psychology”, Series “Medicine”*, 1(19), 423-435. doi: [10.52058/2786-4952-2023-1\(19\)-423-435](https://doi.org/10.52058/2786-4952-2023-1(19)-423-435).
- [6] Declaration of Helsinki. (2013). Retrieved from <https://www.wma.net/what-we-do/medical-ethics/declaration-of-helsinki/>.
- [7] Dehtiarenko, T.V., & Kovylyna, V.H. (2023). *Psychophysiology of development: A textbook for students of higher education institutions*. Kyiv: Publishing House Express Advert.
- [8] Funch, B.S. (1997). *The psychology of art appreciation*. Copenhagen: Museum Tusculanum Press.
- [9] Gibson, J.J. (1978). *The ecological approach to the visual perception of pictures*. *Leonardo*, 11, 227-235.
- [10] Gregory, R. (1997). *Eye and brain: The psychology of seeing*. Princeton: Princeton University Press
- [11] Harrison, M.T., & Strother, L. (2020). Does right hemisphere superiority sufficiently explain the left visual field advantage in face recognition? *Attention, Perception, & Psychophysics*, 82(3), 1205-1220. doi: [10.3758/s13414-019-01896-0](https://doi.org/10.3758/s13414-019-01896-0).
- [12] Henrich, J., Blasi, D.E., Curtin, C.M., Davis, H.E., Hong, Z., Kelly, D., & Kroupin, I. (2022). A cultural species and its cognitive phenotypes: Implications for philosophy. *Review of Philosophy and Psychology*, 14(2), 349-386. doi: [10.1007/s13164-021-00612-y](https://doi.org/10.1007/s13164-021-00612-y).
- [13] Jyvopys. (n.d.). Retrieved from <https://jyvopys.com/slipi-piter-brejgel/>.

- [14] Korobeinikov, H., Korobeinikova, L., Volskyi, D., & Ho, S. (2018). [Functional asymmetry of the brain and cognitive strategies in martial arts](#). *Theory and Methods of Physical Education and Sports*, 2, 73-77.
- [15] Kovaleva, A.A., Kovaleva, O.V., Kovaleva, O.V., Burka, O.M., & Prysiazhniuk, O.A. (2022). [Neurobiology of development and learning](#). Zaporizhzhia: Zaporizhzhia Polytechnic National University.
- [16] Levus, N.I., & Kuchebo, O.S. (2021). Personal peculiarities of perception of works of art. *Young Scientist*, 8(96), 21-24. doi: [10.32839/2304-5809/2021-8-96-5](#).
- [17] Lozova, O., Kopylov, S., & Shepelova, M. (2023). [Peculiarities of semiosis in the perception of fine art](#). London: GlobeEdit.
- [18] Lugova, V.M., Lytovchenko, I.V., Golubev, S.M., & Bilokononko, G.V. (2020). [Psychology](#). Kharkiv: Simon Kuznets Kharkiv National University of Economics.
- [19] Moliako, V.O. (2021). [Functioning of creative thinking in the subject's information-virtual space](#). Kyiv-Lviv: Viktoriia Kundelska.
- [20] Pinterest. (n.d.). Retrieved from <https://www.pinterest.com/pin/305541155951414634/>.
- [21] Pysanko, M.M. (1995). [Movement, space and time in fine art](#). Kyiv: Higher School.
- [22] Røsvoll, A., Rusten, E.H., & Westerhausen, R. (2024). Left-hand preference in visual artists: A pre-registered observational study on Instagram. *Laterality: Asymmetries of Brain, Behaviour, and Cognition*, 29(2), 184-198. doi: [10.1080/1357650X.2024.2315856](#).
- [23] Sedgwick, H.A. (2021). J.J. Gibson's "Ground theory of space perception". *I-Perception*, 12(3). doi: [10.1177/20416695211021111](#).
- [24] Shkarban, L.V. (2018). [Preparation of the primary school teacher to work with left-handed children](#). (PhD dissertation, Borys Grinchenko Kyiv Metropolitan University, Kyiv, Ukraine).
- [25] Starr, R.A., & Smith, J.A. (2023). The psychology of art-viewing: Insights from interpretative phenomenological analysis. In M. Poltrum, M. Musalek, K. Galvin & Y. Saito (Eds.), *The Oxford handbook of mental health and contemporary Western aesthetics* (ch. 36). doi: [10.1093/oxfordhb/9780192866929.013.43](#).
- [26] Ukrinform. (n.d.). Retrieved from <https://www.ukrinform.ua/rubric-politics/3781886-rosijski-j-ukrainski-smisli-simvoli-burlakiv-ta-zaporozciv-repina.html>.
- [27] Ulan, A., & Shinkaruk, O. (2019). Functional asymmetry in sports: Features of manifestation and approaches to use in the orientation process of training fencers. *Science in Olympic Sports*, 1, 24-35. doi: [10.32652/olympic2019.1_4](#).
- [28] Vozniuk, O.V., & Horobets, S.M. (2019). [Using the concept of functional asymmetry of the cerebral hemispheres in the construction of information and digital technology for working with gifted children and young people](#). In *Information and digital educational space of Ukraine: Transformation processes and development prospects: Materials of the methodological seminar of the National Academy of Sciences of Ukraine* (pp. 312-321). Kyiv: NAES of Ukraine.
- [29] Warren, W.H. (2021). Information is where you find it: Perception as an ecologically well-posed problem. *I-Perception*, 12(2). doi: [10.1177/20416695211000366](#).
- [30] Pinto, Y., Neville, D.A., Otten, M., Corballis, P.M., Lamme, V.A.F., de Haan, E.H.F., Foschi, N., & Fabri, M. (2017). Split brain: Divided perception but undivided consciousness. *Brain*, 140(5), 1231-1237. doi: [10.1093/brain/aww358](#).

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Психологічні особливості сприймання творів мистецтва особами з різним типом функціональної асиметрії мозку

Анотація. Актуальність дослідження зумовлена підвищенням уваги сучасної психології до індивідуальних особливостей особистості та зменшенням її орієнтації на нормативність окремого індивіда. В процесі індивідуального розвитку споглядання мистецтва дозволяє особистості не лише розширювати власний світогляд, а й сприяє її культурному збагаченню. Метою статті стало емпіричне дослідження особливостей сприймання творів мистецтва особами з різними типами функціональної асиметрії мозку. Дослідження відбувалося за допомогою методу стандартизованого інтерв'ю з досліджуваними двох груп: основна група – особи, які не мають професійних знань про мистецтво (N=43), а також контрольна група – студенти, що вивчають мистецтвознавство та образотворче мистецтво, як фахові дисципліни, і знайомі з правилами конструювання композиції на картині (N = 30). Результати були проаналізовані за допомогою статистичних критеріїв: тест Колмогорова-Смирнова та критерій кутового перетворення Фішера ϕ^* . В результаті емпіричного дослідження не було виявлено статистично достовірних закономірностей у сприйманні творів мистецтва у загальній групі, проте виявлені істотні відмінності в особливостях сприймання руху та його швидкості у творах мистецтва особами з різним типом функціональної/міжпівкульової асиметрії головного мозку, що свідчить про нелінійний характер сприймання, а також вплив когнітивних фенотипів на сприймання творів мистецтва. Сприймання творів мистецтва є індивідуально-когнітивним процесом, що може відрізнятися у автора та реципієнта художньої творчості, а авторський задум може бути некоректно зрозумілий глядачами, якщо не враховані особливості індивідуального сприйняття твору мистецтва, а також латеральність особистості. Практичне значення дослідження полягає у можливості застосувати його результати у процесі фахової підготовки студентів мистецьких спеціальностей з урахуванням особливостей латеральності реципієнтів мистецтва

Ключові слова: сприймання творів мистецтва; функціональна/міжпівкульова асиметрія головного мозку; праворукість; ліворукість; латеральність; когнітивний фенотип

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Abstract. The relevance of the study is conditioned by the need to update data on the specifics of the activities of cadet sailors due to rapid changes in the organisational structure of modern society and understanding the role of this profession in it. The purpose of the study was to reveal the psychophysiological and individual psychological determinants of adaptation and their interdependence in the context of professional activity of novice seafarers. The paper uses methods of theoretic and methodological analysis, psychodiagnostic survey, and Pearson's correlation analysis methods. As a result of the theoretical analysis, four groups of factors of professional adaptation were identified: psychophysiological, individual and psychological, socio-psychological, organisational and structural. Based on these factors, an empirical study was organised, which revealed the relationship between indicators of psychological stability, self-confidence, adaptability, and tolerance to ambiguity. It was determined that psychological resilience is associated with the parameters of passion, resourcefulness, optimism, and the level of expression of motivational components of professional activity of cadets, determined by the motives of life support and self-realisation. Disturbances in health, in particular in terms of exhaustion, emotional and vegetative instability, anxiety and fears, and maladjustment, affect the effectiveness and quality of value, emotional, volitional, social and informational regulation. The most common symptoms of health disorders among cadets on a voyage are vegetative and emotional instability, sleep disturbances, less pronounced symptoms of maladjustment such as addictions, anxiety, and fears, and the least pronounced symptoms are psychophysical exhaustion and willpower disorders. The paper contributes to the psychological science of professional and personal adaptability of the individual in extreme conditions. The study is of practical value for

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sociologists, teachers, psychologists, psychotherapists and doctors, who can contribute to solving problems of maladaptation in the labour sphere

Keywords: psychological stability; confidence; readiness for change; motivation; professional activity; regulation of activity

INTRODUCTION

In the modern world, it is quite difficult for a person to learn and acquire skills that would improve their life. Technological progress requires a rapid, sharp and large-scale step forward in the development of personal ability to perceive and adapt to innovations, while adapting them to their activities and life in general. Over the years, the requirement for the amount of necessary knowledge, skills, and abilities put forward to a person increases. A state of constant fatigue and exhaustion has been introduced, and a person who works continuously is now praised and encouraged to do so, although a few decades ago it was called workaholicism and preventive measures were proposed for professional exhaustion. That is why the chosen topic requires comprehensive empirical research, which will reveal the specific properties of seafarers' personalities and will contribute to the acquisition of practical experience by researchers both in the field of studying adaptation factors and in the field of direct interaction – correction, development, or their formation.

When it comes to working in extreme conditions, these conditions have increased significantly – their frequency and scale. A person is not able to cope with such a tremendous workload without systematically renewing their strength and resting while making physical and mental efforts. This is especially true for people who have specific conditions of professional activity, accompanied by frequent stress, in particular, military personnel, firefighters, police officers, and sailors. Analysis of modern research on the topic of adaptability of sailors shows that the problem of adaptation to living conditions at sea on a ship concerns every sailor. The study of the health and performance of seafarers by E.A. Schmied *et al.* (2021) confirms that sailors experience health and behavioural problems, which highlights some facts of maladjustment. E.A. Schmied *et al.* (2023) in a study of the challenges faced by seafarers point to severe psychological stress and a lack of knowledge and skills to deal with and manage stress, including due to limited access to habitual activities and tools to improve their mental well-being. According to M.G. Bagus Ani Putra (2021), sailors experience a high level of stress associated with the organisation of the working environment, and in connection with the events of recent years, they confirm that they have difficulty concentrating and are strongly influenced by negative information coming from the news. L. Matysková *et al.* (2020), in the study of habits as prerequisites for adaptation, came to the conclusion that it is really difficult to develop new habits in a completely new environment, which requires abandoning previously effective ways of adaptation and self-management. Instead,

T. Khraban (2022) draws attention to other prerequisites for successful adaptability that precedes the psychological well-being of the cadet personality – healthy self-esteem, which forms the necessary positive states and promotes the experience of negative emotions in a favourable and constructive way for the individual. G.A. Prib *et al.* (2020), O. Soroka *et al.* (2022) note that the key to adaptability in professional activity is the high stress tolerance of employees and the ability to quickly and efficiently recover lost resources, which ensures stability in stressful situations and helps to respond accordingly to the requirements of professional activity with high efficiency. Based on the above, the purpose of the study was to reveal the features of the relationship between individual psychological factors of adaptation of cadets in voyage conditions.

MATERIALS AND METHODS

The study of psychological factors of cadets' adaptation in voyage conditions was implemented through successive tasks. First, a theoretical analysis of existing studies was conducted, such as O. Ichanska & K. Lopushanska (2019) and A. Shydelko *et al.* (2022) and recommendations for identifying indicators that indicate the adaptability of the individual and the success of its adaptation in the work environment. As a result, further work was aimed at investigating such parameters as psychological stability of a person in unusual circumstances, self-confidence, readiness for change (psychological flexibility) and motivation in professional activities.

To investigate these parameters, a block of psychodiagnostic methods was developed, containing 4 questionnaires. The Questionnaire "Well-being in extreme conditions" (2009) was developed within the framework of the symptomatic questionnaire of well-being, which was primarily focused on identifying the tendencies of military personnel to pathological stress response in extreme conditions of military service. Since the study was conducted with a contingent of cadet sailors in conditions of voyage, which can be attributed to non-standard and often extreme conditions of activity, the questionnaire is quite an appropriate choice for studying psychological resistance to stressful circumstances. It contains 42 statements that describe the usual way of life, and it is proposed to confirm or reject these statements. The level of the following symptoms of well-being was determined: psychophysical exhaustion, violation of volitional regulation, instability of the emotional background and mood, vegetative instability, sleep disorders, the presence of anxiety and fears, manifestations of maladaptation in the form of addiction. Further, a general

conclusion was drawn regarding the level of neuroticism, the medium and high levels of which are interpreted as psychological instability to extreme conditions and a state of poor adaptation.

The Rathus assertiveness schedule (RAS) (1973) technique was designed to diagnose the degree of self-confidence. It contained 30 questions that respondents rated based on the compatibility of statements with their usual behaviour, on a 5-point scale. As a result, data was obtained on a scale from 0 to 120 points, divided into 5 levels of self-confidence expression. The Personal Change-Readiness Survey (PCRS) technique developed by A. Rolnic *et al.* (2005) was used quite frequently in HR work, showing good effectiveness when it comes to dealing with stressful situations that arise due to changes. Since no one was able to fully cope with changes without experiencing some reactions and sensations accompanied by stressors, they resorted to resisting these changes, which helped to protect themselves from stress in situations where they were most vulnerable and sensitive. The method had 35 questions and identified parameters that explain these features of confrontation and organically fit into the framework of positive psychology. These were passion, ingenuity, optimism, courage, adaptability, confidence, and tolerance to ambiguity.

Questionnaire for diagnosing the motives of professional activity by T.M. Frantseva determined the complex structure of motives for professional activity and identified factors that regulate the professional activity of a specialist. It contained 60 questions with 5 possible answers on a 5-point scale. As a result, there was a certain picture of ideas about the sphere of professional motives of the

individual. They, in turn, were divided into internal and external. Internal ones included: cognitive motive, motives of activity and self-realisation. External ones included: the motive of life support, interaction, and recognition. Separately, the methodology examined the methods of regulating professional activity: value, emotional, social, volitional, and informational regulation. The organisation of the environment and sampling took place at the LLC "Mersk Ukraine Ltd". The number of respondents involved in the survey was 42. Sample characteristics: male cadets in voyage conditions, aged 20-25 years. The survey was conducted in an online format using Google Form, individually and on the basis of confidentiality and anonymity. During the survey, all the provisions of the Declaration of Helsinki (2013) were observed, and participants were informed about the possibility of spreading information in the scientific community, in particular in this paper.

RESULTS

Interrelation of individual psychological adaptability indicators

To understand the nature of the influence of individual psychological parameters and the success of adaptation, a correlation analysis (according to the Pearson criterion) of individual psychological indicators was performed to determine which properties and to what extent have an effect on the adaptability of the individual as a personal characteristic. Since self-confidence is the key to psychological stability and inner readiness for any challenges of fate, the mutual influence of the indicator of neuroticism and self-confidence on other individuality determinants were considered first (Table 1).

Table 1. Relationship between neuroticism indicators and self-confidence

	Psychophysical exhaustion	Violation of will	Emotional instability	Vegetative instability	Sleep disorders	Anxiety and fears	Maladaptation	Neuroticism
Neuroticism	0.323*	0.575**	0.481**	0.519**	0.545**	0.398**	0.313*	1
Self-confidence	-	-	-0.402**	-	-0.404**	-	-	-0.391*

Notes: * – correlation is statistically significant at the level of $p < 0.05$; ** – correlation is statistically significant at the level of $p < 0.01$

Source: developed by the author

The obtained correlation analysis showed that, firstly, neurotisation is affected by absolutely every parameter of well-being in extreme situations (correlation of the indicator total level of neuroticism and the indicator psychophysical exhaustion ($r = 0.323$, at $p < 0.05$), and the indicator of willpower disorder ($r = 0.575$, at $p < 0.01$), the indicator of emotional instability ($r = 0.481$, at $p < 0.01$), and the indicator of vegetative instability ($r = 0.519$, at $p < 0.01$), the indicator of sleep disorders ($r = 0.545$, at $p < 0.01$), and the indicator of anxiety and fears ($r = 0.398$, at $p < 0.01$), the indicator of maladaptation ($r = 0.313$, at $p < 0.05$). Since these parameters were considered as components that, with a certain expression,

constitute the corresponding level of neuroticism of the individual, the data obtained only confirm this. It is worth noting that psychological stability is the result of the absence of indicators of psychophysical exhaustion, dysfunctions of will and adaptation, vegetative and emotional instability. However, as the analysis of the psychoemotional state of a person in the current world shows, almost everyone has at least one or more symptoms of neuroticism. Actually, this is confirmed by this study, because among the sample only 14% have a really high indicator of psychological stability, while as much as 67% have an average indicator. As for the self-confidence indicator, there is a correlation between the overall

level of neuroticism ($r = -0.391$, at $p < 0.05$), the emotional instability indicator ($r = -0.402$, at $p < 0.01$), and the sleep disturbance indicator ($r = -0.404$, at $p < 0.01$). That

is, self-confidence can provide higher psychological stability, especially with regard to emotional stability, and also prevent sleep violations (Table 2).

Table 2. Relationship between neuroticism, self-confidence, and readiness for change

	Passion	Ingenuity	Optimism	Courage	Adaptability	Confidence	Tolerance to ambiguity
Neuroticism	-0.391*	-0.350*	-0.387*	-	-0.337*	-	-
Self-confidence	-	-	0.386*	-	0.306*	-	0.383*

Notes: * – correlation is statistically significant at the level of $p < 0.05$; ** – correlation is statistically significant at the level of $p < 0.01$

Source: developed by the author

The following correlation was found between the indicators of general neuroticism and passion ($r = -0.391$, at $p < 0.05$), ingenuity ($r = -0.350$, at $p < 0.05$), optimism ($r = -0.387$, at $p < 0.05$), adaptability ($r = 0.337$, at $p < 0.05$); between the indicators of self-confidence and optimism ($r = 0.386$, at $p < 0.05$), adaptability ($r = 0.306$, at $p < 0.05$), tolerance to ambiguity ($r = 0.383$, at $p < 0.05$). This suggests, first, that the levels of neuroticism and self-confidence significantly affect the adaptive capabilities of respondents, interacting with various individual-personal

connections. When a person has a sufficiently high vitality and energy, when they try to look for different ways to achieve goals and overcome difficulties, when a person looks at their present and future with hope and faith, the lower the level of neuroticism and, accordingly, the better the resilience in extreme circumstances. Optimism and a tolerance to ambiguity are also inherent in people with a sufficient level of self-confidence. In general, a psychologically stable and confident person shows higher adaptability results (Table 3).

Table 3. Relationship between indicators of well-being in extreme situations and readiness for change

	Passion	Optimism	Courage	Adaptability	Self-confidence	Tolerance to ambiguity
Psychophysical exhaustion	-	-	0.329*	-	0.304*	-
Violation of will	-	0.342*	-	-0.513**	-	-0.319*
Emotional instability	-	-	-0.350*	-	-0.306*	-
Vegetative instability	0.392*	0.336*	-	-	-	-
Sleep disorders	0.310*	-	0.331*	-	-	-
Anxiety and fears	0.383*	-	-	-	0.375*	-
Maladaptation	0.355*	-	-	0.340*	-	-

Notes: * – correlation is statistically significant at the level of $p < 0.05$; ** – correlation is statistically significant at the level of $p < 0.01$

Source: developed by the author

The parameters of well-being in extreme conditions and readiness for change are strongly interrelated. Thus, the degree of depletion of psychoenergetic resources can affect how brave, determined, and confident a person will feel. Violations of the regulation of the volitional sphere are observed with excessive optimism, undeveloped adaptability, and in the absence of tolerance and calmness in conditions of uncertainty. Emotional instability is accompanied by a loss of confidence in the correctness and correctness of their decisions and in themselves as a whole. With an increase in physical discomfort, sleep disorders, with an increase in fears and anxiety, and with

the appearance of addictions, there is a decrease in interest and enthusiasm for their activities. In addition, if cadets experience body discomfort and a malfunction in the body's functionality, this reduces their faith in future success. Sleep disorders lead to feelings of indecision and doubt, hesitation about the decisions made. When the degree of anxiety increases and many fears arise, there is also a decrease in self-confidence indicators. A tendency to various addictions, the use of sedatives, etc., indicates a low adaptability of the individual, since it does not provide for an effective and truly solving a problem situation, but only escape from it (Table 4).

Table 4. Relationship between indicators of neuroticism, self-confidence, motives and ways of regulating professional activity

	Life support motive	Cognitive motive	Activity motive	Self-realisation motive	Value regulation	Social regulation	Information regulation
Neuroticism	0.418**	-	-	-0.539**	-0.413**	0.396*	-0.348*
Self-confidence	0.348*	0.375*	0.320*	0.391*	0.394*	-	0.319*

Notes: * – correlation is statistically significant at the level of $p < 0.05$; ** – correlation is statistically significant at the level of $p < 0.01$

Source: developed by the author

Indicators of neuroticism and confidence also correlate with motives and regulatory methods of professional activity. These data determine the relationship between the reasons for choosing a profession and the individual characteristics of respondents. Thus, it is recorded that the overall level of neuroticism correlates with the life support motive ($r = 0.418$, at $p < 0.01$) and the self-realisation motive ($r = -0.539$, at $p < 0.01$). That is, the neurotisation of the individual can increase if the dominant need for professional activity is to earn money to provide for their family. If this motive is key in a person, that is, others are poorly expressed, this may be followed by an increase in tension about constant worries about the amount of wages, receiving additional rewards, this makes the focus in the activity very narrow, since the main goal is set as obtaining as much material benefit as possible. In addition, the self-realisation motive is absent with low psychological stability, which can be explained as follows: if a person experiences constant internal discomfort and tension for certain reasons, first of all it is necessary to satisfy the need for safety and comfort, while self-realisation has a secondary role in this case or is not considered at all, since for self-realisation it is necessary to have internal support and sufficient psychoenergetic resources, and skills of their recovery and regulation, which is usually absent with high neuroticism.

The self-confidence indicator correlates with the life support motive ($r = 0.348$, at $p < 0.05$), cognitive motive ($r = 0.375$, at $p < 0.05$), activity motive ($r = 0.320$, at $p < 0.05$), and self-realisation motive ($r = 0.391$, at $p < 0.05$). This means that a confident person, firstly, is able to establish the causes and purpose of their activity, and secondly, is guided by several areas of motivational structure, considering their life and professional activity holistically, as complementary structures that require functioning at many different levels. This person seeks new information, is not afraid of complications caused by innovations and innovations, initiates them themselves, as they see personal growth in this, is active in their work, is amateurish, and uses the profession as an opportunity to realise their sides and desires. Regarding the regulation of professional activity, respondents with well-developed motivational and value orientation and purposefulness, and good orientation in the constant information flow of news and changing data, have a lower level of neuroticism, while following social requirements and expectations, cadets feel more exhausted and anxious. Self-confidence manifests itself as part of a motivational

and value-oriented structure, and an informational one, when the respondent knows their goal, follows it, analysing surrounding events, information, and changes.

Severity of adaptability indicators in cadets in voyage conditions

As correlation analysis has shown, the state of well-being is associated with readiness for changes and ways of regulating the activity of the individual. These individual psychological parameters of the cadets under voyage conditions are discussed below (Fig. 1).

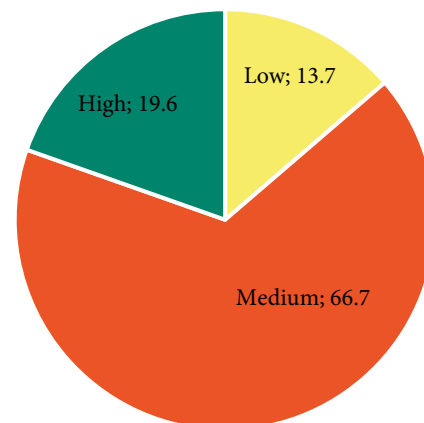


Figure 1. General level of neuroticism of cadets in voyage conditions

Source: developed by the author

Considering the results obtained in this experiment, only 13.7% of cadets scored points that signal a high degree of psychological resistance to extreme situations and are characterised as a state of good adaptability. However, 19.6% showed extremely low stress tolerance, a state of maladaptation, which was probably accompanied by high risks of pathological stress response and neurotic disorders. 66.7% of cadets, which is two-thirds of the entire sample, showed an average level of psychological resistance to extreme conditions and a state of satisfactory adaptability. These are fairly good results, even though their adaptability is more situational than general. However, it can be argued that for the majority of cadets in the study sample, the issue of adaptability is not an acute problem, but rather one that needs to be consolidated in the phases of success (Fig. 2).

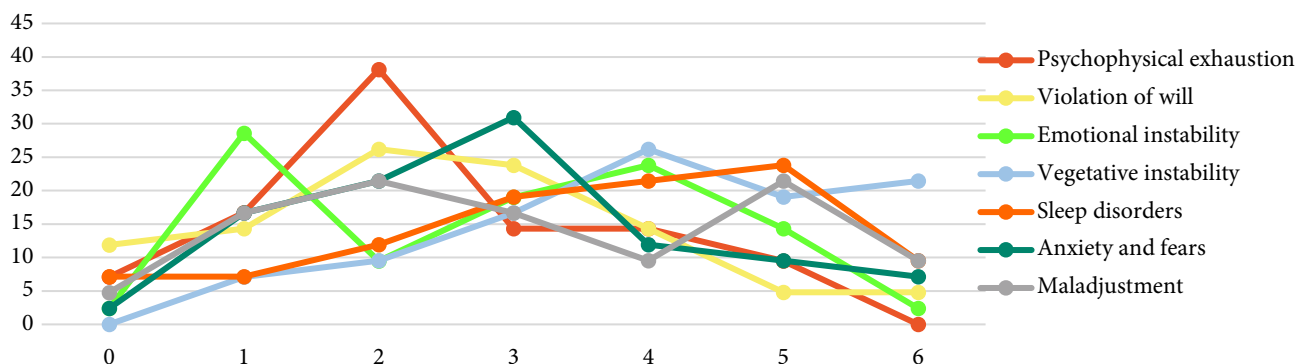


Figure 2. Frequency and level of expression of well-being symptoms in cadets during the voyage

Source: developed by the author

Given the schematic representation of the course of the symptoms of neuroticism of cadets on a voyage, some points can be summarised. The analysis uses a 6-point scale, where 0 – complete absence of the parameter, and 6 – extremely high value. First of all, according to some indicators, there is no extreme high level, namely, according to the indicator of Psychophysical exhaustion. That is, an acute and critical shortage of psychoenergetic resources were not recorded in the sample of cadets in voyage conditions. However, 38.1% of respondents indicate a reduced manifestation of symptoms (score of 2 points), 14.3% each have an average and slightly increased indicator (3 and 4 points). According to the indicator of vegetative instability, there is also an estimate that was not noted by any of the samples. This is a score of “0 points”, which indicates that there is no tendency to develop a symptom. That is, all cadets have vegetative instability to a certain extent; in particular, it is increased in 26.2%, extremely high in 21.4%, and high in 19%.

Other indicators include all estimates. Thus, 21.4% of cadets had a low level of Violation of will, and 23.8% had a moderate level. The Emotional instability indicator is most often found at a score of 1 – in 28.6% of people, as evidence of a low indicator, and a score of 4 – in 23.8% as an increased indicator. According to the indicator of Sleep disorders, the following picture was established: 23.8% of cadets have a high indicator, 21.4% – increased, 19% – average, 9.5% – extremely high. According to the indicator of Anxiety and fears, 31% indicated an average score, 21.4% – a reduced one. According to the indicator of Maladaptation, 21.4% scored two assessment scales indicating low and high indicators, 9.5% have an extremely high manifestation of the symptom. Thus, most often among cadets on the voyage there are violations in the symptoms of well-being, which form vegetative and emotional instability, sleep disorders, less pronounced symptoms of maladaptation as a tendency to addictions, anxiety, and fears, less manifested at high levels symptoms of psychophysical exhaustion and disorders of will.

Next, the study considers the individual psychological parameter of self-confidence, which is the key to adaptability. When a person is confident, they perceive most of the

stress factors, especially minor ones, without excessive psychoemotional stress, because they know their capabilities and strengths, that is, they are can cope with them. It also guarantees good health and a specific necessary reaction when it comes to troubles or difficulties, because a person has an understanding of what exactly they can do and an idea of the desired result. However, overconfidence, as well as underconfidence, borders on high levels of neuroticism and, for researchers, such indicators indicate an unrealistic self-perception and assessment of reality (Fig. 3).

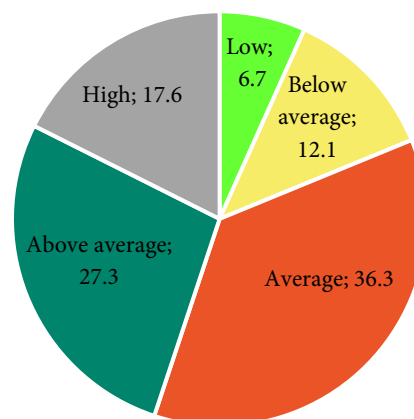


Figure 3. Level of self-confidence of cadets in voyage conditions

Source: developed by the author

As for the sample of cadets in voyage conditions, the following trends were observed: 27.3% have high and 36.3% have average values. Self-confidence is characterised by purposefulness and personal responsibility, a sense of autonomy and its defining role in making decisions and actions. With high values, cadets have an open mind in analysing the realities of life, due to which they are well-versed in it, with flexibility and efficiency in behaviour and considering various situational aspects. With averages, there is a tendency to avoid problems, especially when the person is tired or the question is too difficult. That is, there is a slightly lower individual activity, which underlies purposeful and delicate progress in life.

17.6% of cadets indicated self-confidence. These high values can be generalised as a tendency to excessive, reckless risk and perseverance, inability to let go of some situations when it needs to be done. A person may perceive themselves as majestic and omnipotent, but in reality it is a matter of all-encompassing control, born of anxiety and timidity that is not acknowledged. However, it is worth noting that with self-confidence, according to the methodology, a person is always quick and open to new experiences. While with indicators below average, which is 12.1% of people, and low, which is 6.7%, when it comes to self-doubt, this

means personal passivity, lack of willpower and perseverance, closeness in the expression of thoughts and feelings, emotional instability. These cadets have little flexibility, and new circumstances are always a challenge for them. Now, having received a detailed description of the parameters of well-being in emergency situations and self-confidence, it is advisable to consider what other individual psychological factors can affect neuroticism and uncertainty bordering on maladjustment. Accordingly, the factors that determine successful adaptation are also being studied, along with psychological resilience and self-confidence (Fig. 4).

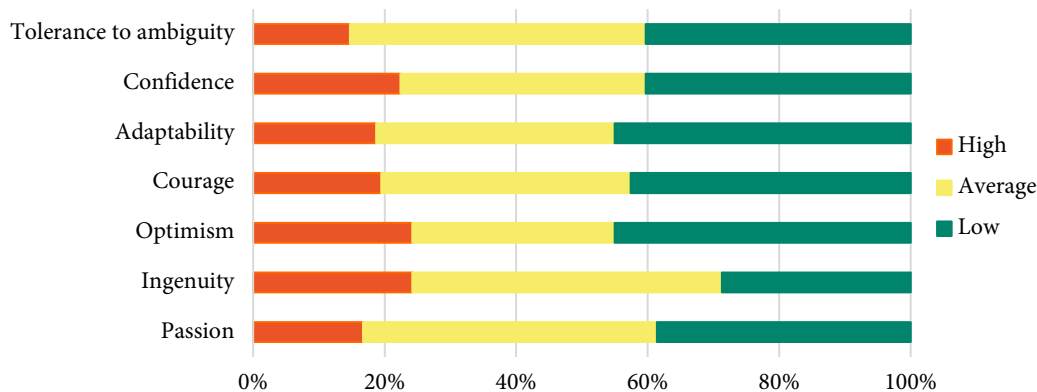


Figure 4. Parameters of readiness for changes among cadets in voyage conditions

Source: developed by the author

According to the interpretation, the optimal variant of the development of a particular property in the number system is based on the average values of the indicator. That is, as a norm, the desired level in this case is defined as average. The average level of passion and tolerance to ambiguity is 45% of cadets, ingenuity – 47.1%, optimism – 30.8%, courage and confidence – 37.9%, adaptability – 36.3%. Passion at this level indicates an increased vitality, activity and energy of the individual, their tirelessness due to a well-established system of resource provision and recovery. In 38.6% of cadets, it is underestimated, which indicates a weak vitality, lack of strength or desire for something, fatigue. In 16.7%, on the contrary, the results are too high, which can be a sign of hypertension, excessive mobility, inability to rest due to a developed need to always do something, be busy with something.

Ingenuity in average values symbolises the ability to find a way out of difficult circumstances when a person is able to turn to other, new sources of answers and information to find a solution to their situation. 28.7% of respondents have a low indicator, they have difficulties finding sources of information, and often feel “cornered” due to limited knowledge and ways to obtain it. 24.2%, on the contrary, show excessive enthusiasm in finding a variable solution to the situation, do not know how to analyse data, but rather accumulate it, in the end, not knowing how to use it due to the large volume. Optimism in average values is the embodiment of high hopes and faith in success, shows that a person focuses on the good, wanting to avoid the worst

options for the development of events, focuses not on the problem itself, but on how to solve it and in what ways. When the values are low, which is the case for 45% of the sample, pessimism, lack of belief that success can be real, focus on the problem and the troubles that follow, while the issue of solving these consequences is only discussed and perceived as a disaster. 24.2% of cadets are characterised by dreaminess and an unrealistic view of the world. They are already too optimistic, usually do not notice that something is wrong and needs a solution, believe in success, but do not use their strength to achieve it.

Courage in average scores is interpreted as a desire for the new and unknown, a willingness to abandon the already lived and reliable in favour of innovation. When the values are too low, as in the case of 42.6% of respondents, it means a lack of entrepreneurship, a fearful desire to stay stuck in the old, even when the situation requires updating knowledge, skills, material or other resources. And 19.5% of cadets show an excessive attraction to everything unknown and novelties, without distinguishing between important and secondary, they leave what they have already acquired in order to discover something else.

Adaptability at an average rate implies the ability to change your own plans and decisions, adapting to new circumstances, not to insist firmly only on your own when situational changes require it. 45% of cadets have a low score. This indicates that they do not have or are very poorly developed these skills listed above. However, 18.4% of cadets, on the contrary, have a very high rate. This may

indicate that they lack the firmness of decisions and actions when they are ready to change their plans even with the smallest and most insignificant changes. Confidence, if it has average values, is based on faith in themselves, in their own preferences and their own strength, in the fact that everything is within their power and possible, if only they want it. In 40.3%, the indicator is reduced, which indicates a lack of self-confidence and inability to manage their internal resources and strengths. In 22.4%, confidence took the form of arrogance, when their strengths and preferences are clearly exaggerated, which does not coincide with the real data of the individual.

Tolerance to ambiguity at average values is based on calmness in relation to the lack of clear and clear answers. This is self-control when there are situations of

ambiguity and unclear essence of the case, or when goals and expectations are not identified, or if the case started remains unfinished. When the values are too low, as in 40.3% of respondents, they talk about anxiety in these circumstances, an acute need for certainty and specification of conditions, requirements, goals, the final result, and the process itself. When the values are high, as in 14.7% of cadets, then they talk about indifference and insensitivity to what is happening around them, when a person acts purely according to their own instructions, not paying attention to other processes. Usually, such an activity does not give a productive result, since it does not have a vector, according to which it is organised and the final clear goal that would signal the completion of the case (Fig. 5).

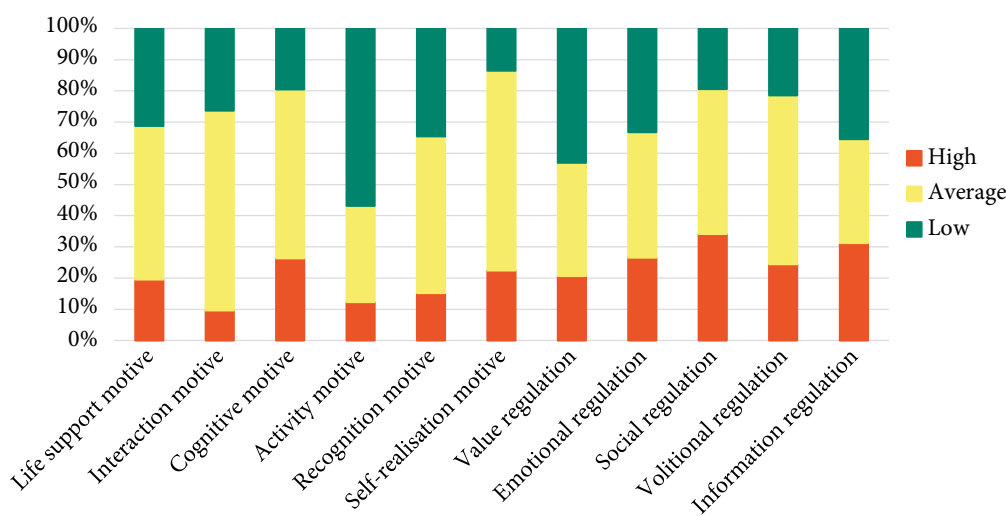


Figure 5. Parameters of motives and methods of regulating professional activity in cadets in voyage conditions

Source: developed by the author

The motives of external conditions and circumstances of cadets' activities are expressed as follows: the motive of life support is expressed in 19.5% at low levels, in 49.3% at medium levels, and in 31.2% at high levels. If the motive is shown, then professional behaviour is motivated by the needs for high earnings and material remuneration, the desire to have a job that would bring great benefits and various additional benefits, bonuses. The emphasis is placed on the ability to provide for the family, that is, attention at work is focused on earnings, remuneration for work. The interaction motive is expressed in 9.6% at low levels, in 64.1% at medium levels, and in 26.3% at high levels. It manifests itself in the orientation of behaviour to establish a certain nature of relationships. This means that the cadet strives for mutual understanding, mutual assistance, and mutual mental contact, which takes the form of transmitting non-verbal and verbal information to the communication partner. The recognition motive is expressed in 15.2% at low levels, in 50.2% at medium levels, and in 34.6% at high levels. If the motive of recognition prevails in the respondent, then their activity is focused on receiving praise

or approval from others – the need to be constantly highly appreciated for their own qualities and preferences, the need to feel respect from others.

As for the internal motives, that is, certain psychological properties of behaviour, the direct internal interest of the individual in what will happen, the following trend is observed: the cognitive motive is expressed in 19.5% at low, in 54.2% at medium, and in 26.3% at high levels. When it dominates, behaviour is motivated by new information and its receipt, when the respondent's desires fluctuate around increasing the depth of their work. In this case, a person is ready to meet changes in their work in order to raise the level of their complexity, update the requirements for more complex and high technical and qualification skills, and mobilise their intellectual abilities. The activity motif is expressed in 57.4% at low levels, 31.2% at medium levels, and 12.4% at high levels. It manifests itself in an inner readiness to enter into purposeful interaction with the environment, to self-activity built on the basis of the needs and interests of the individual, with the existing desire and desire to act. The self-realisation motive is expressed in 13.5% at low

levels, in 64.1% at medium levels, and in 22.4% at high levels. It symbolises the desire for self-improvement, the need for growth and development as a person, the desire to fully realise their abilities, the desire to feel personal competence, to solve their goals with a creative approach.

The second block of the methodology proposes to study the ways in which cadets' professional activities are regulated in voyage conditions. These are the guidelines that guide and from which a person starts in their work, what regulates their activities. Thus, among the study sample, 43% of respondents have a low, 36.3% average and 20.7% high level of the value regulation indicator. With a high level of the indicator, a person's activity is regulated by the motivational components of values and serves as the basis for motivation. This is the highest degree of motivation. Poorly developed value regulation is a sign of an unformed motivational structure and a lack of understanding of the purpose of their activities in the future, its significance for themselves and society. Emotional regulation of 33.2% of respondents is low, 40.2% is medium, and 26.6% is high. If the values are high, this indicates a developed emotional support for the activity of motives related both to the level and direction of their arousal, and to real worries. Poor development can indicate non-emotional variability as a gratuitous and unjustified change in mood, a lack of understanding of the connection between one's goals and the emotional experiences that accompany behaviour. Social regulation in 19.4% of respondents is low, 46.5% is average, and 34.1% is high. This indicator indicates the degree of influence of the social environment on the individual, their drives and desires. If the level is high, then the person is strongly guided by the opinion of the environment and sets their benchmarks and goals in accordance with the social framework and standards of normality and success. If the indicator is low, then the person rarely pays attention to social postulates and builds their path rather as a loner, separated from the rest. Volitional regulation in 21.4% of respondents is low, 54.2% is medium, and 24.4% is high. High values indicate excellent management of behaviour by one's own consciousness, namely by mobilising volitional efforts. Such cadets are described as responsible, independent in decisions and initiation of actions, their implementation and control. Respondents with low values are weak-willed, rarely take matters into their own hands, they are changeable and sluggish, indecisive and often inactive. Information regulation in 35.5% of respondents has a low, 33.3% average, and 31.2% high level. At a high level, a person is guided by information and their cognitive abilities. During work, when a certain information flow is received, this will lead to the actualisation of the motive. In other words, such respondents regulate their activities, their methods and intensity, depending on the information they receive, making adjustments, if necessary, to the final goal and form of work. If the values are low, then a person rarely pays attention to important information needed to achieve their goals, and

in their professional activities they do not know how to use new data to correct their behaviour and actions.

Study of sailors' health and productivity by E.A. Schmi-ed *et al.* (2021) found that a third of seafarers frequently experience mental health problems ($n = 26$; 28.9%), half have symptoms of depression ($n = 14$; 53.8%), a third have symptoms of anxiety ($n = 7$; 26.9%), and a third of cadets rate their mental health as unsatisfactory ($n = 9$; 19.2%). A third of seafarers consider the level of occupational stress excessive ($n = 35$, 38.9 %), but among the reasons often indicated is separation from the family, conflicts between work and family obligations. Productivity is also recorded as an adaptation to working conditions in several aspects – cognitive and physical. When considering the factors of personality adaptation, it is worth paying attention to the study by Ye.V. Karpenko (2013) and M. Houser *et al.* (2022). They present the results of an empirical study of the influence of motivational compounds on adaptation. The study showed that the success of adaptation is interconnected with the communicative and behavioural potential, and with neuropsychological stability, moral and value-based behavioural regulators.

Results of the study of psychological factors of social adaptation by I. Haletska & M. Klimanska (2019) showed a correlation between adaptability and self-efficacy and a person's mental well-being. Thus, associations with neuroticism, extraversion, openness to new experiences, conscientiousness, pessimism and optimism, emotional lability, anxiety, and rigidity were recorded. It also indicates a significant relationship between individual adaptation and indicators of self-reward as a belief in the availability of resources that are important for a person and the possibility of their timely use. Confirmation of the correlation of adaptability with mental resilience, optimism and pessimism, anxiety, mental stress, and emotional resilience is present in the study by L.V. Stepanenko (2021). The researcher also pointed out a direct correlation between the adaptive properties of a person and their courage in social contacts and responsibility. The study of psychosocial factors of successful adaptation in adults by M.G. Jiménez Ambriz *et al.* (2011) confirmed that indicators such as self-esteem, optimism, internal regulation, and self-control mediate the negative effects of stress, thereby providing better individual adaptability. R.M. Shamionov *et al.* (2014) focused on indicators of motivation and understanding the purpose of one's own activities as a catalyst for adaptation to any conditions that it imposes.

T. Khraban (2022) pointed to the correlation of personality adaptability with its psychological well-being, which is influenced by personal determinants, in particular self-acceptance, self-esteem, autonomy, independence, purposefulness and the development of a motivational factor as an understanding of the goals and motives of professional activity carried out by a cadet. A.K. Ledford *et al.* (2020) paid attention to the factors of psychological resilience in the conditions of marine training and work, because the conditions are non-standard for humans and require special

adaptation to functioning at different levels and activities in them. There is a separate physical predictor of adaptation to stressful conditions, these are indicators of the vegetative and psychophysical, hormonal plan, and a psychological predictor as mental stability, endurance, perseverance, concentration on success.

M. Nordmo *et al.* (2020), investigating endurance and the causes of poor sleep quality in sailors, found that daily performance is influenced by several main factors. This is endurance as mental resilience and sleep quality. In turn, the quality of sleep correlates with the endurance indicator, which indicates that the more stable a person is, the better their recovery rates will be – physical and mental, and, accordingly, the more successful their adaptation in extreme and unknown conditions will be. C. Baglioni *et al.* (2016) and N. Cellini *et al.* (2017) indicate that sleep quality disorders are strongly associated with neuroticism and emotional regulation, affecting a person's mood and well-being. In addition, sleep disorders contribute to interpersonal conflicts and hyperexcitation, which can manifest as increased involvement in activities or as maladaptive behavioural strategies, in particular, taking sedatives or alcoholic substances.

Thus, the results of an empirical study presented in the paper highlight the relationship between psychophysiological and individual psychological parameters with individual adaptability, including in a professional context. Psychophysiological indicators include the level of physical fitness and endurance, the corresponding state of physical and mental health, psychological training, psychological readiness and stability. Individual psychological indicators include the level of responsibility and determination, independence, mental readiness, motivation and interest in the chosen profession, the correlation of personal values with the ideology of the profession and the employer organisation. The interdependence of indicators of readiness for changes, which are partially determined by the psychophysical state of the individual, is confirmed. It can be argued that these individual psychological indicators are to a certain extent determined by well-being. The greater the number and frequency of manifestation of neuroticism, the less inclined a person becomes to adapt, that is, becomes less interested and optimistic, more despondent in their abilities that will help to cope with challenges in their personal life and professional activities. As the study showed, there is an urgent need for psychocorrective intervention in the internal organisational processes of the working environment of cadets during voyage, since the work space in which cadets are located is quite stressful and requires optimisation to improve the indicators of psychophysical and psychoemotional well-being of employees.

CONCLUSIONS

It was established that the psychological stability of cadets on the voyage is influenced by their level of passion, resourcefulness, optimism, leading motives of professional activity, in particular, the motive of life support and self-realisation. Adaptability and tolerance to ambiguity are affected by the level of neuroticism and confidence, which are also inter-related. Disturbances in health, in particular in terms of exhaustion, emotional and vegetative instability, anxiety and fears, and maladjustment, affect the effectiveness and quality of value, emotional, volitional, social and informational regulation. Thus, the degree of depletion of psychoenergetic resources can affect how brave, determined, and confident a person will feel. Violations of the regulation of the volitional sphere are observed with excessive optimism, undeveloped adaptability, and in the absence of tolerance and calmness in conditions of uncertainty. Emotional instability is accompanied by a loss of confidence in the correctness and correctness of their decisions and in themselves as a whole. With an increase in physical discomfort, sleep disorders, with an increase in fears and anxiety, and with the appearance of addictions, there is a decrease in interest and enthusiasm for their activities. In addition, if cadets experience body discomfort and a malfunction in the body's functionality, this reduces their faith in future success. Sleep disorders lead to feelings of indecision and doubt, hesitation about the decisions made. When the degree of anxiety increases and many fears arise, there is also a decrease in self-confidence indicators. A tendency to various addictions, the use of sedatives, etc., indicate a low adaptability of the individual, since it does not imply an effective and truly solving a problem situation, but only an escape from it.

A study of individual psychological parameters of cadets' adaptability showed a general tendency to neuroticism, while half of the respondents have too high or low self-confidence. The most common symptoms among cadets are sleep disorders, addiction to sedatives or alcohol, vegetative complaints, and symptoms of psychophysical exhaustion. Almost half of the cadets have difficulties with adaptation, violations of value, information and emotional regulation, it is difficult to react to situations of ambiguity, and feel indecisive. The prospect of further research is seen in detailing the scheme of vectors of development of adaptability of cadets in voyage conditions, developing and testing a psychological plan for correcting individual psychological parameters associated with personality adaptation.

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CONFLICT OF INTEREST

None.

REFERENCES

- [1] Baglioni, C., Nanovska, S., Regen, W., Spiegelhalter, K., Feige, B., Nissen, C., Reynolds, C.F., & Riemann, D. (2016). Sleep and mental disorders: A meta-analysis of polysomnographic research. *Psychological Bulletin*, 142(9), 969-990. doi: [10.1037/bul0000053](https://doi.org/10.1037/bul0000053).
- [2] Bagus Ani Putra, M.G. (2021). [Stress responses of sailors on board toward Covid-19 pandemic](#). *Proceeding International Seminar of Multicultural Psychology*, 1(1), 12-17.
- [3] Cellini, N., Duggan, K.A., & Sarlo, M. (2017). Perceived sleep quality: The interplay of neuroticism, affect, and hyperarousal. *Sleep Health*, 3(3), 184-189. doi: [10.1016/j.sleh.2017.03.001](https://doi.org/10.1016/j.sleh.2017.03.001).
- [4] Declaration of Helsinki. (2013). Retrieved from <https://www.wma.net/what-we-do/medical-ethics/declaration-of-helsinki/>.
- [5] Haletska, I., & Klimanska, M. (2019). Ukrainain adaptation of the short five factor personality questionnaire TIPI (TIPI-UKR). *Psychological Journal*, 5(9), 57-74. doi: [10.31108/1.2019.5.9.4](https://doi.org/10.31108/1.2019.5.9.4).
- [6] Houser, M., Gazley, B., Reynolds, H., Browning, E.G., Sandweiss, E., & Shanahan, J. (2022). Public support for local adaptation policy: The role of social-psychological factors, perceived climatic stimuli, and social structural characteristics. *Global Environmental Change*, 72, article number 102424. doi: [10.1016/j.gloenvcha.2021.102424](https://doi.org/10.1016/j.gloenvcha.2021.102424).
- [7] Ichanska, O., & Lopushanska, K. (2019). [Professional adaptation of sailors depending on experience in extreme profile activity](#). In *Individuality in psychological dimensions of communities and professions in a network society* (pp. 131-134). Kyiv: AlfaPeak LLC.
- [8] Jiménez, M., Izal, M., & Montorio, I. (2011). Psychological and social factors that promote resilience in the adult life cycle. *Journal of Happiness Studies*, 13, 833-848. doi: [10.1007/s10902-011-9294-2](https://doi.org/10.1007/s10902-011-9294-2).
- [9] Karpenko, Ye.V. (2013). [Correlation between adaptation and self-actualization: Age and gender aspects](#). *Scientific Journal of Lviv State University of Internal Affairs*, 1, 42-52.
- [10] Khraban, T. (2022). Cadets' psychological well-being during training period at military institutions of higher education. *Scientific Journal of Polonia University*, 52(3), 146-155. doi: [10.23856/5219](https://doi.org/10.23856/5219).
- [11] Ledford, A.K., Dixon, D., Luning, C.R., Martin, B.J., Miles, P.C., Beckner, M., & Nindl, B.C. (2020). Psychological and physiological predictors of resilience in Navy SEAL training. *Behavioral Medicine*, 46(3-4), 290-301. doi: [10.1080/08964289.2020.1712648](https://doi.org/10.1080/08964289.2020.1712648).
- [12] Matysková, L., Rogers, B., Steiner, J., & Sun, K.-K. (2020). Habits as adaptations: An experimental study. *Games and Economic Behavior*, 122, 391-406. doi: [10.1016/j.geb.2020.04.013](https://doi.org/10.1016/j.geb.2020.04.013).
- [13] Nordmo, M., Olsen, O.K., Hetland, J., Espevik, R., Bakker, A.B., & Pallesen, S. (2020). It's been a hard day's night: A diary study on hardiness and reduced sleep quality among naval sailors. *Personality and Individual Differences*, 153, article number 109635. doi: [10.1016/j.paid.2019.109635](https://doi.org/10.1016/j.paid.2019.109635).
- [14] Prib, G.A., Raievska, Ya.M., & Beheza, L.Ie. (2020). Socio-psychological features of personality adaptation in the conditions of combat. *Academic Notes of V.I. Vernadsky Taurida National University. Series: Psychology*, 33(72), 104-108. doi: [10.32626/2227-6246.2019-44.31-52](https://doi.org/10.32626/2227-6246.2019-44.31-52).
- [15] Questionnaire "Well-being in extreme conditions". (2009). Retrieved from https://stud.com.ua/124951/psihologiya/simptomatichniy_opituvalnik_samopochuttya_ekstremalnih_umovah.
- [16] Rathus assertiveness schedule (RAS). (1973). Retrieved from <https://um.co.ua/2/2-2/2-25034.html>.
- [17] Rolnic, A., Heather, S., Gold, M., & Hull, C. (2005). *Personal change-readiness survey*. Retrieved from https://stud.com.ua/155512/psihologiya/metodika_osobistisna_gotovnist_zmin_personal_change_readiness_survey_pcrs.
- [18] Schmied, E.A., Harrison, E.M., Englert, R.M., Thomsen, C.J., & Glassman, L.H. (2023). Challenges and opportunities to maximize mental health among shipboard sailors: A qualitative study. *Military Behavioral Health*. doi: [10.1080/21635781.2023.2258785](https://doi.org/10.1080/21635781.2023.2258785).
- [19] Schmied, E.A., Martin, R.M., Harrison, E.M., Perez, V.G., & Thomsen, C.J. (2021). Studying the health and performance of shipboard sailors: An evidence map. *Military Medicine*, 186(5-6), 512-524. doi: [10.1093/milmed/usaa459](https://doi.org/10.1093/milmed/usaa459).
- [20] Shamionov, R.M., Grigoryeva, M.V., & Grigoryev, A.V. (2014). Influence of beliefs and motivation on social-psychological adaptation among university students. *Procedia – Social and Behavioral Sciences*, 112, 323-332. doi: [10.1016/j.sbspro.2014.01.1171](https://doi.org/10.1016/j.sbspro.2014.01.1171).
- [21] Shydelko, A., Holovach, T., & Mayorchak, N. (2022). Professional adaptation of personality in the educational process. *The National Defence University of Ukraine Named After I. Cherniakhovskyi*, 65(1), 141-146. doi: [10.33099/2617-6858-2022-65-1-141-146](https://doi.org/10.33099/2617-6858-2022-65-1-141-146).
- [22] Soroka, O., Kravchenko, O., Mishchenko, M., Levenets, A., Korolchuk, V., Myronets, S., Tsymbal, S., Vakhotska, I., & Hotsuliak, N. (2022). Development of specialists' stress tolerance in the process of their professional activity. *Human Factors, Business Management and Society*, 196-204. doi: [10.54941/ahfe1002269](https://doi.org/10.54941/ahfe1002269).
- [23] Stepanenko, L.V. (2021). Adaptive properties in the composition of the emotional-functional potential of the personality. *Problems of Modern Psychology*, 1(20), 137-143. doi: [10.26661/2310-4368/2021-1-15](https://doi.org/10.26661/2310-4368/2021-1-15).

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Взаємозв'язок індивідуально-психологічних чинників адаптації кадетів в умовах рейсу

Анотація. Актуальність дослідження зумовлено необхідністю у поновленні даних щодо специфіки діяльності моряків-кадетів у зв'язку зі стрімкими змінами організаційної структури сучасного суспільства та розуміння ролі даної професії у ньому. Метою статті було розкриття психофізіологічних та індивідуально-психологічних детермінант адаптації та їх взаємообумовленості у контексті професійної діяльності моряків-початківців. У роботі застосовано методи теоретико-методологічного аналізу, психодіагностичні методи опитування та метод кореляційного аналізу Пірсона. У результаті теоретичного аналізу встановлено чотири групи факторів професійної адаптації: психофізіологічні, індивідуально-психологічні, соціально-психологічні та організаційно-структурні. На основі цих факторів організовано емпіричне дослідження, у ході якого виявлено взаємозв'язок між показниками психологічної стійкості, впевненості в собі, адаптивності та толерантності до двозначності. Визначено, що психологічна резильєнтність пов'язана з параметрами пристрасності, винахідливості, оптимізму та рівнем вираження мотиваційних компонентів професійної діяльності кадетів, детермінується мотивами життєзабезпечення та самореалізації. Порушення у самопочутті, зокрема у показниках виснаження, емоційної та вегетативної нестабільності, тривоги та страхів, дезадаптивності впливають на ефективність та якість ціннісної, емоційної, вольової, соціальної та інформаційної регуляції. Найчастіше серед кадетів в рейсі зустрічаються порушення у симптомах самопочуття, що формують собою вегетативну та емоційну нестійкість, порушення сну, менш виражені симптоми дезадаптації як схильності до залежностей, тривоги та страхів, найменше проявляються на високих рівнях симптоми психофізичного виснаження та порушень волі. Стаття робить внесок у психологічну науку щодо питань професійної та особистісної адаптивності особистості в екстремальних умовах діяльності. Робота має практичну цінність для соціологів, педагогів, психологів, психотерапевтів та медиків, які можуть сприяти вирішенню проблем дезадаптації у трудовій сфері

Ключові слова: психологічна стійкість; впевненість; готовність до змін; мотивація; професійна діяльність; регуляція діяльності

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Development of creative abilities of primary school students by means of project-based technologies in foreign countries

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Abstract. In the context of global competition, the ability to think outside the box and work effectively in a team, acquired through the use of project-based technologies, plays a key role in preparing the younger generation for future professional challenges. Methods that promote the active development of these qualities, such as project-based learning, have proven themselves in the international context as an effective way to unlock the creative potential of students. The purpose of the study was to investigate the features of using project-based technologies for the development of creative abilities of primary school students in foreign countries. General methods of scientific research, such as empirical (observation, comparison) and complex (analysis and synthesis), were applied. Various approaches to the interpretation of project-based learning, conditions for its effectiveness and advantages for the development of children's creative abilities are presented. Studies that demonstrate the successful use of project-based technologies in foreign countries, namely: Finland, Great Britain, USA, Canada, Poland, Czech Republic, Netherlands, Norway, Sweden, Spain, Germany, Japan, and methods that contribute to the development of creative and critical thinking in primary school students are analysed. It was found that creativity is a key competence of students' future success. The use of project-based technologies in primary schools contributes to the identification of individuality and the development of personal qualities. The use of project-based technologies in primary schools in foreign countries is an effective means of developing students' creative abilities, the learning environment that promotes students' self-realisation, development of their creative potential, and preparation for the requirements of the modern world. The practical significance of the study is to provide teachers, methodologists and other teachers of Ukrainian primary schools with information and insights on the use of project-based technologies for the development of creative abilities of students based on foreign experience

Keywords: creative abilities of primary school students; project method; project activity; foreign experience; educational process in primary school

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INTRODUCTION

In the modern world, the development of creative abilities of primary school students is an important problem in the educational sphere. The growing demands for individual and creative thinking, the need for innovation and the ability to solve complex problems require students not only to assimilate factual knowledge, but also to develop their

creative potential. In the context of educational innovations, such as the focus on competencies and the importance of developing basic skills in students, there is a need to turn to new learning strategies. Among such strategies, the use of project-based technologies stands out as an effective tool for stimulating students' creative potential. This



highlights the need to adapt educational methods to requirements that seek to develop the critical skills and competencies needed for a successful future.

The results of the analysis of psychological and pedagogical literature indicate that researchers have investigated various aspects of problems related to the emergence and development of the project method in foreign experience. In particular, Yu. Senko (2019) distinguishes between the stages of development of children's creativity and the stages of manifestation of creative activity. The researcher analysed various methods and approaches to learning that contribute to the activation of students' creative potential, identified key factors that affect the development of creative abilities, and offers specific examples and strategies that can be applied in the educational process. The main focus was on the development and implementation of innovative techniques that help younger students not only develop creative thinking, but also develop skills of critical analysis, self-expression and interaction in the social environment. L. Dubrovska *et al.* (2022) noted that components of students' creative abilities in grades 1-2, such as creative attention and thinking, can be called basic, which means using certain tasks. In addition, the researchers note that with the development of creative abilities, students are increasingly interested in new knowledge, the level of their independence in learning increases, so teachers should focus on revealing students' curiosity and interests, expanding their learning interests, teaching and developing thinking and communication skills, etc.

D. Prima (2020) revealed some content and procedural aspects of the project and research activities of primary school teachers in the context of the requirements of the New Ukrainian School. The focus is on how project-research methods can be integrated into the learning process to promote critical thinking, learners' autonomy and engagement in active learning. The researcher highlights how such activities can support teachers in achieving educational goals, in particular, in developing key competencies of students, considering the needs of a modern school. Y. Didyk & O. Liba (2022) described a theoretical approach that explains the concept of "development of creative abilities" and confirms the pedagogical conditions that contribute to the development of creative abilities in children of primary school age in the course of educational activities. H. Tovkanets & Y. Hapak (2019) defined the advantages and effectiveness of implementing project technology and revealed its role in the development of innovative abilities of younger schoolchildren. The researchers analysed how the use of project-based teaching methods contributes to the development and stimulation of children's creative potential, and affects the increase in their motivation and interest in the educational process. K. Bondareva & O. Ivleva (2021) exploring a new Ukrainian school, discovered unique aspects of using project-based technologies in the classroom as a means of learning about the world. V. Bondar (2020) presented key categories for defining project activities, and a clear explanation of the goals, objectives,

functions, and principles of educational implementation. In addition, didactic aspects of using project technology in primary schools were identified.

The study by M. Semankiv *et al.* (2019) demonstrated the importance of using project-based technologies, disclosing their content, studying the pros and cons of implementing project-based technologies in education, and classifying different types of projects. K. Chub (2022) reveals the fundamental principles of using project-based learning technology in primary schools. It was shown that the project technology serves as an innovative educational approach aimed at the spiritual and professional growth of young students, teaching them a variety of creative and research methods. S. Lavrenko (2021) considered the specifics of the project method in primary school, taking into account the age and psychological characteristics of younger schoolchildren. S. Kupchak (2021) analysed the foreign experience of preparing future primary school teachers for the use of project technology. The researcher reviewed various methodological and practical approaches adopted in the educational systems of different countries, with an emphasis on the importance of integrating project-based technologies into teacher training. Special attention was paid to the analysis of educational programmes, teaching methods, and practical experience, which allows future teachers to effectively use project-based technologies for the development of critical thinking, creative abilities and active participation of students in the educational process. O. Mykhaylenko & T. Butko (2023) considered the historical aspects of the development of the project method in foreign and Ukrainian pedagogical theory and practice, and defined the stages of development of this method.

The purpose of the study was an analytical review and evaluation of project-based learning methods as a tool for developing creativity and teamwork among primary school students. The objectives of the study were to investigate the mechanisms of development of creative abilities among primary school students using project-based technologies; analysis of effective methods and practices applied in educational systems of foreign countries that contribute to the stimulation and development of creative potential of children at the initial stages of education; identification of basic principles and strategies that can be adapted and applied in the practice of Ukrainian teachers for the effective development of creative abilities of students.

MATERIALS AND METHODS

The paper used various methods of scientific research for the purpose of detailed consideration and analysis of the problem. The main methods were empirical and complex methods of scientific cognition. In the course of the study, the researchers used observations to draw attention to specific situations and events related to the introduction of project-based technologies in the educational process of primary schools in foreign countries. The main purpose of the observations was to obtain specific data and investigate the real experience of applying project-based technologies,

and their impact on the development of students' creative abilities. The comparison played a crucial role in this study, as it allowed for a better understanding of the analysis and evaluation of the implementation of project-based technologies in the educational process of primary schools at the international level. Using comparative analysis, the authors were able to identify common patterns and unique approaches to developing students' creative abilities through project-based technologies. This helped to identify which strategies are most effective in different cultural and educational contexts, and determine potential challenges and limitations that educators may face when implementing them. The comparison allowed contrasting the results of various studies to identify certain trends and differences in the use of project-based technologies in different countries.

The analysis allowed considering existing research and publications related to the use of project-based technologies in the development of creative abilities of primary school students. During the analysis of the literature sources mentioned in the previous section, attention was drawn to a number of key aspects: the relationship between the use of project-based technologies and the development of creative abilities of younger schoolchildren; the effectiveness of the use of project-based technologies in foreign countries in the development of creative abilities of students; identification of features and factors that contribute to or hinder the development of creative abilities

of students in the context of the use of project-based technologies; advantages and disadvantages of using different types of project-based technologies (for example, group projects, individual projects, etc.) for the development of creative abilities of students.

The study was conducted by analysing scientific and pedagogical literature, statistical data, and special reports and studies conducted in foreign countries using project-based technologies in primary education. The paper used a variety of materials, such as scientific articles, monographs, reports and collections of scientific conferences, which provided a comprehensive understanding of the problem under study and enabled a reasonable assessment of the results. The synthesis was used to summarise and systematise the collected data, put forward conclusions and recommendations. Using various sources of information, such as papers, reports and collections of scientific conferences, these data were summarised and systematised to obtain a complete amount of information on the topic under study. Based on the obtained data and their analysis, conclusions were formulated regarding the problem under study. These findings included new ideas, trends, and patterns identified from literature and data analysis. For the convenience of presenting and analysing the collected data, a table has been compiled that reflects the studied criteria for applying project-based technologies in educational institutions of each country (Table 1).

Table 1. Evaluated aspects of project-based learning in primary schools in the analysed countries

Country	Criteria under study
Finland	How does the use of projects contribute to the development of independence, critical thinking, and creative abilities of students?
Wales	The role of project activity as an approach, and what role it plays in the development of independence, critical analysis, and creativity among students.
Great Britain and USA	The impact of project use, integrated learning, role-playing games, and project presentations on the development of students' creative thinking and skills.
Canada	How do social science project assignments contribute to students' development and skills?
Poland	What contributes to the development of self-directed learning and preparation for further education?
Czech Republic	What teaching methods help enrich the learning process?
Netherlands	How does the use of projects contribute to the development of students' emotional sphere and creative abilities?
Norway	What projects are aimed at developing students' creativity and environmental awareness, fostering independence and responsibility?
Sweden	How is the use of project-based technologies aimed at developing students' creative abilities and independence?
Germany	What methods are used to acquire the necessary skills and practical experience that are useful for the future career?
Spain	What projects contribute to the development of students' creative abilities, speech competence, and self-expression?
Japan	What projects contribute to the development of creativity and creative thinking of students?

Source: developed by the author

Thus, the combination of these methods ensured the completeness and objectivity of the study of the problem and the investigation of its various aspects.

RESULTS AND DISCUSSION

Primary school students are a special group of students who are at an early stage of their learning and development. At this age period, the child is in the process of developing basic learning skills, cognitive functions, and

social skills. In primary school age, there is a favourable context for the development of creativity in children and their creative abilities (Table 2). It is during this period of childhood development that the active process of imagination, fantasy, creative thinking and curiosity are formed. At this stage, children begin to acquire the skills of observing, comparing, and critically evaluating events and phenomena around them. Psychologically, childhood is an important period for the development of creative

abilities, because it is at this time that children begin to understand the relationship between themselves and the world around, analyse social motives for behaviour, moral assessments, and the importance of conflict situations. At this age, the development of personality passes into

a conscious phase. If earlier the game was the main activity, now the main focus is on education – the equivalent of work. A child's school success becomes a criterion for evaluating and determining their attitude to others (Rudakova, 2005).

Table 2. Features of using project-based technologies in primary schools

The use of project-based technologies with younger students has several important features

- 1) At this age, the younger student has a wide field for the development of creative abilities, because the brain is at the stage of intensive development. It is flexible and able to quickly adapt to new experiences and knowledge. Younger students are interested in the world around them and begin to actively explore it. This gives them the opportunity to experiment and discover new things. The use of project-based technologies gives them the opportunity to express their creativity, generate ideas and apply them in real projects.
- 2) Expansion of the learning experience: project activities allow younger students to increase their learning experience by working on projects. They can explore different topics, acquire new knowledge and skills, and communicate with experts from different industries.
- 3) Development of key competencies: the use of project-based technologies contributes to the development of key competencies that are necessary in the modern world. These competencies include critical thinking, problem thinking, communication skills, collaboration, and creativity.
- 4) Motivation to learn: working on projects encourages students to be motivated to learn. They are more interested and involved in the creative process, as they have the opportunity to choose the topic of the project, put forward their own ideas, and take an active part in its creation.

Source: developed by the author

The use of project-based technologies in primary schools provides students with the opportunity to actively interact with educational material and the world. Instead of passively accepting information from the textbook, students perform real projects, explore topics, solve problems, and present their own results. It is important to note that project-based learning technology not only develops students' creative abilities, but also contributes to the development of critical thinking and self-esteem, and a systematic approach to solving educational problems. Students learn to analyse and evaluate their work, identify the strengths and weaknesses of the project, and look for ways to improve it. This helps them develop self-control and self-discipline. According to the results of research by the authors of this study, in foreign countries, the use of project-based technologies in primary schools allows achieving positive results in the development of creative abilities of students.

In *Finland*, primary school consists of grades 1-6. One of the main principles of organising the educational process in Finnish schools is active learning through play, creative and creative learning, project-based learning, development of creative abilities and the use of innovative technologies (Hrynyova, 2017). According to teachers, the goal of the Finnish learning system is to make learning more practical, considering the specifics of the area and involving students in the life of the community. Students should not just receive knowledge passively, but actively acquire it. The content of training recedes into the background in favour of the training itself. The main goal is to educate students in such a way that they understand themselves and their preferences. Although each school organises projects and integration in its own way, there are common approaches. Learning in projects involves a gradual expansion of

knowledge: each new knowledge is based on the previous one. Students work in an "inverted" classroom, where tasks are completed on weekends and then tested on Monday with mini-tests. Homework assignments are completed from grades 1 to 12. During project activities, no other lessons are held: two days a week for eight weeks (although each school does this in its own way) are allocated to the project. Teachers act as a coach or tutor, not just a teacher. They do not teach, but help students learn independently. Projects are implemented starting from primary school (Shvets, 2017). Finland is actively implementing phenomenon-oriented training based on the project method. The basic principles of this approach include connection to real life, indivisibility, and meaningfulness. Finnish teachers emphasise that it is the learning process that is important, and not just its result, as it contributes to the personal development of students and constructive mutual influence (Melnikova, 2021).

In Finland, learning strategies aim to prepare students for real life and develop their autonomy and critical thinking. The Finnish learning system supports students' ability to effectively use information, analyse it, and make informed decisions, and the ability to create projects and work in a team. In Finland, project-based technologies are used to develop students' creative abilities already at the initial stage of training. Children from the first grades are engaged in project work in various subjects, such as studying the world around them, mathematics, music, drawing, and language. Schools in Finland have great autonomy, and each teacher can independently determine the number and content of projects, considering the individual characteristics of students. Students from the first grades are actively involved in the entire process of working on the project,

starting from generating ideas to implementing them. This allows children to be active participants in their learning and interested in its results (Golovina, 2019). The Finnish school has an interesting paradox: it is both pragmatic and philosophical. Subjects in it are considered more as a means of replenishing erudition, with the main goal of expanding the understanding of how this knowledge can be useful for a person. Since the first grade, students have been engaged in a multidisciplinary subject, which officially cancels the clear line between different disciplines in its schedule. However, its main goal is to bring students together during lessons in projects that allow them to use knowledge from different industries simultaneously. For example, in one of the Helsinki schools, the result of one of these projects is a self-prepared cookbook. While working on the project, students are independently engaged in drawing, photographing, searching for recipes, and cooking dishes (Baburets, 2019).

Lyudmyla Kazmiruk, a Ukrainian English teacher, spoke about her experience as a teacher's assistant at a primary school in Wales after she worked at school No. 28 in Ternopil before Russia's large-scale military invasion of Ukraine on February 24, 2022. She was particularly impressed by the method of project work in Wales, where the assistant is also actively involved in the process. She compared this to the Ukrainian education system, where teachers usually have two or three lessons to implement a project in one subject, such as "Me and Ukraine". But at a school in Wales, the project can last from two to three weeks or even longer, covering a wide variety of subjects, including English, history and literature, similar to the Ukrainian "I explore the world". Each project takes about half a day, and schools do not use calls, so teachers independently determine the beginning and end of classes (The experience of..., 2023). When the teacher entered the classroom, the students were actively engaged in a project to learn the history of their native land. They studied this topic in detail from various aspects. The introductory part is organised by the teacher, and then explains what to do and gives instructions. Students are divided into 4 groups, each of which performs its own task:

- the 1st group draws a wizard from local legends, photographs him, and animates him using special software;
- the 2nd group compares photos of their city from the 1970s to the present with a map. Students mark known objects and places, record videos where they analyse changes over time;
- the 3rd group explores the unique Welsh boats – coracles. Students watch videos and choose five interesting facts. After that, they watch another video on how to draw these boats. Then they create a presentation where they draw coracles and tell interesting facts that they remember from the video;
- the 4th group collaborates with the teacher on historical facts and legends of the region.

Students are constantly interacting with modern technologies. The teacher provides for the preparation of necessary materials for the class, creating a special information

folder on the school learning platform, which every student has access to. This folder contains videos, texts, and other resources necessary for work on the project. Students do not work with traditional textbooks, because they are not available at school. Instead, each child receives personal notebooks and chromebooks with the school's pre-installed educational platform. This platform is used by teachers to host all the necessary materials for learning. Each of the four groups performs its tasks alternately, meaning that the project components are constantly in rotation between groups. Project work at a Welsh primary school greatly impressed a teacher from Ukraine and brought her joy and pleasure in the learning process. The Ukrainian education system tries to simplify the school curriculum, but it remains quite intensive, leaving no room for ease. Teachers in Ukraine are limited in time to study each topic, after which they are forced to move on to the next ones. There is no such rush at the local Welsh school. Students have the opportunity to study one topic for a long period of time, return to it again and look at it from different angles (The experience of a teacher from..., 2023).

Thus, comparing the two education systems (Finland and Wales) with the Ukrainian one, the main emphasis is on the use of project work in teaching, in particular, in these two countries, as a method that promotes the development of independence, critical thinking and creative abilities of students. It is worth noting that both training systems focus on interactivity, the use of modern technologies and deep study of the topic through long-term projects. The Ukrainian teacher is interested in working methods in Wales, where she observes greater freedom and the possibility of deeper study of the topic, compared to the Ukrainian system, which is often characterised by a greater pace and limited time to study the material. After reviewing the educational systems of Finland and Ukraine, the study will move on to the analysis of other countries to give a more complete comparative overview.

In *Great Britain*, students often visit libraries, as one of the most popular tasks for them is to create a project. At the same time, the teacher only provides a general topic, and the student chooses a specific topic and materials for research. Thus, teachers implement one of the basic principles of the education system, which is that the main task of the school is to teach the child to work with information (Sukhoveenko, 2019). In the UK, the method of projects in primary schools is widely used in the educational process, this approach allows stimulating creativity, independence, and critical thinking of students. They can be used in British primary schools in the following ways. 1. Project weeks or project days. These are specially designated periods of time when students work on projects on a specific topic or subject. They have the ability to research, study, and solve problems in groups or individually. 2. Integrated training. Lessons are aimed at integrating multiple subjects within a single project. For example, a project can combine mathematics, literature, and science around a specific topic or problem. 3. Application of technologies. Students can use

various technologies to research and present their projects. This may include using computers, tablets, video and audio recordings, etc. 4. Role-playing games. Students play role-playing games that help them better understand the topic or problem they are working on. It promotes collaboration, empathy, and creativity. 5. Project presentations. Students have the opportunity to demonstrate their knowledge and skills through the creation of projects, presentations, public speeches or videos. These methods allow students to actively participate in learning, create their own projects, and develop skills that they will need in the future. During the holidays in Britain, children are usually assigned to create an interesting project.

In USA, project-based technologies aimed at developing students' creativity are popular. The Dalton School in New York it is forbidden to force students to study, students work independently on projects and perform tasks that gradually become more complex. In addition, tasks are as close as possible to life situations. Students learn to work more in teams, discuss, think independently, and improve themselves. The project method was introduced into the US educational process throughout the 20th century and is actively used in the 21st century. Prominent Ukrainian researcher V.M. Madzhigon (2004), studying the features of labour training of students in developed countries of the world, in particular the United States, in his monograph pointed to the fact that the main methods of labour training in primary secondary schools are the method of projects, the method of business game, and solving problem situations. For example, in Maryland (Sherwood High School), all students participate in projects in pottery lessons. Students do not just learn how to sculpt dishes, vases, figurines, they often fulfil orders of public organisations of the district (Kapelyushna, 2019). This method is used in various forms, namely: authentic, interpreted, and authorial. Students are offered various tasks during project activities, such as designing, re-designing, searching for alternative solutions, evaluating efficiency, explaining expected and undesirable results, checking solutions according to appropriate criteria, developing and implementing technological devices, converting information into a more meaningful form, correctly calculating time and financial resources for a technological project, etc. An interesting and non-standard project task for elementary school students in the United States, which is aimed at reducing the amount of solid waste by reducing the use of packaging. First, students count the amount of packaging waste that accumulates in their homes over a certain period of time. They then visually present their data and combine it with other students' data to get an overall result for the class. These activities promote students' analytical thinking, stimulate their own reasoning, and offer practical strategies for reducing solid waste within the school.

In the UK and the USA, project-based teaching methods are also used to develop students' creativity and independence. These techniques include project weeks, integrated learning, technology use, role-playing games, and

project presentations. They contribute to the active involvement of students in learning, the development of their skills and the stimulation of creative thinking. Teachers in these countries actively support students in choosing their own research topics and materials, giving them more freedom in choosing and developing projects. This approach contributes to the development of student initiative and skills in working with information.

In *Canada*, separate independent projects are common as a form of homework. In Canadian schools, each student must complete an independent project that is individual, not group. As part of this project, they collect information, write an abstract, and prepare a presentation for presentation in front of the class. One of the special features is the presence of a consultant in Canadian schools who can help students solve educational problems, including project activities, but does not perform tasks for them. In the city of Mississauga, located in Ontario, Canada, homework assignments are not provided in schools. However, students complete projects at home that may take considerable time to complete. In primary schools in Canada, the SCIENCE course is being taught, which combines knowledge in Chemistry, Physics, and Biology. Students are actively involved in working on their own projects, which allows them to feel like real scientists. In Canadian schools, project tasks are actively used to study the main issue of social sciences – identity. These tasks can be diverse – from creative to research. For example, elementary and junior high school students have the opportunity to express their thoughts and explore themselves. This not only promotes active learning, but also develops self-expression skills.

In *Poland*, there is an American School in Warsaw, which actively uses projects, and this is quite an individual work of schoolchildren. Students have a significant choice of areas for their projects, which include art, 3D modelling, programming, pottery, etc. Each student has the opportunity to work on their project throughout the year, which encourages them to plan their work, calculate the time and effort to achieve results. At the end of this period, each child defends their project in front of a large audience, including friends, teachers, and parents. It is important that this is independent work, where each student works on their own project, and teachers act as consultants if necessary. This approach allows students to explore more deeply what interests them and prepares them for the next stages of education and social life. They get the opportunity to learn how to manage their activities and plan for a long period of time in advance (Koval, 2023). Students of the University of National Education Comision in Krakow, majoring in “Preschool and primary pedagogy”, study the discipline “Educational projects”. This allows them to get acquainted with the essence of projects, their features and methods of use in the educational process of primary school and pre-school education of children (Kupchak, 2021).

In *Czech Republic*, primary school covers the education of students up to the 9th grade. But it is divided into

a 1st-degree school (children aged 6-10 years) and a 2nd-degree school (children aged 11-15 years). In Czech schools, homework assignments are offered in limited quantities, and the curriculum is deployed at a moderate pace, especially at the primary level. This encourages children to be more interested in learning and reduces their workload. Teachers do not move on to the next topic until all students have mastered the material at least at an intermediate level. Various methods are used in the process of teaching the material, such as educational games, group tasks and intersubject classes, which contribute to a holistic perception of information. Special attention is paid to project-based training, which provides good results. The elementary school also offers numerous guided tours, outdoor lessons, and “outdoor activities” with access to the green area (Zabiaka, 2023).

In Canada, Poland, and the Czech Republic, the use of project activities in the educational process is widespread and contributes to the development of independence, creativity and deep assimilation of the material by students. In Canada, each student is involved in independent projects that include individual work and presentation preparation. Social science project assignments help develop students' identity and self-expression skills. In Poland, at the American School in Warsaw, students work on their own projects in various areas, which contributes to their planning and organisation of time to achieve results. This helps them develop self-directed learning skills and prepares them for further education. In the Czech Republic, an elementary school organises student learning, focusing on project-based learning and various methods that promote a holistic perception of the material. Teaching methods are supplemented with excursions and outdoor activities, which enriches the learning process. All these approaches contribute not only to the assimilation of knowledge, but also to the development of students' personality, preparation for life in the modern world and further successful learning.

In *the Netherlands*, primary school covers the ages of 4-12. There are schools with different philosophies, for example, in Dalton Schools, students learn to make individual plans and schedules, work in groups on projects. The main goal of primary school education is to promote the development of students' emotional sphere, and to develop their intelligence and creativity. At the final stage – the development of adequate social, cultural, and physical skills. There are practically no homework assignments, but they offer extracurricular activities and group projects. Project-based technologies aimed at developing the creative abilities of primary school students are used. The project “Life of my family” provides an opportunity for students to explore their family roots, interview relatives, create a family tree, and tell the story of their family. This project develops students' creativity, research skills, and social consciousness.

Norwegian primary school covers the education of children from the 1st to 4th grade and from the 5th to 7th grade (senior primary school). Primary school students have the

opportunity to choose one discipline to choose from and participate in project work. The learning system is built in such a way that each person develops only through relationships with others. Project-based technologies are actively used to form students' creative abilities. For example, the ecological city project gives students the opportunity to develop an environmentally sustainable city using the principles of sustainable development and environmental protection. This project contributes to the development of creativity, environmental awareness and social activity of students. The main task of the Norwegian school is to develop students' independence and responsibility. Even if there is homework, the teacher is unlikely to check its completion, but it is mandatory to understand the content of the topic. Children can learn the material in a way that is most effective for them. The teacher can recommend additional literature, specialised websites, exercises, or projects that will help the child understand the topic and successfully assimilate its content. Project-based technologies also help stimulate students' creative and critical thinking. They require students to generate new ideas, find non-standard solutions, and analyse different approaches to solving a problem. Students learn to explore and analyse information, go beyond the usual patterns, and see the problem from different perspectives.

In *Sweden*, primary school students are trained without any special loads. One homework assignment per week per one subject. Students only work at the blackboard during project presentations that children perform in groups of several people. In this way, children are taught to cooperate. Schools have extremely high logistical support. There is a cabinet system for various subjects, a workshop for performing practical projects, which has everything: special clothing and shoes, machines, tools, and materials (Acquisition with education..., 2018).

In *Spain*, primary school covers the 1st-6th grades. In primary school, students receive homework assignments in each subject, but in a small amount. After each trimester and for the final year of study, students are given report cards. Often, the school uses project-based technologies to develop students' creativity and language skills. For example, the “My little book” project gives students the opportunity to write and illustrate their own book using creativity, imagination, and language skills. This project contributes to the development of creative abilities, speech competence, and self-expression of students.

In *Germany*, primary school lasts 4-6 years and often ends with the differentiation of graduate students by ability. In addition to traditional subjects such as language, mathematics, and art, German primary school students occasionally perform projects instead of their usual lessons. For example, they learn to play musical instruments or make videos for a whole week. The German model of a specialised school has a relatively strict approach, but it actively uses the project method to acquire the necessary skills and practical experience that are useful for future careers. In Germany, project-based technologies are used to encourage

creativity and implement integrated learning. The experimental garden project provides an opportunity for students to explore the plant world, conduct experiments, and develop their own organic gardening projects. This project contributes to the development of creative thinking, scientific skills, and environmental awareness of students. The walls in German schools display students' work and projects.

The main objective of the educational policy in *Japan* is the education of creative, creatively thinking, harmonious, and spiritually developed individuals who can act in various social and state structures and contribute to their consolidation. Primary school education lasts for 6 years. In Japan, group project-based technologies are mainly used to develop students' creativity and technological skills. The class is divided into groups that are assigned various "projects-tasks". In the classroom system, the class is often divided into 6-7 mobile groups, depending on the academic performance of students (Sukhoveenko, 2019). For example, the project "Robotics in primary school" gives students the opportunity to design and programme robots, contributing to the development of creativity, problem thinking and technological literacy.

In the Netherlands, Norway, Sweden, Germany, Spain, and Japan, the use of project activities in primary schools is a popular approach to learning aimed at developing creativity, critical thinking, and other key skills of students. In the Netherlands, Dalton Schools provide students with the opportunity to work in groups on projects, which contributes to the development of the emotional sphere and creative abilities. Projects such as "Life of my family" help students explore their family roots and develop social awareness. In Norway, projects such as "Ecological city" are aimed at developing students' creativity and environmental awareness, and building independence and responsibility. In Sweden, Germany, and Spain, the use of project-based technologies is also aimed at developing students' creativity and independence. For example, the project "My little book" in Spain gives students the opportunity to create books independently, while developing their speech skills and creativity. In Japan, where the main goal of learning is to develop creativity and creative thinking, the use of group projects helps students collaborate and develop different skills. All these approaches reflect a focus on the individual development of each student, and supporting their creative potential in the educational process.

The historical and theoretical aspect of the development of project methodology in education, represented by the works of outstanding teachers, such as D. Dewey (2003), as one of the founders of pragmatic philosophy in education, believed that learning should be focused on the student's experience, the idea of active and holistic assimilation of knowledge. His papers emphasise the importance of the relationship between education and real life, where project-based teaching methods allow students to apply theory in practice, while developing critical thinking and independence. W. Kilpatrick (1918) developed the idea of the project method and proposed the first classification

of projects according to their purpose. He identified four types of projects: constructive, aesthetic, research, and social, each of which is responsible for the development of relevant skills in students. M. Woodward (1887) was one of the first to introduce the idea of using project-based learning technology not only in higher education, but also in secondary education. He emphasised the importance of real-world experience and practical work for students to better understand theoretical knowledge. C. Richards (1900) proposed the use of project lessons in primary schools, which supported the idea of project-based learning as an effective way to activate children's participation and encourage creative approach to learning. D. Snedden (1923) introduced the concept of a "home project plan" for teaching children in rural areas, which included practical tasks and projects focused on the real needs of the community, and the Ecole Decroly "Lermitage" school in Belgium, testifies to the long and multifaceted history of using projects in the educational process. Research conducted by D. Fried-Booth (2002) and M. Knoll (1991), refines and expands the understanding of project methodology, demonstrating its evolution and adaptation to modern educational needs. They analyse in detail how project methods can be used to increase students' motivation, develop critical thinking skills, and creativity.

In comparison with historical methods, modern research adds new approaches and practical guidelines for implementing projects in modern educational systems. These studies confirm the effectiveness of the project methodology in developing key skills of students, such as independence, critical thinking and creativity, and emphasise its relevance in the modern educational environment. The results of research on historical and modern approaches to the project methodology indicate its importance in modern education and the constant need for further improvement and implementation. Summarising the analysis of educational systems in Finland, Wales, Great Britain, USA, Canada, Poland, Czech Republic, Netherlands, Norway, Sweden, Germany, Spain, and Japan, it is clear that the use of project-based technologies in primary education is becoming the dominant trend. This approach actively promotes the development of students' key skills, such as self-reliance, critical thinking, and creativity. Each country adapts these methods to its own educational system and cultural needs, ensuring the individual development of each student. Project-based technologies become not only a means of mastering knowledge, but also a preparation for life in the modern world, where independence, creativity and the ability to work in a team are required. This approach allows each student to realise their potential and prepares them for successful further training and development in various spheres of life.

The highlighted examples demonstrate the variety of project-based technologies used by foreign countries to develop the creative abilities of primary school students. It is indisputable that these technologies contribute to the development of creativity, critical thinking, communication

skills, and social consciousness of students. Project-based teaching methods, which are actively implemented in primary schools in different parts of the world, play a key role in shaping not only students' academic knowledge, but also in developing their life competencies. From the UK to Japan, through Finland, Canada and other countries, pedagogical approaches based on project work are aimed at activating the creative potential of children, fostering independence, critical thinking, and the ability to self-organise. The central element is the involvement of students in practical activities through the use of Integrated technologies, role-playing games, individual and group projects that encourage them to independently search for information, analyse and present results. This interactive approach not only promotes deeper assimilation of educational material, but also educates students with the skills necessary for successful adaptation in a rapidly changing world, preparing them for further educational challenges and life situations.

CONCLUSIONS

As a result of the analysis of literature and research on the formation of creative abilities of Primary School students with the help of project-based technologies in foreign countries, it can be concluded that project-based technologies are widely used in the educational process of the analysed countries for the formation of creative abilities of primary school students. These technologies are based on an active approach to learning, when students are active participants in solving real problems and tasks. Foreign experience shows that the use of project-based technologies contributes to the development of creative thinking, independence, critical thinking, communication and collective skills of students. These technologies encourage students to actively participate in the learning process and help motivate them to work independently. Project-based technologies contribute to the integration of various subjects and disciplines, develop students' creativity, analytical and communication skills. They stimulate the development

of student initiative and contribute to the development of creative thinking. Successful implementation of project-based technologies in foreign countries requires the training and support of teachers who have appropriate methodological knowledge and skills.

During the implementation of projects, teachers act as organisers and managers of project activities. According to the results of the study, it can be concluded that project-based technologies in the primary contribute not only to the development of creativity, but also to other important aspects, such as speech competence, scientific skills, environmental awareness, problem thinking, and technological literacy. Each country has its own unique approach to the use of project-based technologies, but the overall goal is to form a harmoniously developed personality capable of creative thinking and activity in the modern world. This approach in primary education helps to prepare children for the complex challenges of modern society and develop their potential. The Ukrainian pedagogical community can use the ideas of foreign experience in implementing project-based technologies to develop the creative abilities of primary school students. It is important to be familiar with best practices, adapt them to the conditions of Ukrainian education, and ensure proper training of teachers for the successful implementation of these technologies.

Prospects for further research include the investigation of the long-term effects of using project-based technologies, the quality and sustainability of acquired creative skills, and the impact of socio-cultural factors on the effectiveness of using project-based technologies in developing the creative abilities of primary schoolchildren, considering role of modern technologies, including artificial intelligence.

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CONFLICT OF INTEREST

None.

REFERENCES

- [1] Acquaintance with education systems of Finland, Sweden, Denmark. (2018). Retrieved from <https://www.dano.dp.ua/diyalnist/mizhnarodni-vidnosyny/1654>.
- [2] Baburets, M. (2019). *From objects to projects. The boldest education reform in Finland*. Retrieved from <https://life.pravda.com.ua/society/2017/01/9/221945/>.
- [3] Bondar, V. (2020). Project activity in the extra-class work of the primary school. *Bulletin of the Cherkasy National University Named After Bohdan Khmelnytskyi. Series: "Pedagogical Sciences"*, 4. doi: 10.31651/2524-2660-2019-4-76-82.
- [4] Bondareva, K., & Ivleva, O. (2021). Features of using project technologies in lessons I explore the world in the conditions of the new Ukrainian school. In *Modernization of science and its influence on global processes* (pp. 52-53). Bern: Swiss Confederation. doi: 10.36074/scientia-05.11.2021.
- [5] Chub, K. (2022). Features of use of design technology of learning in primary school. *Perspectives and Innovations of Science*, 13(18), 509-515. doi: 10.52058/2786-4952-2022-13(18)-509-515.
- [6] Dewey, D. (2003). *Experience and education*. Retrieved from <https://www.schoolofeducators.com/wp-content/uploads/2011/12/EXPERIENCE-EDUCATION-JOHN-DEWEY.pdf>.
- [7] Didyk, Y., & Liba, O. (2022). *Formation of creative abilities of younger schoolchildren in the concept of the new Ukrainian school*. Mukachevo: Mukachevo State University.

- [8] Dubrovska, L., Dubrovskiy, V., & Butenko, S. (2022). Modern pedagogical tasks and methods of developing the creative abilities of younger schoolchildren (and the cycle). *Research Notes. Series "Psychology and Pedagogy Research"*, 2, 61-68. doi: 10.31654/2663-4902-2022-PP-2-61-68.
- [9] Fried-Booth, D. (2002). *Project work* (2 ed.). Oxford: Oxford University Press.
- [10] Golovina, O. (2019). *How to teach through projects. Examples from Finnish lessons*. Retrieved from <https://nus.org.ua/articles/yak-mozhna-navchaty-cherez-proekty-pryklady-z-finskyh-urokiv/>.
- [11] Hrynyova, M. (2017). *Educational transformer: Finland as an inspiration*. Retrieved from <http://education-ua.org/ru/porivnyalna-pedagogika/1104-osvitnij-transformer-finlyandiya-yak-natkhennya>.
- [12] Kapelyushna, T. (2019). Peculiarities of using the project method in technological training of US students. *Collection of Scientific Papers of Uman State Pedagogical University*, 2. doi: 10.31499/2307-4906.2.2010.188060.
- [13] Kilpatrick, W. (1918). *The project method: The use of the purposeful act in the education process*. *Teachers College Record*, 19, 319-335.
- [14] Knoll, M. (2011). *Learning through practical problem reading: The project method in the United States, 1860-1915*. *Journal of International Education and Social Science*, 8, 103-127.
- [15] Koval, O. (2023). *Bicycle park, outdoor classes and protection of individual projects: How the American School in Warsaw teaches*. Retrieved from <https://osvitoria.media/experience/velopark-zanyattya-prosto-neba-ta-zahyst-indyvidualnyh-proyektiv-yak-navchaye-amerykanska-shkola-u-varshavi/>.
- [16] Kupchak, S. (2021). Foreign experience of training future primary school teachers for the use of project technology. *Ukrainian Professional Education*, 9-10, 144-150. doi: 10.33989/2519-8254.2021.9-10.263655.
- [17] Lavrenko, S. (2021). *The specifics of using the project method in primary school*. In *New and traditional in the research of modern representatives of psychological and pedagogical sciences: Collection of theses of sciences works of the participants of the international science and practice conference* (pp. 63-67). Lviv: Public Organisation "Lviv Pedagogical Community".
- [18] Madzhigon, V. (2004). *Productive pedagogy*. Kyiv: September.
- [19] Melnikova, D. (2021). *Five secrets of the Finnish educational miracle*. Retrieved from <https://osvitoria.media/experience/5-sekretiv-finskogo-osvitnogo-dyva/>.
- [20] Mykhaylenko, O., & Butko, T. (2023). Project method in domestic and foreign pedagogical theory and practice. *Pedagogical Sciences: Realities and Prospects*, 92(1), 79-83. doi: 10.31392/NPU-nc.series5.2023.92.1.16.
- [21] Prima, D. (2020). Project-research activity of the primary school teacher in the context of the requirements of the school. *Proceedings. Series: Pedagogical Sciences*, 189, 152-155. doi: 10.36550/2415-7988-2020-1-189-152-155.
- [22] Richards, C. (1900). The function of hand work in the school. *Teachers College Record*, 1(5), 1-28. doi: 10.1177/016146810000100.
- [23] Rudakova, T. (2005). A didactic game is an effective means of activating students' creative activity. *Elementary School*, 16, 7-13.
- [24] Semankiv, M., Karpenko, N., & Bilusiak, B. (2019). *Design technologies in the educational process*. In *Information technologies in technical and special purpose systems* (pp. 106-109). Ivano-Frankivsk: Vasyl Stefanyk Precarpathian National University.
- [25] Senko, Yu. (2019). *Peculiarities of the development of creative abilities of younger schoolchildren*. In *Primary education: History, problems, prospects. Materials of the II all-Ukrainian scientific and practical Internet conference* (pp. 208-210). Nizhyn: Nizhyn Mykola Gogol State University.
- [26] Shvets, T. (2017). School education in Finland: Secrets of success. *Head Teacher*, 10, 4-8.
- [27] Snedden, D. (1923). Sociology, a basic science to education. *Teachers College Record*, 24(2), 1-10. doi: 10.1177/016146812302400204.
- [28] Sukhoveenko, K. (2019). *School education: Experience of foreign teachers*. Retrieved from <https://naurok.com.ua/post/shkilna-osvita-dosvid-zakordonnih-pedagogiv>.
- [29] The experience of a teacher from Ternopil who works in Wales: No pursuit of the material, but mainly project work. (2023). Retrieved from <https://osvitanova.com.ua/posts/6055-dosvid-vchytelky-z-ternopolia-iaka-pratsiuie-v-uelsi-bez-honytyv-za-materialom-a-v-osnovi-proiektna-robota>.
- [30] Tovkanets, H., & Hapak, Y. (2019). *Design technologies in the development of creative abilities of primary school students*. In *Modern trends in the development of science and education in the context of deepening European integration processes. Collection of abstracts based on the materials of the III all-Ukrainian scientific and practical conference* (pp. 311-312). Mukachevo: Mukachevo State University.
- [31] Woodward, C. (1887). *The manual training school, comprising a full statement of its aims, methods, and results*. Boston: Heath.
- [32] Zabiaka, I. (2023). *Czech schools: "Slow" program and career guidance from the age of 10*. Retrieved from <https://osvitoria.media/experience/cheski-shkoly-povilna-programa-ta-proforiyentatsiya-z-10-rokiv/>.

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<https://orcid.org/0000-0002-1265-6723>**Формування творчих здібностей учнів початкової школи
засобами проектних технологій у зарубіжних країнах**

Анотація. В умовах глобальної конкуренції, вміння нестандартно мислити та ефективно працювати в колективі, набуті через застосування проектних технологій, відіграють ключову роль у підготовці молодого покоління до майбутніх професійних викликів. Методики, які сприяють активному розвитку цих якостей, такі як проектне навчання, зарекомендували себе у міжнародному контексті як ефективний спосіб розкриття творчого потенціалу учнів. Метою статті стало вивчення особливостей використання проектних технологій для формування творчих здібностей учнів початкової школи в зарубіжних країнах. У статті використовувалися загальні методи наукового дослідження, такі як емпіричні (спостереження, порівняння) та комплексні (аналіз і синтез). Представлено різні підходи до трактування проектного навчання, умов його ефективності і переваги для розвитку творчих здібностей дітей. Проаналізовано дослідження, які демонструють успішне використання проектних технологій у зарубіжних країнах, а саме: Фінляндії, Великої Британії, США, Канаді, Польщі, Чехії, Нідерландах, Норвегії, Швеції, Іспанії, Німеччини, Японії, а також методи, що сприяють формуванню творчого та критичного мислення в учнів початкової школи. З'ясовано, що творчість є ключовою компетенцією майбутнього успіху учнів. Використання проектних технологій у початковій школі сприяє виявленню індивідуальності та розвитку особистих якостей. Застосування проектних технологій у початковій школі у зарубіжних країнах є ефективним засобом формування творчих здібностей учнів, навчального середовища, яке сприяє самореалізації учнів, розвитку їхнього творчого потенціалу та підготовці до вимог сучасного світу. Практичне значення статті полягає в тому, щоб надати вчителям, методистам та іншим педагогічним працівникам українських початкових шкіл інформацію та інсайти з використання проектних технологій для формування творчих здібностей учнів, засновані на зарубіжному досвіді

Ключові слова: творчі здібності молодших школярів; метод проєктів; проектна діяльність; зарубіжний досвід; освітній процес у початковій школі

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English language teachers' experiences with the first transition to online education during COVID-19

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Abstract. Teaching English as a foreign language is important in the 21st century. However, as a result of the sudden outbreak of the COVID-19 pandemic and the consequential quarantine measures in March 2020, the education process had to be reorganised from the traditional face-to-face method to the online space within a few days. English teachers had to face previously not experienced problems all over the world. The purpose of this study was to shed light on the main obstacles that emerged during the first transition to digital education in the spring of 2020. With the help of semi-structured interviews, sixteen English language teachers were asked from various Transcarpathian secondary and higher education institutions about their experiences with online education and the useful practices which helped them overcome the most serious problems. Based on the results, the personal contact between teachers and learners was important in the development of speaking skills in a foreign language. Although online education was rather convenient and advantageous in terms of developing listening, reading, or writing skills, distance education was not as effective as the traditional face-to-face context. Several problems emerged in connection with the demotivation of students, the overload of both teachers and learners, the lack of the Internet connection or digital equipment, and the unpreparedness of teachers and educational institutions. The practical significance of this study is that it gives possible solutions to these issues and hindrances, thus teaching English in the online space could be more effective

Keywords: online learning; coronavirus disease; teaching English as a foreign language; Transcarpathia; digital education; face-to-face education

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INTRODUCTION

The use of technology has always played an important role in teaching English. In the last century, audio and video recordings were played to language learners with the help of televisions and cassette recorders, but due to technological progress in the first two decades of the 20th century, teachers and students have much more modern tools at their disposal (smartphones, MP3 players, tablet computers). The needs of 21st century students have changed, as they are born into the age of digital technologies and the Internet, and this fact cannot be neglected by teachers when planning the educational process.

Due to mobile-assisted language learning, students can learn foreign languages anywhere and anytime on their

smartphones, laptops, or any other wireless devices. However, many teachers prefer the conservative ways of language teaching because they are afraid of changes (Váradi & Hladonik, 2023). Nevertheless, technology offers a great deal of advantages both for learners and teachers. Just one example is the teaching of pronunciation: by using a speaker and a laptop or a smartphone, teachers have many opportunities to use audio-visual teaching aids in their lessons, thus supporting the language acquisition process of their learners (Altun, 2015). Language education supported by technology has become a decisive role in the recent period, because in the spring of 2020 quarantine measures were introduced in the whole world as a result of the



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coronavirus pandemic (COVID-19), and the use of technology in language education became inevitable (Al-Ataby, 2020). The necessity of suspending in-person education led to the widespread adoption of synchronous and asynchronous online teaching (Moorhouse & Kohnke, 2021). Teachers had to get accustomed to virtual learning environments that were unfamiliar to most of them. In addition, both teachers and learners had to cope with the social and psychological effects of the pandemic on their daily lives (MacIntyre *et al.*, 2020).

As a result of the coronavirus pandemic, video conferencing technologies have become the most important tools in the teaching process at all levels of the education system. In order to conduct online lessons, it has become necessary to use programmes such as Zoom or Skype, through which the lessons can be conducted via the Internet in the presence of the teacher, but it is also important to have social interaction between students (Maher, 2020). A shift of responsibility came with the obligatory transition to distance education. Teachers had to encourage students to produce original work alone, so learners were responsible for their own learning and teachers were functioning only as facilitators of knowledge acquisition (Beatty, 2021). In order to get a better understanding of the main problems of the process of the first transition to online teaching during the global outbreak of the COVID-19 pandemic, interviews were conducted with English language teachers. The purpose of this research was to assess the attitudes and opinions of teachers in connection with teaching English as a foreign language (EFL) through online education in Transcarpathian secondary schools and higher education institutions.

The research was carried out according to the following hypotheses. 1. Development of students' language skills was more difficult to achieve in the framework of online education, as the process of learning a foreign language requires personal contact between the teacher and the learner, and the presence and guidance of the teacher. 2. Language teachers have acquired many new technology-related skills and have adapted to the world of the Internet to a greater extent in the past period, thus the possible retransition to digital education will take place much more smoothly in the future.

The originality of the research results lies in the examination of the first transition to digital education because an insight can be gained into the beginning of online English language education in Transcarpathia, thereby learning more about the factors that made this transition from in-person to online teaching difficult, so that the possible solutions can be discovered.

MATERIALS AND METHODS

The research was designed in a qualitative setting because detailed information had to be collected from a relatively limited number of subjects. The data collection method used in the study followed the form of semi-structured oral interviews. The interview questions covered the next topics: applications and devices used by English teachers; difficulties in transitioning to online education; advantages and disadvantages of digital education; the possibilities of improving language skills in the online space; learners' attitudes towards learning English in distance education; the importance of personal contact; newly developed skills and professional knowledge in the field of technology-enhanced language teaching.

The stratified sampling procedure was used to determine the participants of the research. The selected teachers had different levels of teaching experience and taught English in various districts of Transcarpathia, in different types of secondary and higher education institutions. After data recording, the answers were transcribed, and with the help of content analysis, the obtained information was discussed topically. Interviews were conducted with a total of sixteen English language teachers. Some of the conversations took place in person, while other interviews were conducted through online video meetings, due to the health condition and easier availability of the respondents. After obtaining prior permission, the interviews were recorded and later transcribed in written form. The interviews consisted of twenty-one questions. After recording the answers, thirty-nine pages of data (around 10,750 words) were collected as the basis of the research. Writing down the answers verbatim allowed accurately quoting the words of the interviewed teachers when presenting the results. The provisions of the Declaration of Helsinki (2013) were followed during data processing.

The primary factor considered in choosing participants was their involvement in teaching English through digital distance education amid the global quarantine implemented in March 2020. Some teachers possessed only one or two years of experience as novice language educators, while others had several decades of teaching experience. Nine of the participants were employed at either a grammar school or a lyceum. From an administrative standpoint, the language instructors taught in different districts of Transcarpathia, including Berehove, Mukachevo, Vynohradiv, and Velyka Byihan. In the context of higher education, interviews were carried out with seven English language educators affiliated with a college operating in the Berehove district. The details about the respondents are shown in Table 1.

Table 1. The most important characteristics of the interviewees

Code	Gender	Teaching experience (years)	Place of work (district)	Type of school	Form of interview
SE1	Female	20	Berehove	Lyceum	Online
SE2	Female	16.5	Berehove	Lyceum	Personal
SE3	Female	19	Vynohradiv	Lyceum	Online

Table 1. Continued

Code	Gender	Teaching experience (years)	Place of work (district)	Type of school	Form of interview
SE4	Female	2	Berehove	Grammar school	Online
SE5	Male	2	Mukachevo	Lyceum	Online
SE6	Female	2.5	Mukachevo	Lyceum	Personal
SE7	Male	1	Berehove	Lyceum	Personal
SE8	Male	1.5	Berehove	Lyceum	Online
SE9	Female	1.5	Velyka Byihan	Grammar school	Personal
HE1	Male	6	Berehove	College	Personal
HE2	Female	24	Berehove	College	Online
HE3	Male	15	Berehove	College	Online
HE4	Male	18	Berehove	College	Personal
HE5	Female	25	Berehove	College	Online
HE6	Male	22	Berehove	College	Personal
HE7	Female	20	Berehove	College	Personal

Source: compiled by the author

To safeguard the anonymity of the individuals involved in the study, neither their names nor their educational institutions were incorporated. Instead, codes were employed to identify them uniquely. Specifically, the code SE1 signifies that the individual is the first participant from secondary education establishments, whereas the code HE1 identifies the first interviewee from the realm of higher education.

RESULTS

The information derived from interviews with sixteen educators of English as a foreign language will be showcased here, categorised according to various topics. The focus of these themes or topics is to depict the landscape of online education in Transcarpathia and elucidate the dynamics of foreign language instruction during the quarantine period. Nevertheless, due to the limited size of the research sample, it is impractical to extrapolate overarching conclusions from the gathered findings.

1) Digital devices and online applications used in teaching EFL

In secondary education institutions, the availability of digital devices for teachers was limited. Consequently, language educators frequently relied on their personal laptops or smartphones during English lessons. This was particularly necessary due to the curriculum's inclusion of activities such as listening to English songs and audio materials featuring native speakers' speech, utilised in lower grades. Some lyceums had adequately equipped information technology (IT) classrooms with interactive whiteboards and overhead projectors. These resources enabled teachers to present instructional material more efficiently, facilitating the incorporation of educational videos. Higher education institutions showcased a notable distinction as instructors had widespread access to technology in almost every college classroom. Online education brought about advantages, such as the increased frequency of educators presenting videos related to lesson topics. An English language teacher (SE1) remarked: "During distance

education, I incorporated audio and video recordings several times a week. Almost every lesson included a short video for the students".

Digital applications like Google Classroom, Viber, Gmail, Zoom, and Messenger were commonly employed for communication with learners. However, the situation for first-grade pupils posed challenges, as their young age required the involvement of parents in online classes, demanding considerable organisational efforts from teachers. In the online learning environment of higher education, language instructors utilised platforms like Zoom and Google Meet for video lectures, complemented by supporting materials uploaded to Google Classroom. PowerPoint presentations were frequently employed to illustrate theoretical course content, and testing took place on various platforms, with Redmenta emerging as the most successful choice. "When the quarantine began, catching us off-guard, we initially used familiar apps, reaching out to students via Messenger and Facebook. Compiling the first test with Redmenta took a full day, because I previously compiled my test sheets only as simple Word documents" (HE3).

2) Problems that complicated the first transition (with proposed solutions)

During the spring of 2020, students initially did not focus on learning online as they saw the global quarantine as a period of relaxation. In the beginning, teachers found themselves unprepared for the methodologies and applications required for online curriculum delivery, having previously only engaged in traditional face-to-face teaching. The lack of preparation added complexity to the situation, unfolding abruptly. "Unpreparedness made the situation difficult; everything happened suddenly. One day we were teaching in the classroom, but the next day everything was online. Methodologically, the programmes to be used had not yet been planned, so we had to experiment with everything" (SE5). The significant challenges arising from the swift transition to digital distance education, along with potential solutions, are detailed in Table 2.

Table 2. Issues of the first transition to digital teaching (solutions included)

Problems	Potential solutions
Unpreparedness	Exploring innovative approaches and gaining practical experience. Adhering to a schedule organised by the institution, utilising Google Classroom, and employing video conferencing software.
Lack of IT knowledge	Conducting preparatory sessions for both teachers and students. Integrating the methodology of digital language instruction into the curricula of teacher training courses.
Internet and power outages	Students access virtual classes from their classmates' homes. Distributing course materials in written format for those unable to attend.
Lack of digital devices	Establishing a good relationship with parents, scheduling time of using digital devices within the family in case of multiple siblings.
Negative attitude of learners	Fostering motivation for learning English, issuing reminders for deadlines, presenting engaging assignments, and maintaining consistent communication with both parents and learners.
The difficulty of objective assessment	Implementing online forms and specialised programmes for assessment and testing, customised tasks, soliciting handwritten solutions, and establishing clear time frames for completing test sheets.

Source: compiled by the author

“Online education had a rough start. It began on March 12, but the organisation of Classroom assignments was only achieved by the end of April. Despite my efforts to communicate, numerous students were unaware of my messages and the existence of our institutional Facebook group. Also, the process of correcting and personally responding to each student’s submission proved to be highly time-consuming” (SE3). “Conducting lessons via video call with young children posed its own set of difficulties. While parents assisted in initiating the calls, maintaining the attention of the children for the entire 40-minute duration of a lesson proved challenging. Consequently, lessons often had to be limited to around 20 minutes due to the children’s limited attention spans” (SE9). “The abrupt shift to online education caught teachers unprepared. In contrast, the autumn quarantine of 2020 presented a different scenario, as both students and teachers were more experienced. In addition, teacher training has undergone modifications, with the inclusion of online language teaching in the methodological training for prospective educators” (HE5).

3) *Advantages and disadvantages of digital education compared to face-to-face teaching*

As per the feedback from the participants, online teaching offered the following benefits:

- more vibrant and engaging tasks, along with interactive materials;
- opportunity for shy students to experience more success;
- development of autonomous learning skills;
- it was convenient to teach and learn from home, so the chance of getting sick with covid-19 was lower;
- expansion of it skills;
- students with illness or travel problems could also join online lessons;
- learners could easily find materials in the virtual classroom.

According to language instructors’ perspectives, the drawbacks of online education comprised:

- challenges of objective assessment and testing due to numerous opportunities for cheating on tests;

- insufficiency of personal interaction essential for the acquisition of language skills;
- younger pupils needed the teacher’s presence and guidance;
- difficulties in establishing contact with parents and lower-grade pupils;
- learners displaying inactivity and a lack of engagement;
- certain students faced challenges with a poor internet connection;
- not all learners were able to participate in online lessons due to the limited availability of digital devices;
- correcting and evaluating a large number of written assignments was time-consuming;
- occasional overload of learners;
- each student had to be given a personalised task.

“During the examination period, I could not check whether someone was helping to the given student or not. Sometimes I requested them to raise their hands or look away from the screen. During those instances, they were unable to correctly answer my questions. However, as soon as they redirected their focus to the monitor, they promptly knew the answers. Students possess a variety of smart devices. Yet, when testing occurs at a considerable distance, such as 50 or 100 kilometres from the instructor, there is no means of verifying the test-takers’ identities or monitoring whether questions are being discussed collaboratively in a group” (HE7).

4) *The efficiency of distance education in language learning*

As per insights from interviewed language instructors, digital education facilitates the development of all language skills, but educators must be mindful of the limitations inherent in the online environment. While receptive language skills like reading and listening comprehension can be relatively easily developed, the situation becomes more nuanced when it comes to productive skills. The primary challenge with writing skills lies in creating personalised tasks for each student to prevent copying solutions from one another. In connection with vocabulary acquisition,

challenges arise in learning the correct pronunciation of words since teachers cannot provide immediate support when learners read English texts at home. This becomes especially problematic in interpreting ambiguous words. One interviewee shared a personal approach to learning new words, emphasising the importance of providing pronunciation in familiar letters rather than using phonetic symbols, which may be difficult for children to comprehend. "When learning new words, I wrote down the English word and next to it in brackets the pronunciation with Hungarian and Ukrainian letters. Based on the official education policy, phonetic symbols have to be used, but I think that small children would not have been able to understand those signs anyway" (SE9). Speaking skills development in online education is rather challenging.

While speaking in English during online classes is possible, it is time-consuming, and actively engaging all participants in the conversation poses difficulties. Moreover, the situation is compounded by a significant number of learners either not attending online lessons or not turning on their cameras. Researchers explored the hurdles of developing speaking skills in online teaching, with suggestions such as N. Cowie's (2021) recommendation of using Flipgrid – an application enabling learners to create and share short videos with peers. "Face-to-face education was better because everyone was in the classroom, and it was much easier to divide the students into groups and have them speak in pairs" (SE6). Suggested methods of developing language skills with the help of online education are listed in Table 3.

Table 3. Development of language skills with distance learning

Language skills	Benefits	Drawbacks
Reading	Online reading comprehension tasks; interesting online tests; interactivity.	Absence of teacher clarification; challenges in articulating and understanding unfamiliar terms.
Listening comprehension	Uploading audio materials; watching videos and movie clips in English.	No drawbacks.
Speaking	Possibility of communicating with students in the framework of online video conferences.	The audio quality in a video call did not reflect the characteristics of live speech; reduced attendance at online classes; it was problematic to use pair or group work, and to get students to speak; lack of nonverbal cues.
Writing	Quick check of suspected plagiarism, no problems with reading students' handwriting.	Mutual sharing of documents and task solutions; written assignments sourced from the Internet.
Vocabulary development	Vocabulary could be expanded by watching films and videos in English.	It was difficult to correct students' pronunciation when learning new words; fewer opportunities to check learners' knowledge of the newly learnt words.

Source: compiled by the author

Based on the responses from teachers, the feasibility of learning English in an online setting with limited personal interaction largely hinged on individual students. While some learners managed to independently acquire language skills using dedicated language learning applications, their effectiveness as language users had limitations if they did not apply the newly acquired words through practical exercises. To ensure a lasting enhancement of learners' language proficiency, engaging in pair work, group tasks, offering explanations, fostering classroom communication, and establishing personal contact between teachers and learners were deemed necessary. However, these elements could only be effectively implemented within the context of face-to-face education.

5) Students' attitude towards distance education

Educators involved in the study endeavoured to inspire students to engage with language learning through a variety of diverse and captivating tasks. Alongside the customary writing and listening exercises, they incorporated more interactive educational tools, such as videos from YouTube, interactive exercises, online presentations, and quiz platforms. "Learners were encouraged to seek assistance beyond regular school hours by sending messages. The unique challenge of communicating solely in English

provided a sense of accomplishment when students were able to effectively engage with the teacher" (SE1). In many instances, disinterest, inactivity, and demotivation were prevalent among learners, with only a few teachers reporting positive experiences. The ease of completing assignments from home, coupled with increased cheating opportunities, led to a lack of diligence in online education. Some learners were either absent from lessons or, if present, chose not to turn on their webcams, hindering instructors from monitoring their participation.

"Initially, I established a private Facebook group for each college group, and our communication was maintained through Messenger. However, certain students believed that remaining absent for extended periods would not have consequences. Despite sending assignment notifications via messages, their lack of interest in completing tasks resulted in a few learners withdrawing from the college. The situation has significantly improved since everyone has been assigned a personalised institutional email address. This allows for seamless inclusion in Google Classrooms, eliminating excuses for non-participation" (HE1). A significant burden on learners was the high volume of written assignments. The extended period of staying home, coupled with limited social interactions, adversely affected

some students. Consequently, many welcomed the return to in-person education in September 2020. The home environment often proved distracting, making it challenging to conduct comprehensive lessons, particularly for younger pupils in grades 1-4. Teacher presence and guidance were deemed essential, even for older college students with a greater degree of autonomous learning skills, reinforcing the importance of teaching English in traditional classroom settings. "After we continued teaching through the traditional in-person instruction, there was a significant transformation in the students' behaviour; the presence of the instructor markedly increased their motivation. This factor holds considerable influence in shaping the dynamics of the teaching process" (HE6).

6) How has the shift to remote learning evolved since the spring of 2020?

Through exposure to online education, instructors acquired familiarity with various new programmes and online tools. They gained proficiency in utilising Google Classroom, conducting effective online classes through platforms like Zoom and Google Meet, and experimented with diverse types of tasks. This increased expertise in educational technology has diminished teachers' fear of incorporating digital devices in the classroom. According to their perspectives, the integration of educational software is anticipated to streamline their work in the future. "I have experienced when, how and what to teach and expect from students" (SE4). Online communication channels through which teachers could establish contact with both students and parents had been developed. Language educators addressed the most urgent challenges in foreign language instruction during remote learning, employing innovative approaches such as new methods of preparing tests, personalised assignments, and various synchronous and asynchronous language teaching tasks. As stated by the participants, the IT and pedagogical knowledge gained during the quarantine period would significantly facilitate a potential future transition to distance education.

"Since September 2020, the adoption of Google Classroom has become mandatory for us, irrespective of whether the instruction is conducted online or in the classroom. All students are enrolled using their institutional email addresses, and the procedures for submitting assignments and conducting tests on Redmenta have been preserved as well" (HE3). The information obtained from sixteen teachers of English as a foreign language provides insight into the use of digital technologies in the teaching and learning process in Transcarpathia. It was found that many secondary schools have limited access to digital devices for teachers and they often use their own laptops and smartphones.

Lyceums have more technical facilities, such as interactive whiteboards and projectors. In particular, the use of Google Classroom in higher education institutions has been made mandatory since September 2020, which has become a standard regardless of the form of education – online or in the classroom. Online communication channels for teachers, students and parents have also been developed, which facilitates the solution of organisational problems and maintains communication in the educational process. To summarise, the implementation of online education has given teachers a variety of skills and exposure to different digital tools. Proficiency in platforms such as Google Classroom, Zoom, and Google Meet allows teachers to effectively deliver online lessons and experiment with different types of assignments. Increased expertise in educational technology has reduced teachers' fear of using digital devices in the classroom. According to the participants, the IT and pedagogical knowledge gained during the quarantine will greatly facilitate a possible transition to distance education in the future.

DISCUSSION

Digital distance learning is a form of education in which students are not physically present in the classroom, but only interact with instructors through electronic communication channels. In the past, online education was seen as a practical solution for adult learners who wanted to study in higher education (Lockee, 2021). As a result of the COVID-19 epidemic, face-to-face education was discontinued in almost all educational institutions in the world, being replaced by virtual classrooms and the online educational environment (Daniel, 2020). The most fundamental learning environment is face-to-face or in-person education, the essence of which is that the only source of information for students is available through interaction with the teacher (Ollé, 2016). The importance of the traditional classroom environment was also emphasised in the study because it has many benefits in language teaching compared to online education. The most beneficial educational method in the post-pandemic era would be a mixture of traditional and online modes of education, i.e., blended learning. The new online learning experience was not teacher-centred anymore because education became more interactive and student-centred during the COVID-era. Therefore, by the use of digital technology and different online activities, the educational process can be more effective in the future (Li, 2022). Also, teachers gathered enough experience to make a possible transition to online education much smoother in the future. The advantages and disadvantages of online video lessons are summarised in Table 4.

Table 4. Advantages and disadvantages of online classes

Online video lessons	
Benefits	Drawbacks
Enhanced cooperation between educators and students	Students' attention is more divided in the online space
Facilitating communication between learners	Entertainment options (social networking websites)

Table 4. Continued

Online video lessons	
Benefits	Drawbacks
Sick students can also take part in classes	Absence of nonverbal cues
Guest presenters have the option to participate in the sessions as well	Lack of experience with online education
The recordings of lessons allow for easy repetition, as well as making the course material available for absent students	The instructor's focus is split during the online class, as multiple tasks need to be managed simultaneously through the monitor

Source: compiled by the author based on D. Levy (2020)

The conventional educational scene is the school classroom, where the teacher's task is to promote the learners' effective acquisition of knowledge. The most important benefits of face-to-face education include the possibility of social interaction between the learners and the teachers, as a result of which students are more active in the lessons (Nikolopoulou, 2022). During the first transition to digital education, problems emerged in connection with the demotivation and disengagement of students. Social interaction was considered as an important aspect of the development of children's speaking skills. In addition, the quarantine period and the constant isolation had a negative effect on their performance and attitude in relation to learning from home. When online education was introduced, the entire educational process had to be reorganised into the digital space within a few days. The parents had an even greater responsibility than before, as they had to ensure that their children studying at home could properly participate in online lessons. This was especially true in the case of families with several children or with pupils studying in elementary school, as it was emphasised by Á. Engler (2020). Pupils from lower grades could only connect to online video lessons with the help of their parents, and teachers faced many difficulties when trying to contact them.

The rapid transition to online education meant that instructors had to rapidly develop new skills in connection with online course design. This transition was difficult not only for the educators, but also for the learners and their parents (Tanasijević & Janković, 2021). Students had to get accustomed to the relatively new virtual environment. They had to learn how to manage their own time successfully, thus it was more difficult to discipline themselves during online lessons and to prepare every assignment on time. These difficulties were also mentioned by S. Sumardi & D. Nugrahani (2021). The perceived benefits of online lessons included the improvement of learners' digital learning skills, the ability of being connected even during the difficult times of social distancing, the development of autonomous learning skills, and the improvement of teachers' IT skills. The challenges of online lessons were the following: issues of rapid adaptation to the new situation, time-management problems, the distraction of social media, the lack of personal contact, the problem of objective evaluation, demotivation, and technological obstacles. Both teachers and educational institutions were caught off-guard when they had to rearrange in-person education into the online space within an extremely short period of time.

Immediately after the outbreak of the COVID-19 pandemic, in-person education was replaced by digital distance learning, but teachers were free to choose from a variety of online education platforms. Online test making programmes, video calling software and virtual classrooms, such as Google Classroom, have become increasingly more common (Námesztovszki *et al.*, 2020). In Transcarpathia, teachers tried to rely firstly on familiar applications. They connected students through Messenger, and formed Facebook groups to upload the materials. However, it was not effective because many students did not know about the existence of such groups or they tried to act like they did not receive the teachers' messages. To solve this problem, the use of Google Classroom remained in many educational institutions, and an institutional system of email addresses were introduced to both teachers and students, through which the addition of learners to virtual classrooms became easier.

C. Hodges *et al.* (2020) used the term emergency remote teaching (ERT) to refer to the situation that was caused by COVID-19 in early 2020. ERT is defined as an alternative method of teaching that becomes necessary in a crisis situation. After the emergency situation has ceased to exist, education can be continued in its original form. However, some researchers also emphasised the need for online education even in the post-COVID-19 era (Camilleri, 2021). Most studies dealing with ERT are mainly concerned with tertiary education and focus on the effects of the pandemic on English-speaking countries (Akbaná *et al.*, 2021). For this reason, it was interesting to investigate how such an emergency situation was handled in Transcarpathia, Ukraine. Taking into consideration the Ukrainian context, I. Huszti *et al.* (2022) conducted a case study with 34 higher education teachers in Ukraine with the aim of investigating the success of distance education during the first two quarantine periods in 2020. The researchers found that most educators perceived the rapid transition to online learning as a negative experience, but they believed that their students had a more positive perception. The reason for this is that young learners were born in the digital age, while the use of technology has caused more problems for older teachers. Furthermore, there was little or no interaction between students during synchronous online classes, and it was really important to provide both written and oral feedback for them.

The global outbreak of the COVID-19 pandemic caught many tertiary education institutions off-guard. Previously, Ukrainian universities had to switch to online education

due to the spread of the flu epidemic in 2009, and due to low temperatures in 2015 and 2016. However, the rapid and obligatory transition in the spring of 2020 was much more challenging, and it is still present at some territories in the country as a result of the Russian occupation. There are no universal approaches or centralised platforms for online education, so universities, departments, and tutors have a freedom of choice in the methods and programmes used during distance education (Shevchenko *et al.*, 2021). In a different study, A. Melnychenko & T. Zheliaskova (2021) also found that Ukrainian university students perceived distance learning positively. They would like to keep online education in the country even after the pandemic was over. However, online education is a relatively new phenomenon in Ukraine. Due to the current political turmoil, the lack of a formalised system of distance education, and a lack of emphasis on lifelong learning all pose a serious threat on the efficiency of post-COVID-19 education in the country (Shcherbachenko & Sluisarenko, 2023). In summary, it can be stated that learners viewed the quarantine period as an opportunity to relax and they did not take online education seriously because they had wide access to various online resources when completing tests and assignments. Teachers had to make efforts to successfully motivate their students to learn English. It was especially hard to teach the correct pronunciation of words and to develop the speaking skills of learners, but educators managed to find the perfect ways to conduct online lessons effectively and to give personalised assignments to EFL learners. As a result, later transitions to distance teaching were much less problematic, and both teachers and students became more accustomed to online education.

CONCLUSIONS

The present study dealt with the examination of the possibilities and difficulties of English language teaching in digital distance education in Transcarpathia, based on the experiences and attitudes of sixteen foreign language teachers. The results proved that the lack of prior experience and the novelty of digital education made it very difficult to re-organise education in the online space during the first wave of the COVID-19 pandemic in Transcarpathia. Although, in the opinion of the respondents, online education had its advantages, personal contact and communication between the teacher and learners were essential for the practical acquisition of a foreign language, therefore, the impersonality of the digital space did not allow the development of speaking skills and the implementation of language teaching from a communicative perspective.

Among the advantages of online education were mainly convenience aspects, as it became possible to teach and learn from home, and students who were sick or lived far away from the educational institution could also participate in online lessons. In addition, teachers had the opportunity to use videos and interactive tasks related to the curriculum to motivate students, but digital education required a high degree of independence and autonomous learning skills from learners, which made the process of language learning difficult for many of them. In the past four years, teachers have gained a lot of experience in the management of technologies and the use of programmes that implement online education, so in their opinion they already have the right foundations to ensure an effective and smooth transition to digital education. In addition, educational institutions are also much more prepared, as it may become necessary to suspend face-to-face education at any time depending on the current political situation in Ukraine. Several teachers noted that the online uploading of course materials and the use of Google Classroom will remain unchanged, so the introduction of distance education at all levels of the education system can now be implemented almost without hindrance. As a result of the study, a short insight was gained into teacher attitudes regarding English language teaching in distance education, thereby ensuring a more comprehensive understanding of this modern segment of education. Furthermore, based on the opinions of foreign language teachers, the study shed light on the extent to which the English language could be acquired with limited personal contact between teachers and students. The results of the research will provide useful advice to foreign language teachers, which will facilitate the development of language skills and the management of the educational process in the online space. In connection with prospects for further research, those factors should be examined that contribute to learner engagement and motivation in online EFL courses. This could involve the investigation of the role of instructor presence, peer interaction, gamification, and personalised learning experiences in fostering motivation and participation among EFL learners.

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CONFLICT OF INTEREST

None.

REFERENCES

- [1] Akbana, Y.E., Rathert, S., & Ağçam, R. (2021). Emergency remote education in foreign and second language teaching. *Turkish Journal of Education*, 10(2), 97-124. doi: 10.19128/turje.865344.
- [2] Al-Ataby, A. (2020). Technology-enhanced learning and teaching in COVID-19 era: Challenges and recommendations. *International Journal for Innovation, Education and Research*, 8(10), 317-331. doi: 10.31686/ijer.vol8.iss10.2684.
- [3] Altun, M. (2015). *The integration of technology into foreign language teaching*. *International Journal on New Trends in Education and Their Implications*, 6(1), 22-27.
- [4] Beatty, K. (2021). *A year of online learning: What's working, what's not*. Retrieved from <https://www.youtube.com/watch?v=Ahekulx9HDo>.

- [5] Camilleri, M.A. (2021). Shifting from traditional and blended learning approaches to a fully virtual and remote course delivery: Implications from COVID-19. *Academia Letters*, article number 481. [doi: 10.20935/AL481](https://doi.org/10.20935/AL481).
- [6] Cowie, N. (2021). The development of an ecology of resources for online English as a foreign language (EFL) teachers in a Japanese university during the COVID-19 pandemic. *IJERI: International Journal of Educational Research and Innovation*, 15, 419-430. [doi: 10.46661/ijeri.5356](https://doi.org/10.46661/ijeri.5356).
- [7] Daniel, J. (2020). Education and the COVID-19 pandemic. *Prospects*, 49, 91-96. [doi: 10.1007/s11125-020-09464-3](https://doi.org/10.1007/s11125-020-09464-3).
- [8] Declaration of Helsinki. (2013). Retrieved from <https://www.wma.net/policies-post/wma-declaration-of-helsinki-ethical-principles-for-medical-research-involving-human-subjects/>.
- [9] Engler, Á. (2020). [Distance education from the viewpoint of families](#). *Civil Review*, 2020(1), 117-132.
- [10] Hodges, C., Moore, S., Lockee, B., Trust, T., & Bond, A. (2020). *The difference between emergency remote teaching and online learning*. Retrieved from <https://er.educause.edu/articles/2020/3/the-difference-between-emergency-remote-teaching-and-online-learning>.
- [11] Huszti, I., Csatóry, G., & Lechner, I. (2022). Distance learning as the new reality in tertiary education: A case study. *Advanced Education*, 9(21), 100-120. [doi: 10.20535/2410-8286.261705](https://doi.org/10.20535/2410-8286.261705).
- [12] Levy, D. (2020). *Teaching effectively with Zoom: A practical guide to engage your students and help them learn*. Chicago: LSC Communications.
- [13] Li, D. (2022). The shift to online classes during the COVID-19 pandemic: Benefits, challenges, and required improvements from the students' perspectives. *The Electronic Journal of e-Learning*, 20(1), 1-18. [doi: 10.34190/ejel.20.1.2106](https://doi.org/10.34190/ejel.20.1.2106).
- [14] Lockee, B.B. (2021). Online education in the post-COVID era. *Nature Electronics*, 4(1), 5-6. [doi: 10.31686/ijer.vol8.iss10.2684](https://doi.org/10.31686/ijer.vol8.iss10.2684).
- [15] MacIntyre, P.D., Gregersen, T., & Mercer, S. (2020). Language teachers' coping strategies during the COVID-19 conversion to online teaching: Correlations with stress, wellbeing and negative emotions. *System*, 94, article number 102352. [doi: 10.1016/j.system.2020.102352](https://doi.org/10.1016/j.system.2020.102352).
- [16] Maher, D. (2020). [Video conferencing to support online teaching and learning](#). In *Teaching, technology, and teacher education during the COVID-19 pandemic: Stories from the field* (pp. 91-96). Waynesville: Association for the Advancement of Computing in Education.
- [17] Melnychenko, A., & Zheliaskova, T. (2021). Transformation of educational process in COVID-19 pandemic: A case of Igor Sikorsky Kyiv Polytechnic Institute. *Advanced Education*, 8(18), 4-10. [doi: 10.20535/2410-8286.237575](https://doi.org/10.20535/2410-8286.237575).
- [18] Moorhouse, B.L., & Kohnke, L. (2021). Responses of the English-language-teaching community to the COVID-19 pandemic. *RELC Journal*, 52(3), 359-378. [doi: 10.1177/00336882211053052](https://doi.org/10.1177/00336882211053052).
- [19] Námesztovszki, Z., Molnár, G., Kovács, C., Major, L., & Kulcsár, S. (2020). [Trends, opportunities and limitations of online education appearing in the information society](#). *Civil Review*, 2020(1), 37-58.
- [20] Nikolopoulou, K. (2022). Face-to-face, online and hybrid education: University students' opinions and preferences. *Journal of Digital Educational Technology*, 2(2), article number ep2206. [doi: 10.31686/ijer.vol8.iss10.2684](https://doi.org/10.31686/ijer.vol8.iss10.2684).
- [21] Ollé, J. (2016). [Educational theory, educational planning, educational organization](#). In *Educational design, digital content development* (pp. 6-11). Eger: Líceum Kiadó.
- [22] Shcherbachenko, V., & Sluisarenko, A.D. (2023). Prospects and challenges of online education development in Ukraine. *Socio-Economic Relations in the Digital Society*, 48(2), 82-92. [doi: 10.55643/ser.2.48.2023.496](https://doi.org/10.55643/ser.2.48.2023.496).
- [23] Shevchenko, V., Malysh, N., & Tkachuk-Miroshnychenko, O. (2021). Distance learning in Ukraine in COVID-19 emergency. *Open Learning: The Journal of Open, Distance and e-Learning*, 39(1), 4-19. [doi: 10.1080/02680513.2021.1967115](https://doi.org/10.1080/02680513.2021.1967115).
- [24] Sumardi, S., & Nugrahani, D. (2021). Adaptation to emergency remote teaching: Pedagogical strategy for pre-service language teachers amid COVID-19 pandemic. *Turkish Online Journal of Distance Education*, 22(2), 81-93. [doi: 10.17718/tojde.906553](https://doi.org/10.17718/tojde.906553).
- [25] Tanasijević, M.J., & Janković, N.Z. (2021). The new virtual reality – teachers' and students' perceptions and experience in English language learning and teaching online. *Innovations in the Setting*, 34(4), 167-186. [doi: 10.5937/inovacije2104167T](https://doi.org/10.5937/inovacije2104167T).
- [26] Váradi, K., & Hladonik, G. (2023). The use of mobile phones in teaching English as a foreign language. *Contemporary Studies in Foreign Philology*, 24(2), 270-282. [doi: 10.32782/2617-3921.2023.24.270-282](https://doi.org/10.32782/2617-3921.2023.24.270-282).

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<https://orcid.org/0000-0001-7554-4158>**Досвід вчителів англійської мови
з першим переходом на онлайн-навчання під час COVID-19**

Анотація. Викладання англійської мови як іноземної є надзвичайно актуальним у 21 столітті. Проте внаслідок раптового спалаху пандемії COVID-19 і відповідних карантинних заходів у березні 2020 року навчальний процес довелося за кілька днів перевести з традиційного очного методу на онлайн-простір. Вчителям англійської мови довелося зіткнутися з проблемами, які раніше не виникали в усьому світі. На Закарпатті вчителі раніше не мали досвіду онлайн-навчання, що ще більше ускладнювало ситуацію. Метою цього дослідження було пролити світло на основні перешкоди, які виникли під час першого переходу на цифрову освіту навесні 2020 року. За допомогою напівструктурованих інтерв'ю шістнадцять вчителів англійської мови з різних середніх та вищих навчальних закладів Закарпаття опитали про їхній досвід онлайн-освіти та хороші практики, які допомогли їм подолати найсерйозніші проблеми. Виходячи з отриманих результатів, особистий контакт між викладачем і учнями є особливо важливим для розвитку навичок мовлення іноземною мовою. Хоча онлайн-навчання є досить зручним і вигідним з точки зору розвитку навичок аудіювання, читання чи письма, дистанційне навчання не настільки ефективне, як традиційне очне навчання. Викладачі мають можливість використовувати відео та інтерактивні завдання, пов'язані з навчальною програмою, щоб мотивувати учнів, але цифрова освіта вимагає від учнів високого ступеня незалежності та автономних навичок навчання, що ускладнює процес вивчення мови для багатьох із них. Виникло декілька проблем у зв'язку з демотивацією студентів, перевантаженням як викладачів, так і учнів, відсутністю підключення до Інтернету чи цифрового обладнання, непідготовленістю викладачів та навчальних закладів. Практична цінність цього дослідження полягає в тому, що воно дає можливі рішення цих проблем і перешкод, тому викладання англійської мови в онлайн-просторі може бути більш ефективним

Ключові слова: онлайн-навчання; коронавірусна хвороба; викладання англійської мови як іноземної; Закарпаття; цифрова освіта; очна освіта

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Specifics of innovative educational environment and its influence on the development of future teachers' innovative competence

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Abstract. The relevance of the study is determined by the change in views on the process of developing innovative competence of future teachers and the need to improve the innovative educational environment. Accordingly, the purpose of the study was to reveal the specific features and properties of the innovative educational environment and its impact on the process of developing innovative competence in future teachers. To implement the goal, a set of general scientific methods was used: theoretical methods – system analysis, synthesis, generalisation, and comparison; empirical methods – observational (direct and indirect observation, methods of expert assessment and self-assessment); ranking, which helped to find out the specifics of the innovative educational environment in the process of developing innovative competence of future teachers. The content of the concepts “innovation environment”, “innovation space”, “development of innovative competence”, “innovative educational environment” was analysed. It was emphasised that through participation in the work of project groups, educators and future teachers gain valuable experience in innovative and creative collective activities and have the opportunity to develop leadership qualities and innovative competence. It was established that the innovative educational environment in the context of professional training of future teachers functions as a system that creates conditions for personal development as an innovator, promotes the disclosure of creative abilities, and the improvement of innovative and professional skills, emphasising the unity and interaction of its elements. The results of the study also indicate that the professional development of future teachers is significantly influenced by the innovative learning environment, which is simultaneously developed due to the innovation activity of students. The practical significance of this study is that the results obtained can be used in future studies on the impact of information and communication technologies on the subject-subject interaction between participants in the educational process

Keywords: group work; collective innovation activity; communication between students and teachers; subjects of the educational process

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INTRODUCTION

Training of the teacher's personality and the process of modernisation of higher education in Ukraine require new approaches and define high requirements for the development of professional and innovative competence. As a result of the full-scale invasion of the Russian Federation, a new type of teachers in the educational environment is required – innovative professionals who can make non-standard and innovative decisions, constantly work on their self-improvement and education, and be able to support and creatively develop students. Thus, the specifics of the innovative educational environment and its impact on the process of developing innovative competence are an important component of professional training of future teachers, which is relevant and requires detailed scientific consideration.

The needs of modern educational practice give rise to the need for innovative training of the teacher, who not only acts as an intermediary between the student and society, but also contributes to the development of the younger generation's readiness to use information and communication technologies (ICTs) in life and professional activities in an open innovation and educational space. The problem of the development of innovative competence of teachers and the introduction of innovative education in the pedagogical process was considered by Ukrainian researchers N. Ventseva & O. Karapetrova (2022) and A. Ruban (2022), who pointed out the uniqueness of its content, which predicted the subject's ability to innovate perception: understanding their own innovations, common or innovative technologies, and the ability to recognise new elements in a sustainable context and the ability to offer completely new innovative solutions to solve pedagogical situations.

A team of researchers consisting of I. Barantsova *et al.* (2022) revealed the essence of the concepts of "competency" and "competence" as concepts of professional training of future specialists, which overlap in semantic terms, but "competency" refers exclusively to the properties and powers of an individual, while "competence" covers the powers of both collective and individual subjects and characterises the activity itself. Pedagogical skills, professional and innovative culture, methodological and information literacy as a foundation for the development of innovative competence in teachers and the image of a scientific and pedagogical worker were revealed as an image that reflects their positive personal and professional qualities and contributes to the choice of an individual style of professional activity and the possession of innovative technologies of self-determination and self-presentation was highlighted by A. Yermolenko *et al.* (2023).

T. Piatnychuk (2019) revealed the process of creating an innovative educational environment based on the following approaches: humanistic, systematic, informational and innovative. I. Zrybnieva (2021) investigated the essence and content of the innovation environment through the prism of social, activity, and environmental approaches. It is this approach that helps to clearly define goals, choose

effective methods for turning scientific ideas into practical active reality, and constantly monitor and manage innovations and innovative technologies at all stages of implementation. That is why these researchers described groups of approaches that allowed considering the essence and content of the innovative educational environment, the specifics of the innovative educational process and innovative competence, and analysed favourable conditions for the development of innovative potential of the future teacher to significantly improve the quality of higher education. The specifics of the innovative educational process through its infrastructure, potential, culture, and monitoring of innovation activity were revealed by V. Vitiuk (2022), while L. Shtefan (2019) analysed the essence of the concepts of "competitiveness of higher education institutions" and "innovation environment" through the prism of a systematic approach, examined in detail and clarified external and internal factors that affect the competitiveness of the innovation environment in an educational institution. In particular, O. Kovalova (2020) outlined the way of development of innovative competence of future specialists in creating an innovative environment as one of the key elements of pedagogical conditions and space, which contributes to the development of innovative potential of the individual and integrates the means of accumulation and implementation of innovations in an educational institution.

The analysed scientific sources indicate that the main components of the process of developing innovative competence include an understanding of the innovation process, which covers the essence of innovations, their role in the development of society and higher education, and awareness of the need for innovative changes to achieve success. The process of developing innovative competence requires an analysis of the impact of the innovative educational environment and participants in the educational process and contributes to the creation of conditions for effective innovation activities. Therefore, the purpose of this study was to consider the features of the innovative educational environment and its impact on the development of innovative competence in future teachers. In accordance with the purpose of the study, the main tasks were formulated. 1. To analyse the problem of innovative educational environment in managing the development of innovative competence of teachers in pedagogical theory and practice. 2. To clarify the essence of the following concepts: "innovation environment", "innovation space", "development of innovative competence", "innovative educational environment". 3. To characterise the content of the influence of the innovative educational environment on the process of developing innovative competence of teachers.

MATERIALS AND METHODS

In the course of the study, various methods and approaches were used in the educational process of Melitopol Bohdan Khmelnytskyi State Pedagogical University. In particular, the literature review and analysis of existing research was

used at the initial stages and included an analysis of existing research and publications on innovative approaches in higher education and their impact on the development of the innovative competence of future teachers. Research and analysis contributed to determining the specifics of the existing classification of educational environments, investigating their structure, components, and features, which contributed to the enrichment of knowledge about innovative aspects in education. Based on the collected data and analysis, a number of methodological recommendations for teachers were developed aimed at improving the level of innovative competence of students.

Methods of synthesis, generalisation, and ranking were used for in-depth analysis of the collected data and highlighting key findings. The synthesis helped to combine various theoretical approaches and empirical data on innovative educational environments, identifying common characteristics and trends that influence the development of innovative competence. The use of generalisation allowed identifying the main principles and mechanisms that contribute to the development of innovative competence among future teachers, based on the analysis of specific examples and research. The ranking, in turn, helped establish a hierarchy of importance for various aspects of the innovative educational environment and their impact on innovation competence. Observations and interviews of future teachers allowed students to get feedback and opinions on their experience in the perception and use of innovative approaches and innovative technologies in the educational process or professional activities, which allowed investigating pedagogical situations in an innovative educational environment and interaction between students and teachers. This, in turn, facilitated a thorough analysis of communication between participants in the educational process. Focus groups (project group participants) involved a group of students to discuss specific aspects of the impact and development of an innovative educational environment and identify innovative ideas and effective proposals for the development of innovative competence of future teachers. Peer review – involvement of experts from the field of education to assess the level of innovative competence of future teachers – has helped to identify key aspects of the effectiveness of the impact of the innovative educational environment. Comparative analysis provided for the comparison of different educational environments and programmes to identify differences in approaches to innovative learning and their impact on the development of future teachers' innovative competence. Experiments and pedagogical innovations: introduction of innovative methods and approaches in the educational process for experimental study of the influence of the innovative educational environment on the development of innovative competence of future pedagogical specialists.

Round tables were also organised with teachers to discuss their experience in implementing innovative teaching practices and the possibilities of applying them to improve the quality of education. This provided a deeper

understanding of the potential of an innovative educational environment in the context of professional training of future teachers. For greater objectivity of the results of the study, the academic performance of students who participated in innovative programmes was analysed, comparing their achievements with the control group that studied under the conventional programme. This helped to assess the real impact of innovative learning on the development of important skills and competencies. During the study, all the norms and provisions of the Declaration of Helsinki (2013) were observed. The use of these methods enabled a detailed study of the specifics of the innovative educational environment and its impact on the development of innovative competence in future teachers at Melitopol Bohdan Khmelnytskyi State Pedagogical University.

RESULTS AND DISCUSSION

The process of influence of the innovative educational environment and the use of ICT for the effective development of innovative competence of future teachers involves: 1) creation of an innovative educational environment in a higher education institution – student clubs, scientific societies, scientific conferences, competitions, projects, all-Ukrainian competitions, etc.; 2) use of teaching forms, methods, and tools (role-playing and business games, problematic seminars, independent work, video lectures, video seminars, etc.); 3) use of information and communication technologies that contribute to the development of innovative competence as a necessary component of successful professional activity of future teachers. The basis for determining the effectiveness of the impact of the innovative educational environment on the development of innovative competence of future teachers are the project groups of the Faculty of Informatics, Mathematics and Economics of Bohdan Khmelnytskyi Melitopol State Pedagogical University: the scientific club “Informaticist” of the Department of Informatics and Cybernetics; the scientific club “Acme” of the Department of Pedagogy and Pedagogical Mastery.

The innovation of educational environment is necessary for the development of the future teacher's personality and innovative competence. Through participation in the work of project groups, educators and future teachers gain valuable experience in innovative and creative collective activities. They also have the opportunity to develop leadership skills and prospects to combine various aspects of their activities, including innovation, creativity, research, popularisation, and teaching. The project group form of work was the most effective for the development of innovative competence of future teachers, since applicants for higher education in extracurricular hours are ready to creatively solve problems in any discipline and contribute to the motivation of the student's professional activity. Mentoring systems were introduced, where experienced teachers or experts from a particular field provided support and advice to future teaching specialists in developing their innovative competence. It is worth noting that the project groups “Informaticist” and “Acme” were a creative team of applicants

for higher education, which contributed to the solution of a number of scientific issues related to the professional training of future teachers and the process of developing innovative competence. The objectives of the project groups were to encourage applicants for higher education to innovative, scientific activities and initiate independent work; to raise the practical value of scientific and creative works and innovative projects; to gain pedagogical experience in organising and participating in scientific discussions, conferences, seminars, round tables, webinars, etc.; to foster love for the native language and culture of the Ukrainian people; to carry out scientific, creative, and practical activities by involving subjects of the educational process in independent or creative collective work; to create conditions for revealing the innovative and creative potential of applicants for higher education; to participate in online-conferences, seminars, forums, competitions, and other events; to test the results of scientific research by applicants for higher education at international and all-Ukrainian competitions and conferences and the publication of findings; to establish relationships with other student scientific organisations, associations, and institutions at the international, national, and regional levels; active participation in the public life of the university.

Participants of scientific circles conducted research on the topics “innovative pedagogical technologies of training in a general secondary education institution”, and “Information and communication applications in teaching” the purpose of which was to analyse and study innovative pedagogical technologies used in educational institutions to identify their effectiveness and opportunities for improving the educational process; study and evaluate the use of information and communication tools in teaching the subject “Informatics”; identify their impact on the quality of material assimilation and activation of the educational process; highlight the possibilities of implementing the found research results in the practice of the educational process to improve its quality and effectiveness. Representatives of the project groups used various information and graphic tools to visualise statistical data, analysed and compared the study results. The obtained conclusions and information data were presented in the form of reports at scientific and practical conferences at various levels. Thus, according to the assessment of the performers of these student research papers, they gained important experience in organising scientific research on the relevance of using information and communication technologies and solving modern scientific problems. In the course of joint scientific and project activities, which were attended by students of the project groups “Informaticist” and “Acme”, it turned out that they are more interested in conducting innovative research and developing innovative competence. That is why the influence of the innovative educational environment and the outlined integration created favorable conditions for the formation of innovative competence of future teachers and the active development of subjects of the educational process. Information and communication technol-

ogies are a key element of modern models of innovation processes, as a means of ensuring external and internal relations of an educational institution as an innovation system in the process of developing innovative competence. These technologies will not only mean the consumption of information, but also represent an interactive process of subject-subject interaction, exchange of knowledge, creative ideas, and innovative experience. Such interaction promotes cooperation and serves as one of the tools for increasing the teacher’s motivation for innovation (Gotko & Chaikovska, 2015).

Thus, the use of ICTs reflects the teachers’ skills, whereas their individual methods, techniques, and forms of training and mentoring influence the personal development level of higher education applicants. Analysis of the use of information and communication technologies in the training of future teachers confirmed that such a process is complex, constantly changing and requires continuous consideration of the latest requirements for informatisation of the educational process and adaptation to the needs of modern society (Kozhevnikova *et al.*, 2023). The authors of this study suggest that the use of information and communication technologies by future teachers in professional and pedagogical activities in the course of performing innovative creative tasks corresponded to all the principles of higher education and provided an opportunity to test the influence of the innovative educational environment on improving the quality of education of higher education applicants and the process of developing innovative competence and positive motivation for innovation activities. To understand how the innovative educational environment affects the development of innovative competence of future teachers, it is necessary to characterise the essence and content of the concepts of “innovative competence” and “innovative educational environment”. Thus, O. Marynovska (2023) considered the concept of “innovative competence of a teacher” as an integrated personal and professional quality, dynamic in essence; a combination of knowledge, skills, values, views, ways of thinking, personal qualities developed based on their own subject experience, which determines their ability to successfully carry out activities by means of educational innovations. The researcher identified the following components of innovative competence of the teacher: cognitive, axiological, acmeological, thinking and activity, personal, andrological components, and determining the level of formed innovative competence of the teacher, it is necessary to clarify the specific type of innovation, since there may be a high level of knowledge of teaching technologies in the field of research, but the basic level in other areas of acme technologies.

L. Burchak (2023) identified specific features of innovative competence of teachers – five classes according to their characteristics: 1) generic features that indicate the presence of a certain class to which the concept under consideration belongs; 2) species differences to distinguish the concept from similar ones; 3) complex, which consists of generic features and species differences, and is a characteristic that

can be attributed to the concept; 4) own features that are common to all subjects of this class, but are not mandatory features that can be derived from others; 5) non-proprietary features that cannot be derived from essential features, but can still be specific to all items in this class. Notably, the key goal of the innovative competence of the future teacher was to combine various subject areas with innovative approaches aimed at changing the ideas of the subjects of the educational process about the digital transformation of modern society and this was done with the help of a competence approach. It is the innovative competence of a modern teacher that is aimed at integrating various subject areas with innovation, which leads to a change in the consciousness of students and their understanding of digitalisation processes in modern society. The use of information and communication technologies in education, their introduction into the structure and content of education is essential, because it provides for the restructuring of the educational process in an innovative creative way (Kyrylenko, 2023).

O. Yevdokimova & N. Alekseienco (2017) concluded that functional, personal, cultural, and virtual approaches are not the only correct group of approaches to defining the concept of innovation competence. Therefore, it is necessary to analyse this concept from different perspectives and methodologies, because modern society requires continuous updating and improvement of professional education, development of their readiness for innovative work as a key professional quality, which increases their competitiveness and efficiency in the field of professional activity. The process of development of innovative competence at all levels of education contributes to the development of the methodological base, the development of the innovative potential of all participants in the educational process, the coordination of joint efforts of scientists and teachers in response to the challenges of modern time – the continuity of the innovative educational process and the innovative educational environment was proved by I. Vakulova (2022). Disclosure of the specifics of the terms “educational environment” and “educational space” are often considered interchangeable in scientific sources, so it is important to carefully consider these concepts and reveal the basic principles of the development of an innovative educational environment in the context of innovative competence. In order to clarify the essence and interaction of the concepts of “innovative educational environment” and “innovative educational space”, it is necessary to define the essence and interdependence of the concepts of “environment” and “space”. The environment is a collection of people connected by the common living conditions, activities, interests, and the social and living conditions in which a person’s life takes place; its concept was revealed by O. Kovalova (2020); and space – the dimension, the place in which objects are located and events occur (Franchuk, 2009).

The concept of “environment” can be interpreted in two ways: first, as a set of natural conditions in which the vital activity of an organism takes place; second, as conditions in which a person’s life takes place; surroundings

(Tkachuk, 2015). In pedagogical science, the concept of “environment” is used in a broad and narrow context: as a general social reality, society, the state as a whole; or as an environment that directly affects a child’s development. The specificity of the term “environment”, as an external space that surrounds the object of research, has systemically organised components and creates conditions for its existence and interaction. The environment reflects the relationship of conditions that contribute to human development. In this context, the presence of a person in the environment is assumed, the interaction of the environment with the subject, while space can exist independently of the presence of a person. And space, in comparison with the environment, was considered by O.P. Tsyunyak (2019) as a higher-order construct in which various interactions can occur. V. Melnyk (2022) examined “the educational environment” in detail as the conditions, context, and methods that influence the effectiveness of teaching and upbringing, which plays a key role in improving the educational process, contributing to the development of a person with such important qualities as flexibility, integrity, diversity, adaptability, consistency, and emotional saturation. But the researcher notes that one of the important aspects associated with the innovative educational space is a complex phenomenon in pedagogy, since it is characterised by qualitative indicators that change within the educational system. It is important to note that educational innovations involve updating educational materials, methods, forms of teaching and upbringing, developing and implementing new systems, and spreading existing pedagogical approaches. A review of the literature indicates that there is no single system for classifying educational environments. Often, criteria related to educational levels are used to classify educational environments, such as: pre-school education environment; general secondary education environment; vocational education environment; and higher education environment. Pedagogical categories are also used, such as: learning environment, educational environment, and developmental environment.

The authors of this study agree with I. Konovalchuk (2014b), who describes the innovation environment as a complex of innovations that open up new ways to develop the innovative potential of an educational institution and the innovative abilities of teachers. This is manifested through a high level of innovative characteristics, forms, and methods, which contributes to significant changes in the activities of the educational institution and creates optimal conditions for the development of social and pedagogical initiatives of teachers, supports creativity, and expands opportunities for the implementation of new ideas. It is important to emphasise that the innovation environment is not just a set of individual elements, but a complex system of their interaction, where the environment itself develops, including professional and personal growth of teachers. The study of specific aspects of information and communication technologies and their impact on the training process of future teachers, especially in the context of changing the paradigm of

knowledge transfer and introducing innovative teaching methods, was carried out by I. Konovalchuk (2014a). To support the interaction and development of structural elements of the system aimed at increasing the innovation competence of teachers, non-standard models of the innovation process are used. This includes integration, creating innovative networks, sharing knowledge and experience, and accelerated learning. Such approaches provide conditions for establishing horizontal communication between innovative educational institutions and their employees.

The authors of this study also agree with N.P. Onishchenko (2021) that an innovative educational environment plays a key role in improving teacher training, becoming an important element in the professional training of future teachers. Researchers emphasise that for a significant improvement in the quality of education of future teachers, it is critically important to study in conditions that maximise the reproduction of the real socio-cultural environment. Such an innovative environment in educational institutions contributes to the personal and professional growth of teachers, motivating them to actively and creatively search for new ideas within the educational process. I. Konovalchuk (2014b) investigated the specifics of the innovative educational process and innovation competence as a system of technologies aimed at achieving sustainable and predictable results of innovations through a technological approach. The specifics of the innovative educational environment were also revealed by N. Tkachuk (2015) as a complex of interrelated conditions that ensure human education, the development of a teacher's personality with innovative and creative thinking, and their professional competence. Thus, O. Tsyunyak (2019), studying the mechanisms of development of the innovative educational space of the region, considered it in two planes: as an environment, a territory within which there are uniform agreed rules of innovation activity, and as an integral system, the result of which is the latest ideas and original technologies. Thus, analysing the concepts of "innovative educational space" and "innovative educational environment", researchers define them as similar in meaning, but not completely interchangeable.

L. Vashchenko (2012) noted that the main role of an innovative educational environment is to generate new ideas and increase the innovation potential within each educational institution and in the education system as a whole. The researcher considered the innovative educational environment as a set of pedagogical conditions that contribute to the development of personality and professional qualities, including a space where there are principles of innovative work, modern ideas and avant-garde pedagogical technologies used to improve the training of future primary school teachers, to enrich their professional abilities. N. Kalyuzhka (2016) described the process of developing innovative competence through a system of regularities, principles and formal, civilisational, personal and activity, sign and contextual, and intern scientific approaches. O. Tsyunyak (2019) identified the following criteria for assessing

the innovative educational environment in the context of professional development of future pedagogical specialists:

1) Conceptually and meaningfully, this area covers the following aspects: the presence of updated educational and methodological kits and programmes with an innovation focus; considering the opportunities provided by the domestic and international market of educational innovations; and scientific support of future prospects in the professional development of masters of primary education;

2) Activity, which includes such elements as the ability and desire of Masters to apply knowledge and skills in scientific, methodological, organisational, and managerial aspects to work effectively with innovative programmes, and the ability to demonstrate innovative experience using advanced pedagogical technologies and scientific and educational methods;

3) Information and communication component covers the availability of scientific and methodological literature, and specialised publications, continuous access to world educational networks, the availability of online training systems and the use of distance education methods, the creation of electronic educational materials;

4) Professionalism, which is manifested in the creation and use of innovative approaches in the educational process, including updating the content, forms, and methods of teaching, and in the ability to introspect and self-regulation during individual and group work on the search for innovations.

It is worth noting that a modern institution of higher education is a system that includes the presence of organic development of an innovative educational environment and all subjects of the educational process. And dynamic innovation activity of students is key in the process of developing innovative competence, as it helps to create conditions for creative thinking, skills of innovative cooperation and solving pedagogical situations, contributes to the preparation of future teachers for the challenges of the modern world in the labour market. That is why the process of acquiring innovative competence by future teachers includes the integration of components within the pedagogical system of an educational institution, which is characterised by unity, mutual ordering of elements, close connection with the innovative educational environment, and a clearly defined goal of its activities. Each aspect of the system includes specific components related to the problem under study, while the structure of the system ensures interaction between its parts to achieve the main goal – the development of innovative competence in future teachers.

Thus, the process of developing the innovative competence of future teachers in the innovative educational environment of higher educational institutions is complex and multifaceted, including the creation of unique educational spaces, such as project groups and student scientific societies, the introduction of information and communication technologies, the active use of innovative forms and methods of teaching. This process contributes not only to the acquisition of knowledge, skills, and abilities, but also

to the development of personal qualities of future teachers, such as creativity, initiative, the ability to self-education and innovation. In addition, the emphasis is placed on the importance of integrating theoretical knowledge and practical skills through research activities and participation in scientific projects, which leads to the development of professional competence and readiness to implement innovative educational projects in the future. As a result, the innovative educational environment acts as a basis for the development of innovative competence of future teachers, ensuring their readiness for effective professional activity in modern dynamic world.

CONCLUSIONS

The active participation of subjects in the educational process and the development of innovative competence play an important role in modern higher education and is carried out in an innovative educational environment. The process of training future teachers in innovative competence involves engaging students in more active and independent study of the material and developing innovative skills. That is why the authors attribute the following aspects to the active participation of future pedagogical specialists in these processes: collective creative innovation activity, participation in innovative projects and innovative practical tasks; development of critical thinking; use of information and communication technologies – online resources, video tutorials, webinars, and other tools for training, education, and innovative cooperation. The process of developing the innovative competence of future teachers is assigned to the group of key professional competencies of a modern pedagogical specialist, and innovative competence is considered as an integral characteristic that ensures the teacher's readiness for professional and innovative activities in an innovative educational environment and modern society.

In addition, with the help of innovative competence and professional information communication in a higher education institution, an educational innovative environment is created with the specified characteristics of relations and interactions: organisational and managerial, functional and business, interpersonal, information and educational, network; social and partner, humanitarian, etc. To solve this

problem, it is necessary to develop innovative competence and promote the evolution of the dynamics of cognitive and informational needs of subjects of the educational process; understand the structure and mechanisms of development of communicative abilities and innovative competence; characterise the content and structure of the process of developing innovative competence of future teachers. The developed innovative competence in the application of information and communication technology provides for its application in teaching, training, and everyday life; rational use of innovative means in solving pedagogical situations related to the subjects of the innovative educational environment; creation of pedagogical conditions for innovative competence of future computer science teachers is effectively carried out in the process of professional training using information and communication technology. That is why the innovative educational environment and all key components and subjects have an effective impact on the process of developing innovative and professional competence of future teachers; the process of research activities constantly affects the innovative educational environment. An important area of research can be the study of mechanisms for the effective integration of information and communication technologies into the learning process to improve the quality of education and the development of professional skills, and the study of the impact of collective creative activity and participation in innovative projects on the development of critical thinking of future teachers.

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CONFLICT OF INTEREST

None.

REFERENCES

- [1] Barantsova, I., Kotova, O., Vorovka, M., Protsenko, A., & Sukhanova, A. (2022). Competence as a concept in professional training of future specialists. *Sprin Journal of Arts, Humanities and Social Sciences*, 1(6), 294-299. [doi: 10.55559/sjahss.v1i06.31](https://doi.org/10.55559/sjahss.v1i06.31).
- [2] Burchak, L. (2023). Defining the phenomenon of innovative competence in pedagogical theory and practice. *Innovative Pedagogy*, 64(1), 126-129. [doi: 10.32782/2663-6085/2023/64.1.24](https://doi.org/10.32782/2663-6085/2023/64.1.24).
- [3] Declaration of Helsinki. (2013). Retrieved from <https://www.wma.net/what-we-do/medical-ethics/declaration-of-helsinki/>.
- [4] Franchuk, T.Y. (2009). *Holistic educational space: Pedagogical foundations of its formation*. Kamianets-Podilskyi: Kamianets-Podilskyi Ivan Ohienko National University.
- [5] Gotko, O., & Chaikovska, O. (2015). [Information and communication technologies – as a modern means of learning in education](#). *Youth and the Market*, 4(123), 130-134.

- [6] Kalyuzhka, N. (2016). [Laws and principles of innovation competence of future primary school teachers](#). *Pedagogical Sciences: Theory, History, Innovative Technologies*, 2(56), 270-277.
- [7] Konovalchuk, I.I. (2014a). [The innovative environment as a means of the teachers' innovative competence in secondary schools](#). *Bulletin of Zhytomyr State University. Pedagogical Sciences*, 4(76), 62-66.
- [8] Konovalchuk, I.I. (2014b). [Theogou and technology of implementing innovations in general educational institutions](#). Zhytomyr: Zhytomyr Ivan Franko State University.
- [9] Kovalova, O.S. (2020). The innovative environment as a pedagogical condition of forming the innovative competence of a future aviation specialists. *Young Scientist*, 3(79), 379-382. doi: [10.32839/2304-5809/2020-3-79-78](#).
- [10] Kozhevnikova, A.V., Bunchuk, O.V., & Kozhevnikov, P.P. (2023). [Innovative competence as a component of the professional training of future IT teachers](#). In *The 51st international scientific and practical conference "War – challenges in modern science"* (pp. 37-41). Berlin: Littera Verlag.
- [11] Kyrlylenko, S. (2023). Innovative competence is an important component pedagogical activity of the modern teacher. *Young Scientist*, 6(118), 42-46. doi: [10.32839/2304-5809/2023-6-118-9](#).
- [12] Marynovska, O. (2023). The concept of "innovation competence of a teacher". *Productive Horizons*, 56(1), 11-15. doi: [10.15330/obrii.56.1.11-15](#).
- [13] Melnyk, V. (2022). Creation of innovative educational space in pre-school education institutions: Constructive experience european countries. *Scientific Bulletin of the Izmail State Humanitarian University*, 60, 112-117. doi: [10.31909/26168812.2022-\(60\)-13](#).
- [14] Onishchenko, N.P. (2021). The influence of the educational environment of higher education on forming the readiness of future teachers for innovative educational activities. *Innovative Pedagogy*, 31(1), 133-138. doi: [10.32843/2663-6085/2021/31-1.28](#).
- [15] Piatnychuk, T. (2019). An innovative educational environment for forming professional competency in future skilled workers. *Professional Pedagogics*, 1(18), 131-136. doi: [10.32835/2223-5752.2019.18.131-136](#).
- [16] Ruban, A. (2022). Development of information-communication technologies in the format of informational conflicts. *Scientia et Societas*, 1(2), 78-84. doi: [10.31470/2786-6327/2022/2/78-84](#).
- [17] Shtefan, L. (2019). Innovative environment of a modern higher education institution as an object of competitiveness. *Problems of Engineering and Pedagogical Education*, 62, 15-23. doi: [10.32820/2074-8922-2019-62-15-23](#).
- [18] Tkachuk, N. (2015). [Innovative educational environment as condition of teachers' professional competence development](#). *Scientific Bulletin of Lesya Ukrainka East European National University. Pedagogical Sciences Series*, 1(302), 124-129.
- [19] Tsyunyak, O.P. (2019). *Educational environment and its role in the system of professional training of future masters of primary education for innovative activities*. Ivano-Frankivsk: Vasyl Stefanyk Precarpathian National University.
- [20] Vakulova, I. (2022). Innovations in education: Competency-based approach. *Cultural Almanac*, 3, 199-208. doi: [10.31392/cult.alm.2022.3.26](#).
- [21] Vashchenko, L.M. (2012). [An innovative model of the organization of the educational process in the institutes of postgraduate pedagogical education: A scientific and methodological manual](#). Kyiv: University of Educational Management National Academy of Educational Sciences of Ukraine.
- [22] Ventseva, N.O., & Karapetrova, O.V. (2022). Innovative competence as a component of the professional activity of a modern teacher. *Bulletin of Alfred Nobel University. Series: Pedagogy and Psychology*, 1, 109-115. doi: [10.32342/2522-4115-2022-1-23-13](#).
- [23] Vitiuk, V. (2022). [Innovative educational environment as a factor in teachers' professional development](#). *Pedagogical Search*, 3(115), 8-12.
- [24] Yermolenko, A.B., Kulishov, V.S., & Shevchuk, S.S. (2023). Development of innovative competence of modern teacher of vocational school. *The Image of a Modern Teacher*, 5(194), 52-57. doi: [10.33272/2522-9729-2020-5\(194\)-52-57](#).
- [25] Yevdokimova, O.O., & Aleksieienko, N.V. (2017). [Innovative competence as a professionally important feature of a modern specialist](#). *Law and Security*, 2(65), 146-152.
- [26] Zrybnieva, I. (2021). Innovation environment as a necessary institutional basis for ensuring the competitiveness of innovative entrepreneurs on the basis of evaluation results. *Scientific Bulletin of the Uzhhorod National University. Series: International Economic Relations and World Economy*, 35, 95-100. doi: [10.32782/2413-9971/2021-35-18](#).

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Специфіка інноваційного освітнього середовища та його вплив на формування інноваційної компетентності майбутніх вчителів

Анотація. Актуальність дослідження визначається зміною поглядів на процес формування інноваційної компетентності майбутніх вчителів й потребою у вдосконаленні інноваційного освітнього середовища. Відповідно, метою статті було розкриття особливих ознак та властивостей інноваційного освітнього середовища та його вплив на процес розвитку інноваційної компетентності у майбутніх вчителів. Для реалізації мети було використано комплекс загальнонаукових методів: теоретичні методи – системного аналізу, синтезу, узагальнення та зіставлення; емпіричні методи – обсерваційні (пряме та непряме спостереження, методи експертного оцінювання та самооцінювання); ранжування, що допомогло з'ясувати специфіку інноваційного освітнього середовища в процесі формування інноваційної компетентності майбутніх вчителів. Проаналізовано змістове наповнення понять «інноваційне середовище», «інноваційний простір», «формування інноваційної компетентності», «інноваційне освітнє середовище». Виділено, що завдяки участі в роботі гуртків, викладачі та майбутні вчителі здобувають цінний досвід інноваційної та творчої колективної діяльності й мають можливість розвивати лідерські якості та розвивати інноваційну компетентність. Встановлено, що інноваційне освітнє середовище у контексті професійної підготовки майбутніх вчителів функціонує як система, котра створює умови для особистісного розвитку в ролі інноватора, сприяє розкриттю творчих здібностей, а також поліпшенню інноваційних та професійних навичок, підкреслюючи єдність та взаємодію її елементів. Результати дослідження також вказують на те, що професійний розвиток майбутніх педагогів відбувається під значним впливом інноваційного навчального середовища, яке водночас формується за рахунок активної інноваційної діяльності студентів. Практичне значення цієї статті полягає у тому, що отримані результати можуть бути використані у майбутніх дослідженнях щодо впливу інформаційно-комунікаційних технологій на суб'єкт-суб'єктну взаємодію між учасниками освітнього процесу

Ключові слова: гурткова форма роботи; колективна інноваційна діяльність; спілкування між здобувачами та викладачами; суб'єкти освітнього процесу

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Development of mathematical competence as a key competence in English language teaching

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Abstract. The relevance of the study is conditioned to the need to explore new effective methods of implementing competence-oriented education while teaching English and forming key competences as a basis for learners' comprehensive development and successful integration into a fast-moving cross-cultural society. The purpose of the study was to substantiate the category "mathematical competence in English language teaching learning" and analyse the survey of English language teachers to determine its understanding among teachers of secondary educational institutions. General scientific and empirical methods, deduction, comprehensive analysis, and comparison facilitated achieving the set goals. Hence, this paper presents the research on implementing the competence-oriented strategy stated by the Law of Ukraine on Education in general and the features of developing mathematical competence in English language teaching/learning as a key one. The modern view on understanding the concept in scientific discourse was analysed, including considering mathematical competence as a subject-specific, key, and super-competence. Assuming that communication is one of the methods and ways of teaching the English language, the authors' vision of its definition regarding its development in the language learning was suggested. In addition, the survey of English language teachers was conducted and analysed and contradictions and problems in its comprehension and implementation among teachers were revealed: understanding the need to develop mathematical competence as a key one in teaching English; and the lack of methods and didactic materials for practical use at the English language lessons at secondary educational institutions. Furthermore, outlined prospects for future research in developing methods and efficient didactic materials for developing the mentioned competence and conducting an experiment to prove their effectiveness. These didactic materials also should comprise the psychological, linguistic, and lingua-didactic aspects, previously substantiated by the author of this paper, for developing mathematical competence as a key one in the process of teaching the English language

Keywords: comprehensive development; critical thinking; communicative problems; problem-solving; mathematical modelling; logical reasoning

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INTRODUCTION

The relevance of exploring the development of mathematical competence within language teaching lies in the acknowledgment of education as pivotal for holistic individual development. Despite efforts to adopt a competence-oriented paradigm, substantial gaps persist, spanning

from theoretical frameworks to practical application. Understanding and addressing the challenges identified, particularly regarding the clarity and applicability of mathematical competence, are essential steps towards enhancing language education practices. Therefore, this study aims to clarify the



concept of “mathematical competence in English language teaching/learning” and assess its implementation among secondary school English teachers, contributing to the advancement of competence-oriented language education.

Analysis of recent research and publications shows interest in the topic of study in scientific discourse. The fundamental problems of competence-oriented education in teaching language and mechanisms of overcoming are represented in papers (Goroshkina, 2022). Thus, N. Golub (2021) outlined that the development of key competences requires implementing of many processes, including understanding, demonstrating, applying, proving, promoting, utilising, applying, evaluating, choosing, substantiating, constructing, developing, etc. T. Polonska (2021) substantiated conceptual principles of competence-oriented foreign language teaching, the aims, tasks principles, and approaches. V. Redko (2023) explored the aspects of forming the key competencies in foreign language teaching, accentuating that competence-oriented foreign language teaching is a polyfunctional lingua-didactic system that aims to develop comprehensive personality, including strategic abilities to communicate in a foreign language and to maintain appropriate communicative behaviour in various situations of speech interaction. In addition, many researchers explored mathematical competence and its specifics. Scientists M. Niss & T. Højgaard (2019) conducted fundamental research on the mentioned category in teaching mathematics and relevant subjects and substantiated its constituent competencies, particularly communication, which is important for this study. In contrast, little attention was given to research methods for developing mathematical competence in English language teaching. There are also attempts to specify the mentioned phenomenon in Ukrainian language teaching by A.M. Romero (2021), a researcher specified the practical importance of mathematical competence in solving various real-life situations. In addition, L. Artemenko (2024) emphasised the methodological value and the necessity of developing a system of didactic tools for forming mathematical competence as an integral component of linguistic personality. Z. Bakum & A. Neguliaieva (2023) overviewed some theoretical aspects of the mentioned concept and developed its structure: motivational and value, cognitive, activity and communicative, and evaluative and reflexive components. I. Goroshkin (2019; 2020) defined the main problems of developing the mentioned concept as a key competence in language teaching/learning: its limpidness and situational basis. The purpose of this study was to substantiate the category “mathematical competence in English language teaching/learning” and analyse the survey of English language teachers to determine its understanding among teachers of secondary educational institutions.

MATERIALS AND METHODS

The study was based on reviewing modern scientific publications of Ukrainian and foreign scholars regarding the problem of competence-oriented foreign language teaching. General scientific methods, deduction, analysis, and

comparison were used to shed light on the features of the development of mathematical competence as a key one in English language teaching. The comparison revealed similar characteristics of the research concept, including logical reasoning, critical thinking and problem-solving with educational and communicative purposes. An analysis of competencies, abilities and skills was used to define mathematical competence in English language teaching in secondary educational institutions as a basis for the comprehensive development of an individual. In addition, analysis of studies revealed the potential of mathematics to maintain communication in various educational and real-life situations, thus considering competency of mathematical communication as a fundament of foreign language interactions, and developing mathematical competence in English language teaching.

Furthermore, an anonymous survey was conducted in September 2023 at the secondary educational institutions of Kryvyi Rih city (8 participants), Kryvyi Rih Oblast (2 participants), and Kherson city (4 participants), involving 14 teachers. The survey aimed to diagnose the level of awareness among English language teachers regarding the development of mathematical competence during language teaching. The survey had several stages. Firstly, the questionnaire using Google Forms was created according to abilities and skills inherent to mathematical competence in language teaching. It included 12 questions with different options to respond to (multiple-choice, open-ended responses, and ranking definitions). Questions were formulated to specify teachers' awareness of the explored concept and its place among key competences, study their attitude towards the development mathematical competence in English language teaching, recognise appropriate skills and abilities inherent to the researched concept, and reveal the necessity of developing methods of forming mathematical competence in English lessons. Secondly, an online survey was carried out without a time limit for its completion. Then, comprehensive analyses of the result were used to diagnose the state of the problem and reveal possible contradictions. Mathematical methods and forms of representation of information were used to represent the survey results. The survey procedure in the study complied with ethical standards, did not violate the dignity of the participants, and followed the recommendations of the Declaration of Helsinki (2013). The results were published anonymously.

RESULTS AND DISCUSSION

Ukraine's education strategy is reoriented towards developing key competences necessary for each modern individual, their successful socialisation, and self-fulfilment. The affiliation of mathematical competence to one of the 11 key competences by the Law of Ukraine No. 2145-VIII “On Education” (2023) provides the possibility of using the potential and resources of the mentioned competence in teaching/learning the English language. However, it also creates a problem concerning its theoretical substantiation and

practical implementation in the language teaching/learning field. The idea that mathematical competence is fundamental is not only stated by Ukrainian Law. Thus, The National Curriculum in England (2014) includes statements on the development of learners' competence in numeracy and mathematics, which means the necessity to develop pupils' numeracy and mathematical reasoning so that they understand and appreciate the importance of mathematics, use every relevant subject to develop students' mathematical fluency. The programme for international student assessment (2022) also measures competence in 3 domain subjects, including mathematical literacy, which is an individual's capacity to reason mathematically and formulate, employ, and interpret mathematics to solve problems in various real-world contexts, ability to use mathematics knowledge and skills to meet real-life challenges, and the capacity of individuals to reason mathematically and solve various problems of 21st-century contexts.

Hence, there is no doubt that mathematical competence must be developed when teaching all subjects, not only mathematics-relevant ones, because its main purpose is to develop an individual's reasoning and ability to problem-solve in real life and the learning process. Defining the category "mathematical competence in English teaching" requires distinguishing the categories "competence" and "competency". Numerous scientists, including T. Polonska (2017), researched the mentioned issue. Overall, here are two approaches to understanding the relationship between these concepts. The first approach considers "competence" and "competency" to be identical and describes them as a skill or ability (The American heritage dictionary, 2022). The second one indicates the subordinate nature of the relations of these concepts: mathematical competency is a clearly recognisable and distinct principal constituent of mathematical competence (Niss, 2003). Adopting the second viewpoint it is considered that competence is the integrative quality of personality, which appears in some competencies, skills, and abilities. There is no common perspective of the discovered concept in scientific discourse. Thus, M. Holovan (2014) defines mathematical competence as an integrative development of personality that combines mathematical knowledge, abilities, skills, experience in mathematical activities, and personal qualities that lead to the desire, willingness, and ability to solve mathematical problems. O.V. Ovcharuk (2003) outlines the investigated competence as functional, which involves components of intellectual development, the ability to apply logic, mathematical knowledge and abilities, systemic thinking and the ability to solve complex logical and mathematical constructions, spatial ability, and modelling. O.V. Onopriienko (2016) also supports the idea that mathematical competence is a subject one. In addition, N. Rudnytska (2022) substantiated the importance of general and mathematical knowledge and experience of its utilisation, personal qualities that are essential for successful self-realisation.

An essential contribution to the investigation of mathematical competence was made by M. Niss (2003). According

to the researcher, mathematical competence means understanding, judging, doing, and using mathematics in various intra- and extra-mathematical contexts and situations in which mathematics plays or could play a role and consists of eight competencies: thinking mathematically; posing, and solving mathematical problems; modelling mathematically; reasoning mathematically; representing mathematical entities; handling mathematical symbols and formalisms; communicating in, with and about mathematics; making use of aids and tools. Whereas communication is the main form and method of teaching/learning language, close attention was given to competency, "communicating in, with, and about mathematics". According to M. Niss (2003), this competency includes understanding others and expressing oneself in different mathematical forms about matters having such content. Thus, it means communication is held with the means of mathematical science and knowledge of different forms and ways of its expression. Exploring mathematical competencies, R. Turner (2010) outlines communication as one of them: it comprises incoming abilities of reading, decoding, and interpreting statements and mathematical information and outgoing skills of explaining, presenting, and arguing. The skills mentioned are necessary for all individuals and should be developed and used in teaching/learning languages (Ouyang *et al.*, 2021).

Recent scientific research on the development of mathematical competence in language education shed light on some aspects, L. Artemenko (2021) considers mathematical competence as a key one: person's innate mathematical skills and abilities acquired through knowledge in the learning process, which give a unique opportunity to find, using the laws of mathematics and logic, trustworthy solutions in thoughts and actions and implement them in practice for full self-realisation in society. In addition, the researcher proposes the formulation of mathematical competence in learning Ukrainian: a unique opportunity to study modern Ukrainian literary language standards using logical, algorithmic, and critical thinking for their correct application during speech activity and specified the practical importance of mathematical competence in solving real-life situations. The authors of this study agree with I. Goroshkin (2020) opinion, that in the current stage of scientific research mathematical competence is developed while acquiring a foreign language on the situational basis in the process of solving communicative and educational problems by the learners, for instance, while dealing with time concepts, amount, dates, prices, air temperature and has certain limitedness of its utilisation. However, to be an efficient, comprehensive development tool, mathematical competence should be developed regularly in learning/teaching the English language at educational institutions.

Summarising those mentioned above and adopting an attempt made by A.O. Neguliaieva (2022), the authors of this study define mathematical competence as the integrative quality of personality, which manifests in the ability to engage "mathematical communication competency"

effectively; the ability to build mathematical models of various situation of speech interaction; applying logical, mathematical, and critical thinking to overcome real-life problems in the process of learning English; to conduct critical analysis of information, one's own and others' statements, efficient use of mathematical tools, methods in language learning. Furthermore, competency of "mathematical communication in the teaching the English language" is considered to be the ability and readiness of learners to communicate with the means of mathematical science, to read and decode information with efficient utilisation of mathematical tools, methods, and forms in the process of English language communication, processing information through mathematical methods, solving problems in the process of speech interactions on a situational basis.

For a comprehensive investigation of the mentioned concept in secondary educational institutions, a survey among English language teachers was conducted. The survey results determined that 64.29% of teachers attribute mathematical competence as a key competency, while 35.71% consider it a subject-specific one. Moreover, the perceived necessity of developing the investigated competence varies across defined educational sectors (Fig. 1): 100% of respondents suggest that it is necessary to foster the investigated competence in mathematical, technological, and informational fields, 50% in natural and social (health-preserving) domains, 42.86% in civic and historical sectors, 35.71% see this necessity during the study of language and literature subjects, 21.43% in the artistic field, and 7.14% during physical education lessons.

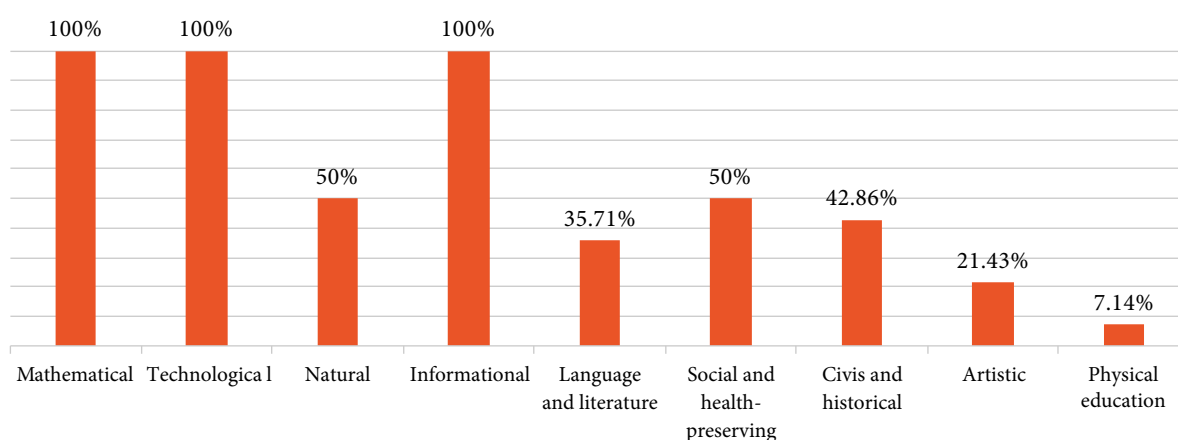


Figure 1. The necessity of developing mathematical competence in educational sectors (among the interviewed teachers)
Source: developed by the authors

The summary of responses regarding the frequency of using mathematical methods of representation of information in English language teaching is displayed in Figure 2. Accordingly, tables (71.43%) and diagrams (64.29%) are

the most frequently employed formats, while respondents mainly did not indicate the use of timelines (71.43%), graphs (78.57%), charts (86.71%), and algorithms (92.86%) at their lessons.

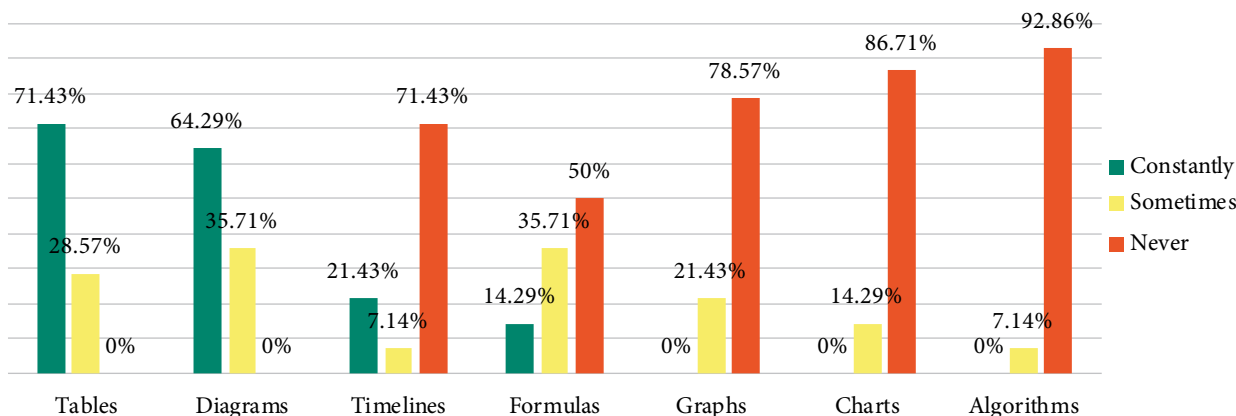


Figure 2. The frequency of using mathematical formats to present information in English language teaching
Source: developed by the authors

Respondents indicated (Fig. 3) that, for studying grammatical material, they choose to use rules – 100%,

table format – 71.43%, diagrams – 64.29%, algorithms – 7.14%, formulas – 14.29%, and timelines – 21.43%. In

addition, according to the survey, a deductive approach predominates in grammar instruction: 100% of the respondents noted the use of deduction, while only 14.29% also employed induction when explaining grammatical

material. However, using such formats as timelines, formulas, algorithms, and induction may become an efficient way to teach grammar, for instance, when teaching verb forms and tenses.

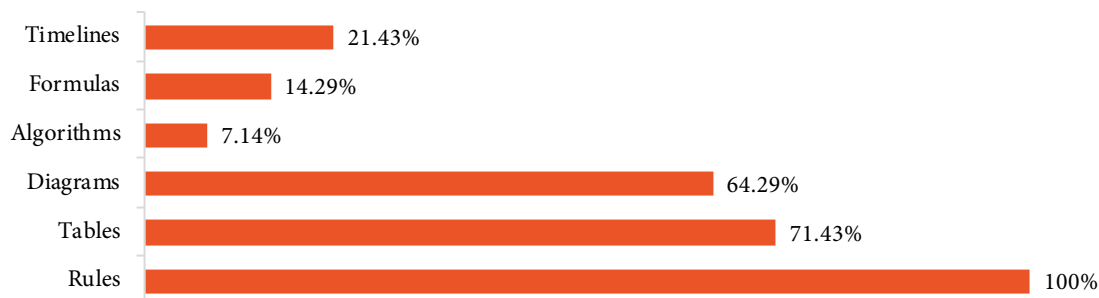


Figure 3. The frequency of using mathematical methods of representation of information in English language teaching
Source: developed by the authors

In response to the question: “Do you see advantages in developing mathematical competence among students in the process of English language teaching?” 78.57% of respondents chose the option “hard to say”, 14.29% – “yes”, and 7.14% – “no”. Furthermore, 64.29% of those surveyed expressed a desire to use mathematical language, methods of representing information during the teaching of the English language, while 35.71% – “not decided”. The analysis of responses to the question: “In your opinion, how will the use of learners’ mathematical competence affect the quality and strength of English language knowledge?”

is presented in Figure 4. The responses to the importance of developing specific characteristics, qualities, skills, and abilities in English language education are presented in Table 1. According to the obtained results, respondents believe that the most essential skills for learners in teaching/learning English include the ability to solve communicative (educational) problems (85.71%), draw conclusions (generalisations, systematisation) (78.57%), and compare (contrast) (71.43%). Meanwhile, the fewest respondents perceive the need for skills in mathematical modelling (14.29%) and the use of mathematical tools (28.57%).

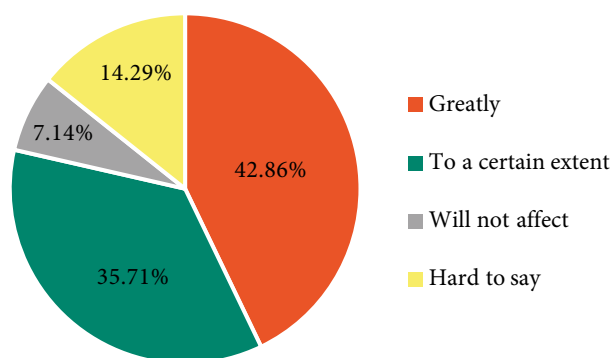


Figure 4. The impact of usage of mathematical competence on quality and strength of knowledge abilities and skills to communicate in the English language
Source: developed by the authors

Table 1. The importance of developing specific characteristics, qualities, skills, and abilities in English language teaching/learning

No.	Characteristics, qualities, skills, and abilities	Rating		
		Essential	Important to a certain extent	Not essential
1.	Compare and contrast	71.43%	21.43%	7.14%
2.	Analyse, distinguish between main and secondary	64.29%	35.31%	0%
3.	Draw conclusions, generalise, systematise	78.57%	21.43%	0%
4.	Solve communicative, educational problems	85.71%	14.29%	0%
5.	Creative approach to problem-solving	57.14%	21.43%	21.43%
6.	Represent a position in a mathematical format	28.57%	21.43%	50%

Table 1. Continued

No.	Characteristics, qualities, skills, and abilities	Rating		
		Essential	Important to a certain extent	Not essential
7.	Use mathematical tools in the process of teaching the English language	28.57%	21.43%	50%
8.	Explore various ways to complete tasks	50%	35.71%	14.29%
9.	Apply mathematical modelling	14.29%	21.43%	64.28
10.	Solve logical problems	14.29%	14.29%	71.42%
11.	Think logically	50%	50%	0%
12.	Expressing position with reasoning	71.43%	28.57%	0%
13.	Critical thinking	64.29%	28.57%	7.14%
14.	Conduct a critical analysis of own communicative activities and conversation partners	57.14%	42.86%	0%
15.	Self-reflection, self-analysis	78.57%	21.43%	0%

Source: developed by the authors

The overwhelming majority of respondents (92.86%) desired to learn more about mathematical competence and its formation methodology in teaching the English language, 7.14% – “not decided”, and 0% – “do not have such readiness”. Furthermore, among the reasons hindering the development of the investigated competence during language teaching/learning, 100% of respondents noted the absence of a corresponding methodology, and 71.43% mentioned a lack of time for preparation or insufficient didactic material. The results of responses to the question: “If you were provided with the necessary didactic materials and knew the corresponding methodology for developing mathematical competence, would you form it in English language teaching?” indicate the motivation of teachers to learn more about the researched issue: 92.86% answered “yes” to the question, 0% – “no”, and 7.14% – “not decided”.

Ukraine’s educational strategy now emphasises the importance of mathematical competence as one of the key competencies necessary for modern individuals, aligning with international educational standards that advocate for its integration across various subjects, including language learning. This recognition poses both opportunities for enhancing English language teaching through mathematical reasoning and challenges related to its theoretical and practical implementation. Surveys among teachers highlight a keen interest in incorporating mathematical competence into language education, though they also reveal significant gaps in available methodologies and resources for doing so effectively. In summary, the integration of mathematical competence into English language teaching is seen as a key strategy for enhancing students’ reasoning, problem-solving skills, and overall ability to apply mathematics in various contexts. However, the lack of established methodologies and resources presents a significant challenge to its practical implementation, pointing to a need for further research and development in this area.

CONCLUSIONS

This paper emphasises the problem of developing mathematical competence as a key competence while teaching

foreign languages in secondary educational institutions. The current approach to understanding the researched concept was analysed, and its theoretical substantiation was suggested according to the specific features of language teaching, considering communication as a basis for successful teaching/learning English. Hence, mathematical competence is the integrative quality of personality, which comprises the ability to communicate with the help of mathematics in various communicative interactions while learning language, build mathematical models of real situations, utilise mathematical tools, methods, means and conduct problem-solving with the help of logical, mathematical, and critical thinking; critical analysis of own and others’ opinions, conclusions, and statements in the process of teaching English. In addition, English language teachers were surveyed and contradictions and problems in developing mathematical competence in educational institutions in teaching the English language were revealed. These issues include the willingness to work in a specified area, a lack of corresponding methodology and didactic material, the necessity of developing specific characteristics inherent in the investigated competence, but with a lack of awareness of the importance of some of them, and insufficient use of mathematical methods and formats when explaining material (grammatical, lexical, and phonetical) in English language teaching/learning. Therefore, further prospects for research include creation of methods for developing mathematical competence in English teaching/learning in secondary educational institutions and practically experimenting with its effectiveness. While developing the mentioned methods and didactic materials, the survey’s results and those previously substantiated linguistic, lingua-didactic, and psychological aspects should be considered.

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CONFLICT OF INTEREST

None.

REFERENCES

- [1] Artemenko, L.I. (2021). The problem of learners' mathematical competence as a key one. *Current Issues and Prospects for the Development of Scientific Research*, 71, 85-90. doi: 10.51582/interconf.19-20.08.2021.009.
- [2] Artemenko, L.I. (2024). Didactic foundations of forming mathematical competence of secondary school students in learning the syntax of the Ukrainian language. *Educational Dimension*, 10, 66-83. doi: 10.55056/ed.657.
- [3] Bakum, Z.P., & Neguliaieva, A.O. (2023). Mathematical competence as a key competence in English language teaching and its components. *Prospects and Innovations of Science*, 11(29), 36-46. doi: 10.52058/2786-4952-2023-11(29)-36-46.
- [4] Declaration of Helsinki. (2013). Retrieved from <https://www.wma.net/what-we-do/medical-ethics/declaration-of-helsinki/>.
- [5] Golub, N.B. (2021). [Competency-oriented method of teaching the Ukrainian language in institutions of general secondary education \(barriers and implementation mechanisms\)](#). In *Linguistic personality in the educational space* (pp. 66-78). Ostroh: Publishing House of the National University of Ostroh Academy.
- [6] Goroshkin, I.O. (2019). [Formation of elementary school students' mathematical competence in foreign language lessons](#). *Innovations in education and pedagogical skills of a language teacher: Proceedings of the 3rd all-Ukrainian scientific and practical conference* (pp. 101-103). Sumy: Sumy State Pedagogical University Named After A.S. Makarenko.
- [7] Goroshkin, I.O. (2020). Aspects of developing key competences in the 5th graders of gymnasium in the process of teaching foreign languages. *Ukrainian Educational Journal*, 2, 104-109. doi: 10.32405/2411-1317-2020-2-104-109.
- [8] Goroshkina, O.M. (2022). [Competency dimension of Ukrainian language learning in NUS](#). In *Proceedings of the VIII international scientific and practical conference "Continuing education of the new century: Challenges and priorities"* (pp. 50-55). Zaporizhzhia: Zaporizhzhia Regional Institute of Postgraduate Pedagogical Education.
- [9] Holovan, M.S. (2014). [Mathematical competence: The nature and structure](#). *Scientific Bulletin of the East European National University*, 1, 35-39.
- [10] Neguliaieva, A.O. (2022). Category "mathematical competence" in learning foreign languages. *Oleksandr Dovzhenko Hlukhiv National Pedagogical University Bulletin*, 50(2), 245-251. doi: 10.31376/2410-0897-2022-3-50-245-254.
- [11] Niss, M. (2003). [Mathematical competencies and the learning of mathematics: The Danish KOM project](#). In *Third Mediterranean conference on mathematical education* (pp. 115-124). Denmark: Roskilde University.
- [12] Niss, M., & Højgaard, T. (2019). Mathematical competencies revisited. *Educational Studies in Mathematics*, 102, 9-28. doi: 10.1007/s10649-019-09903-9.
- [13] Onopriienko, O.V. (2016). [Subject mathematical competence as a didactic category](#). Retrieved from <http://surl.li/stnewx>.
- [14] Ouyang, F., Li, X., Jiao, P., Peng, X., & Chen, W. (2021). The three-iterative design and implementation of a student-facing social learning analytics tool. *International Journal of Distance Education Technologies*, 19(4), 1-22. doi: 10.4018/IJDET.286738.
- [15] Ovcharuk, O.V. (2003). [Competencies as the key to renewal content of education](#). *Strategy for Reforming Education in Ukraine: Recommendations on Education Policy*, 296, 13-41.
- [16] PISA 2022 mathematics framework (draft). (2018). Retrieved from <https://pisa2022-maths.oecd.org/files/PISA%202022%20Mathematics%20Framework%20Draft.pdf>.
- [17] Polonska, T.K. (2017). [The essence of competence-oriented foreign languages teaching at primary school](#). *Pedagogical Education: Theory and Practice*, 22(1), 294-300.
- [18] Polonska, T.K. (2021). [Formation of the key competences of 5-6th graders of the gymnasium at English language lesson using game technology](#). In *Collection of abstracts of the III all-Ukrainian scientific and practical online conference "Competence-based learning: Challenges and prospects"* (pp. 176-180). Kyiv: Pedagogic Thought.
- [19] Redko, V.H. (2023). [Competence-oriented teaching of foreign language communication of students of general secondary education as a foreign language communicative environment educational phenomenon](#). In *Development of modern education and science: Results, problems, prospects* (pp. 65-67). Posvit: Konin.
- [20] Romero, A.M., Armenteros, A.Q., & Castro, A.E. (2021). Promoting critical thinking through mathematics and science teacher education: The case of argumentation and graphs interpretation about climate change. *European Journal of Teacher Education*, 47(1), 41-59. doi: 10.1080/02619768.2021.1961736.
- [21] Rudnytska, N.Yu. (2022). [Development of mathematical competence of primary school students in the conditions of a new educational paradigm](#). In *Collection of materials of the all-Ukrainian scientific and practical conference with international participation* (pp. 63-66). Zhytomyr: PE "N.M. Levkovets".
- [22] The American heritage dictionary. (2022). Retrieved from <https://ahdictionary.com/>.
- [23] The Law of Ukraine No. 2145-VIII "On Education". (2023, September). Retrieved from <https://zakon.rada.gov.ua/laws/show/en/2145-19#Text>.
- [24] The National Curriculum in England. (2014). Retrieved from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/381344/Master_final_national_curriculum_28_Nov.pdf#page34.
- [25] The programme for international student assessment. (2022). Retrieved from <https://nces.ed.gov/surveys/pisa/>.
- [26] Turner, R. (2010). [Exploring mathematical competencies](#). *Research Developments*, 24.

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Формування математичної компетентності як ключової в навчанні англійської мови

Анотація. Актуальність дослідження зумовлена необхідністю пошуку ефективних способів реалізації компетентнісної парадигми навчання та формування ключових компетентностей як підґрунтя гармонійного розвитку учнів і учениць, успішного інтегрування в швидкозмінне крос-культурне суспільство. Мета статті полягала в обґрунтуванні математичної компетентності в навчанні англійської мови, здійсненні аналізу опитування вчителів англійської мови закладів загальної освіти щодо обізнаності окресленого питання. Задля досягнення поставленої мети використано наукові та емпіричні методи, дедукцію, комплексний аналіз, зіставлення. Відповідно, у статті представлено дослідження стану упровадження визначеної Законом України “Про освіту” компетентнісно орієнтованої стратегії освіти загалом і особливостей формування математичної компетентності як ключової в навчанні англійської мови. Проаналізовано сучасні підходи до розуміння математичної компетентності, які охоплюють витлумачення її як предметної, ключової та суперкомпетентності. Зважаючи на комунікативну спрямованість навчання англійської мови, запропоновано визначення означеної категорії, яке урахує специфіку її формування в мовно-літературній царині. Проведено та проаналізовано опитування вчителів англійської мови в ході якого виявлено протиріччя в розумінні досліджуваної категорії та її імплементації: визнання потреби формування математичної компетентності як ключової в навчанні англійської мови; та відсутність ефективної методики, дидактичного забезпечення для практичного її використання на уроках англійської мови в закладах середньої освіти. Окрім того, окреслено подальші перспективи наукових розвідок, які убачаються в розроблені і експериментальній перевірці методики формування означеної компетентності. Зазначені матеріали мають також урахувати попередньо обґрунтовані психологічні, лінгвістичні та лінгводидактичні аспекти формування математичної компетентності як ключової у процесі навчання англійської мови

Ключові слова: гармонійний розвиток; критичне мислення; комунікативні проблеми; розв’язання проблем; математичне моделювання; логічне мислення

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Exploring alternative preschool education methods in Georgia: Enhancing accessibility

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Abstract. This study is relevant as it examines public-private partnerships in early childhood education in Georgia, seeking solutions to the significant educational challenges common to post-Soviet regions. It assesses the suitability of alternative educational models in a society that is still struggling with the infrastructural legacy of the Soviet past, providing valuable recommendations for policy reforms needed to expand access to and improve the quality of preschool education. The purpose of the study was to assess the readiness of Georgian society to implement alternative educational practices. Drawing upon the experiences of post-Soviet nations, alongside international insights and local perspectives, the study aims to provide comprehensive insights into the feasibility and effectiveness of alternative models in Georgia. Employing a mixed-methods approach encompassing qualitative interviews, surveys, and data analysis, the research examines the strengths, challenges, and implementation prospects of various alternative models within the unique socio-economic and cultural context of post-Soviet Georgia. Early childhood education in post-Soviet and similar countries confronts common challenges in access and quality, despite varied policies, with efforts such as legislation and public-private partnerships aimed at addressing financial and geographical barriers. Persistent disparities in preschool systems across the region, as illustrated by reform initiatives and staffing issues in Georgia, highlight the need for continuous reforms. These factors underscore the importance of sustained policy efforts to support comprehensive and effective early learning environments. The results underscore a compelling need for alternative education avenues in Georgia, particularly in regions facing infrastructural and geographical barriers similar to those experienced in other post-Soviet nations. While highlighting the potential benefits of public-private partnerships models, the study also identifies key challenges that need to be addressed to ensure their successful implementation within the post-Soviet context. The practical value of this study extends to policymakers, educators, and communities across post-Soviet countries with similar educational challenges. By advocating for legislative reforms to incorporate alternative approaches, this research contributes to ongoing efforts to strengthen preschool education and promote inclusivity in post-Soviet Georgia and beyond.

Keywords: early childhood education; expanding preschool opportunities; advancing preschool development; original preschool strategies; broadening preschool access

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INTRODUCTION

In rapidly evolving socioeconomic landscape, the focus on advancing society's status has underscored the critical role of education, particularly in early childhood development. Scholars contend that a well-educated populace forms the



bedrock of a thriving economy and societal progress. The correlation between early education and socioeconomic status is well-documented, emphasising the imperative for societies to prioritise educational initiatives, ensuring access for all children.

A synthesis of recent literature underscores the pivotal role of preschool education in fostering school readiness, cognitive development, and socialisation skills (Radsky & Mikayilova, 2023). Traditional preschool models, predominantly centred on formal institutions, face inherent limitations such as limited capacity, high costs, and geographic barriers, hindering access for marginalised communities (Civitas Georgika, 2012). Alternative approaches, including family-based and society-based programmes, have emerged as promising avenues to extend the reach of preschool education, catering to diverse needs and enhancing accessibility (Sankar, 2021).

Despite legislative efforts in Georgia aimed at governing preschool education processes, persistent challenges persist. Reports from UNICEF highlight infrastructural deficiencies, geographical barriers, and inadequate provisions for children with disabilities, signalling the urgent need for reforms (Preschool education..., 2018). Legislative initiatives spanning from 2022 to 2030 aim to systematise kindergartens and enhance standards, yet disparities persist, particularly in regions lacking infrastructure and resources (The process of authorisation..., 2021). Building upon global precedents in countries like Estonia, Serbia, and Uzbekistan, where alternative education models have proven effective in addressing similar challenges, this study focuses on Georgia's context (Zhang *et al.*, 2019; Giunipero, 2021; Sankar, 2021). Rooted in the recognition of public-private partnership (PPP) initiatives as catalysts for change, this research seeks to explore alternative models and assess their feasibility within Georgia's preschool education landscape (Ali *et al.*, 2024).

The study aimed to explore readiness of assessing alternative preschool models through public-private partnerships to improve access and integration into the preschool education system. The study had several objectives. 1. Explore alternative education models inspired by global practices to address challenges within Georgia's preschool education system. 2. Evaluate the potential of cost-effective approaches, such as family-based and society-based programmes, to enhance accessibility and inclusivity. 3. Assess regional readiness and perspectives regarding the incorporation of alternative forms of preschool education. 4. Advocate for the integration of alternative methods into the accreditation process for preschool institutions. The originality of this research lies in its exploration of the potential of alternative forms of education, particularly through public-private partnership (PPP) models, to address challenges in ensuring universal access to preschool facilities in Georgia, despite recent legislative reforms aimed at enhancing preschool education standards

underscore the nation's commitment to providing quality early childhood education.

MATERIALS AND METHODS

The study was planned in two stages. In the first stage, the experience of countries with more or less similar socio-economic conditions was analysed. A thorough desk research was undertaken to investigate the historical evolution of preschool education in Soviet Union countries, particularly focusing on the transition period following the collapse of the USSR. This analysis focused on examining changes in access, organisation, finances, and management of preschool education systems across post-Soviet countries. Particular emphasis was placed on identifying challenges encountered during the transition from the Soviet-era centralised system to the new governance structures.

In the second stage, a qualitative study included expert survey and was conducted to examine the current situation in Georgia. The expert survey delving into the intricacies of Georgia's preschool education system took place between January and February 2024. Spearheaded by a research team from Tbilisi in collaboration with Georgian National University SEU, the survey aimed to pinpoint critical issues within the sector. A total of 76 respondents contributed their insights, including 74 females and 2 males. These participants hailed from diverse backgrounds, representing both educational professionals and concerned parents. Of the participants, 45 were affiliated with the association of municipal kindergartens or worked directly within kindergarten settings, while 31 were parents of preschool-aged children.

The survey used a questionnaire to investigate Georgia's preschool education system, covering topics like perceived problems, reasons for non-enrolment, awareness of PPP initiatives, and willingness to contribute. Participants shared ideas and contact information, ensuring thorough analysis and follow-up. These questions were carefully crafted to elicit insights from participants regarding their perceptions, experiences, and potential contributions to addressing challenges within Georgia's preschool education system. To ensure inclusivity, the research team adopted an online approach due to geographical constraints and adverse weather conditions, leveraging Google Forms as the survey platform. Ethical considerations were paramount throughout the survey process, aligning with the principles delineated in the Declaration of Helsinki (2013). Participants were assured anonymity, fostering candid responses crucial for the study's integrity. Additionally, the research adhered to ethical standards, emphasising transparency, voluntary participation, and informed consent.

Sampling techniques combined elements of purposive sampling with snowball sampling, allowing for a nuanced representation of perspectives. Initial selection criteria were guided by Georgian statistical reports on preschool education availability (Children and adolescents, 2023). However, discrepancies between official data and actual accessibility prompted a recalibration of the sampling

strategy, necessitating the inclusion of a re-target group. The research encompassed a blend of focus groups and individual interviews, totalling 58 interviews alongside 2 focus group sessions. This multifaceted approach facilitated

a comprehensive understanding of the challenges and opportunities within Georgia's preschool education landscape. The sample of survey participants was compiled by region, as shown in Table 1.

Table 1. Distribution of respondents by gender and method of data collection across regions

Region	Ninotsminda	Ozurgeti	Khashuri	Tsageri	Sagarejo	Kharagauli
Respondents	22	23	7	2	21	1
Female	22	22	6	2	21	1
Male	-	1	1	-	-	-
Interview	22	23	7	2	3	1
Focus-group	-	-	-	-	2	-

Note: numbers represent count of persons involved from each region

Source: compiled by the author

Furthermore, the narratives obtained from the research underwent thematic analysis, leading to the identification of several key themes, including: perceived problems and the necessity of preschool education; reasons for non-enrolment in preschool; identification of problems and responsibility; awareness of public-private partnerships (PPP); belief in personal contribution; willingness to engage; expression of ideas and contact information.

RESULTS AND DISCUSSION

Desk Research. In the initial stage, the research examined the accessibility of preschool education, its unique characteristics, experiences with public-private partnerships (PPP), challenges within the education system, and both successful and unsuccessful strategies employed in countries with relevant experience comparable to Georgia's context. Across all post-Soviet countries under study, a largely similar trajectory was observed, although some nations managed to navigate post-union challenges more effectively and expediently than others. In the Soviet Union countries, there was secured and broad access to preschool education. However, after the collapse of the USSR, the situation changed, leading to problems with organisation, finances, and management. This also had a negative effect on children's opportunities to access education. Accessibility was the main element in Soviet preschool education, which was free for everyone. After the collapse, the situation changed, and over the decades, countries have been trying to cope with the challenges that emerged (Chou *et al.*, 2015). Below are examples of some post-Soviet countries and how their education systems have changed since the collapse of the Soviet Union:

In Ukraine, early childhood education significantly impacts a child's development. Therefore, access to educational services at this age is critically important, with educators' qualifications and pedagogical approach playing a special role. Kindergartens in Ukraine offer various services for children aged 0-6 years, including educational, medical, financial, and legal provisions. To cope with identified challenges in preschool education, changes have been made in legislation due to teachers lacking qualifications, requiring

them to have a mandatory university degree. Additionally, mechanisms of support for teachers and measures to improve their qualifications, such as seminars and conferences, are provided for in the legislation (Putcha *et al.*, 2018).

In Uzbekistan, preschool enrolment rates in 2017 lagged significantly behind those of Kazakhstan, Finland, Moldova, and Russia. Recognising this disparity, a study was conducted in 2017/2018 to assess the needs of the preschool education system and understand the underlying causes of its shortcomings. Subsequently, the Educational Sector Plan (ESP) for 2019-2023 outlined action targets aimed at ensuring access, safety, and quality of preschool education, as well as improving management and leadership. By 2021, the implementation of these initiatives led to a 16% increase in children's participation in preschool education. With support from the World Bank and the Global Partnership for Education (GPE), family kindergartens tailored to regional challenges and community needs were established. PPP were also encouraged, incentive's citizens to provide land or buildings for preschools and subsidising community costs. Additionally, a Mobile Buses model was introduced to ensure access for children unable to attend preschool regularly (These school buses..., 2022). However, challenges persist, particularly regarding equality for disabled children, addressed through the creation of manuals and adherence to principles like the child's right to education and family involvement in curriculum development (Sankar, 2021). UNICEF's 2022 report highlighted the benefits of PPP implementation, emphasising collaboration, involvement, and continuous training of parents, communities, and local authorities (Towards achieving..., 2022)

In Kyrgyzstan, in 2014, S. Builasheva (2014) researched the preschool education system. According to the researcher, in Post Soviet Union countries, educational systems are similar to the Soviet Union, are holistic, serve to form school readiness, and have not undergone major changes in recent decades. The reason for this is the ideology of pedagogy: in the development of which Montessori, Ushinsky and others took part. In Kyrgyzstan, this system is considered successful, because it has been consolidated for decades and

residents do not see the need for change. Kyrgyzstan, like most post-Soviet countries, suffers from the difficulties of access to preschool education and the inadequacy of the education of kindergarten workers. Since the 2000s, legislative changes have been introduced, principles of inclusive education have been introduced, and funding has increased, but the issue of accessibility still remains unsolved. Accordingly, there was a need to create new, innovative and highly effective models. Models that would adapt to the existing behaviour of the country and change the existing situation with an experimental approach, and as a result ensure efficiency and equal access to education (McCormack, 2018). In 2021, PPP implementation initiatives, which failed so far in 2009, were launched, and by 2026, with the cooperation of the government and the private sector, many barriers to public welfare will be implemented. With it, Kyrgyzstan, according to the World Bank will become the first Asian country that was able to create a PPP centre that implemented the mentioned model (Kyrgyzstan promotes..., 2022).

In Azerbaijan, access to public nurseries is very limited, with no private alternatives available. Participation rates in existing public nursery schools are also low, attributed partly to the recent Karabakh war and subsequent internal migration, which could potentially change with stabilisation. Despite legislative changes, privatisation of kindergartens, implementation of standards, construction of new facilities, and promotion of temporary employment, the persistent issue of staff shortage remains. Additionally, the allocated budget is insufficient, and crucially, there is a lack of unified vision regarding privatised kindergartens and preschool education (Radsky & Mikayilova, 2023).

In Georgia, interest in early childhood education/development has grown steadily. Numerous studies aim to enhance preschool education, reflecting both legislative and practical efforts. In the 2023 report on child well-being, provision of basic needs was a key indicator, with improvements noted in state support. However, challenges persist, with 37% of children facing multiple deficits, particularly prevalent in rural areas. Notably, 6% experience functional difficulties hindering education access, compounded by parental unwillingness (21%) and various barriers (6%). Non-formal education is primarily accessible at the school stage, with preschool options mainly fee-based. Inequities persist, including harsh parenting practices and disparities based on gender, settlement type, and financial status, often stemming from social deficits beyond societal control. Emphasis on preschool education underscores its pivotal role in shaping future educational outcomes and mitigating disparities (Child wellbeing in Georgia, 2023). As per Georgia's legislation, children attend public kindergartens from ages 2 to 6, with education being tuition-free. A school readiness programme commences at age 5. The legislation outlines specific obligations for kindergartens to fulfil during the authorisation process, ensuring alignment with International Standard Classification of Education (ISCED) requirements. According to the UNESCO (2011),

these standards are designed to meet international educational benchmarks and ensure quality education delivery. The National Bureau of Statistics periodically releases demographic data reports, indicating that post-COVID, 70% of children in Georgia attend kindergarten, with a notable portion enrolled in private institutions. Furthermore, a significant number of children do not attend preschool due to parental choice. The study also explores the Georgian experience, revealing the existence of a PPP agency since 2019. However, the agency's mission aligns with the development strategy of the Government of Georgia, focusing solely on projects contributing to Georgia's role as a regional hub in innovative and digital economy, transport, energy, and industry sectors. Education-related projects are not within their scope (PPP agency in Georgia, 2019). There was a need for a project that would fit with a public-private partnership (PPP). That is where the first forest kindergarten "Bunbare" in Georgia comes in (Bunbare, n.d.). "Bunbare" plans to bring a similar PPP idea to Georgia through its outdoor education hub called "Gare-Gare". Right now, the team is talking to possible guardians and their parents to understand what the kids need. They are using their own resources to meet these needs and figuring out how to measure if it is working. The founder says the project will pay for itself. This means parents and the team will share what they have, like food, time, knowledge, and skills. In return, they will get to use the outdoor area for free and get help and supervision from the founder, who is an expert in teaching outdoors. Additionally, there is the "Future Club", formed from Tsromi (Kharagauli Region) kindergarten, aimed at boosting parent-school collaboration. It is a unique initiative in the region aimed at strengthening family, community, and kindergarten bonds, as stated by the head of the Khashuri Kindergartens Association (Bitvelashvili, 2024).

Serbia, despite not being a post-Soviet country, has encountered similar challenges such as geographical limitations and insufficient space coverage. Efforts have been made to diversify preschool education programmes, as highlighted in the UNICEF (2012), Belgrade, titled "Investing in early childhood education in Serbia". Instead of building new kindergartens, the focus has shifted to developing tailored programmes for children, families, and local governments where formal provision is lacking. In 2013, Serbia, with support from the European Union, initiated the IMPRES project to diversify preschool education programmes and services. The project aimed to emphasise the importance of preschool education, the needs of preschool-aged children, and the multifaceted nature of preschool education. It also focused on enhancing the qualifications of preschool education workers and engaging the community and parents in the process. The project emphasised the importance of considering local government resources and involving all stakeholders, recognising that even small contributions are valuable. Through research and analysis of regional challenges and resources, services were developed to address the lack of access to formal

education. While alternative services have positive aspects, such as promoting early education and development where formal education is difficult to obtain, there are also drawbacks. These include the stigmatisation of the target group, the exclusion of those who prefer formal services, and potential resistance from parents opposed to kindergarten (Vandekerckhove *et al.*, 2013; Kekelia & Kitoshvili, 2023).

While the Estonia, which is not a post-Soviet country, shared common challenges. But for today, preschool education and care in Estonia span from 0 to 6 years. Separate programmes are provided for ages 0-3 and 3-6, both aimed at supporting parental employment and facilitating maternity and parental leave. The legislation undergoes continuous improvements based on monitoring and evaluating indicators of the preschool educational process. Although preschool education is not mandatory in Estonia, it is accessible to all, with a participation rate reaching up to 100% (Zhang *et al.*, 2019).

In Poland, attending preschool is not compulsory, but children are required to complete a one-year preschool “zero class”. Consequently, some children may stay at home with a guardian or participate in alternative services. Non-conventional preschool programmes in Poland include church, music, sports, and combined kindergartens. Alternative forms of preschool education, such as Waldorf, Montessori, Reggio Emilia, and the Scandinavian Forest Kindergarten model, are also available. But they are rather costly (Okrasa, 2010). These programmes aim to support parents, protect children’s rights, ensure proper educational standards, prioritise children’s safety, and respect their development. All kindergartens in Poland must align their curriculum with regulations introduced by the Ministry of Poland in 2017, with autonomy in choosing specific methods to achieve the educational goals (Bertrain & Pascal, 2016; Preschools in Poland, 2023). In Poland, the government is under pressure to provide citizens with a wide range of public services, all while struggling with financial deficits and public debts. Public-private partnerships offer a valuable opportunity for governments to make efficient investments that benefit the public as a whole (Jachowicz, 2016).

In summary, the desk research provides a comprehensive overview of the status and challenges of early childhood education (ECE) and preschool education in both post-Soviet Union and other similar countries. Despite variations in policies and approaches, common themes emerge, including the importance of access to preschool education, efforts to address barriers such as financial constraints and geographical limitations, and the role of legislation in promoting quality and equity in ECE. Post-Soviet Union countries have faced significant challenges in transitioning their preschool education systems following the collapse of the USSR. While efforts have been made to improve access and quality through initiatives like the Educational Sector Plan (ESP) in Uzbekistan and PPP in Kyrgyzstan, disparities persist, highlighting the need for ongoing reforms. Similarly, countries like Azerbaijan and Georgia are struggling with issues related to access,

funding, and staff shortages in their preschool education systems. Efforts to address these challenges include legislative reforms, public-private partnerships, and initiatives to enhance parental involvement and community engagement. In contrast, countries like the Estonia, and Poland have made strides in providing comprehensive preschool education programmes, although disparities still exist in access and quality. These countries have implemented various policies and initiatives to promote child development, support parental employment, and ensure equitable access to preschool education for all children. Overall, the literature underscores the importance of preschool education in laying the foundation for lifelong learning and development. While progress has been made in expanding access and improving quality, ongoing efforts are needed to address persistent challenges and ensure that all children have access to high-quality preschool education regardless of their background or circumstances.

Qualitative study. In the second stage, research delved into the multifaceted landscape of preschool education in Georgia, exploring various dimensions ranging from the perceived importance of early childhood education to the challenges encountered in specific regions. One of the central focuses was to understand the factors contributing to non-enrolment in preschool programmes, shedding light on the complexities surrounding access and participation. Moreover, the study scrutinised the distribution of responsibility for addressing these challenges, probing into stakeholders’ awareness of PPP as potential avenues for improvement. It also examined individuals’ beliefs in their personal capacity to effect change and their willingness to actively engage in initiatives aimed at enhancing preschool education accessibility and quality. Through thematic analysis, the research unearthed rich narratives that encompassed participants’ expressions of ideas and suggestions for advancing preschool education. These insights, coupled with the relevant international research findings, paved the way for further exploration and collaboration, ensuring a comprehensive understanding of the issues at hand and fostering avenues for constructive action.

The reports from the National Statistics Office of Georgia are not always accurate, but regional municipalities in Georgia are cooperative and open to collaboration. All interviewed representatives of the Kindergarten Union hold higher education qualifications. Additionally, all respondents believe that preschool education is important, with one educator stating, “Because the kindergarten is the foundation of education”, and a parent expressing, “Because the child’s skills develop better in kindergartens”. Regarding the accuracy of reports from the National Statistics Office of Georgia, findings indicate occasional discrepancies, can be explained and potentially influenced by factors such as migration patterns (Migration profile of Georgia, 2019). This underscores the importance of cross-referencing data and conducting localised studies to complement national statistics. Positive findings emerged concerning the cooperation of regional municipalities in Georgia,

which were found to be receptive to collaboration. This suggests a favourable environment for implementing initiatives aimed at enhancing preschool education, as local authority cooperation is crucial for their success.

Issues such as inadequate support for children with special needs and a shortage of qualified teachers exacerbate the situation. Additionally, the lack of kindergarten facilities meeting quality standards, coupled with concerns about teacher qualifications, underscores systemic challenges. Participants express frustration with the state's perceived failure to address these issues adequately, citing unfavourable conditions in kindergarten facilities and concerns about disease transmission. The prevailing belief among participants is that the state holds the primary responsibility for addressing preschool education challenges. Many suggest that the state can address these issues by constructing new facilities and increasing funding. For example, two of them stated, "The Ministry should take responsibility for the educational process, with both local and central governments responsible for infrastructure. It is also crucial to raise the salary of parents who send their children to kindergarten". However, only a few participants, three to be exact, emphasised the importance of civil society involvement, specifically mentioning "Peoples' activity" – parents of children who do not attend kindergarten. Representatives of kindergarten associations and employees commonly attribute challenges to a lack of funds. Some express optimism that the situation will improve over time, citing factors such as "The time factor". Others believe that issues stem from a lack of children attending kindergartens or insufficient attention to village development. Additionally, some parents suggest that kindergartens should be built according to modern standards and coping with these preschool educational challenges, by their opinion is only state responsibility.

This finding indicates that the majority of participants hold the view that it is primarily the responsibility of the state to tackle the challenges present in preschool education. They believe that the state should take the lead in funding initiatives such as building new facilities and providing greater financial support to improve the preschool education system. In other words, participants expect the government to play a central role in addressing the issues and providing the necessary resources for enhancing preschool education. According to the United Nations (2020) and J. Alessio's (2011) explanation for this may be, the fact, that in societies that are less developed or in the process of transitioning, people often look to the government more for essential services and tackling societal problems. This reliance stems from factors such as scarce resources, inadequate infrastructure, and limited institutional capabilities within society.

Awareness of PPP: while 89.4% of participants are aware of alternative forms of education delivery, very few have knowledge of existing public-private cooperation practices aimed at enhancing the quality of education. Belief in personal contribution: all participants express

confidence in their potential to contribute to enhancing preschool education. They believe that collective involvement is crucial for achieving the goal. A representative of the association of municipal kindergartens emphasises the importance of everyone's participation, while parents highlight the impact of individual engagement in addressing specific concerns. The majority believe in the significance of their role in overcoming preschool education challenges within their community. A staggering 97.3% express their willingness to actively participate in addressing these challenges in their community or village, but without clarification, exactly what they can do or what they should prioritise remain unclear.

The limited awareness about public-private cooperation practices can be explained by factors such as lack of direct exposure, absence of political emphasis, and perceived relevance (Lam & Yang, 2020). It is important to address these factors to raise awareness and implement effective public-private collaboration practices in society, which would be known (Devidze, 2020). Despite uncertainties about effective engagement methods, participants demonstrated a strong willingness to contribute to preschool education improvement. This suggests opportunities for capacity-building initiatives and community-driven interventions utilising local resources and expertise (Ramanadhan *et al.*, 2021).

Willingness to engage: participants' readiness to participate in improving preschool education, considering factors like transportation, time availability, and financial constraints. While expressing a desire to contribute, some participants feel unsure about how they can effectively engage. Despite this uncertainty, all participants express their willingness to get involved. For instance, one parent stated, "I do not remember now, but I will definitely be able to pitch in as needed". Another parent, residing in Khashuri and unable to enrol their child in kindergarten, expressed a willingness to provide material resources and financial support to facilitate educational activities. Additionally, a parent mentioned being available to alternate with others weekly to contribute to the education of preschool-aged children. A parent of a preschool-aged child residing in Khashuri, whose child is unable to attend kindergarten, expressed interest in sourcing material resources and funding to establish or support a venue for educational activities. Having own visions and motivations can help parents feel necessary and regain a sense of control over their children's lives. Additionally, it highlights the importance of this approach as a positive step towards initiating collaboration with community representatives. This collaboration can further support families and enhance the well-being of children by leveraging the insights and expertise of community members. Overall, it emphasises the significance of involving parents and communities in decisions that impact children's lives (An alternative education..., 2023).

Expression of ideas and contact information: only a small number of participants provided contact information, particularly in regions where there is existing cooperation experience with community and non-government

tal organisations, and those who have heard about PPP. Limited provision of contact information indicated varying engagement and awareness levels among participants, with regions familiar with PPP initiatives exhibiting higher contact provision rates. While participants express willingness to contribute and engage in improving preschool education, there is uncertainty or hesitation about the most effective ways to organise or facilitate this involvement. They may lack clarity on how to channel their readiness into concrete actions or initiatives effectively. This underlines the importance of targeted outreach and information dissemination strategies (Mukherji & Deborah, 2009; An alternative education..., 2023).

Cost-effective alternative preschool education through PPP model be understood in different ways (Naudeau *et al.*, 2011). This includes: cooperation, privatisation, deregulation, and more broader frameworks, where: cooperation means – partner contracts and includes responsibilities of two or three sides; decentralisation means – privatisation by concrete sides and there is necessary be taken in to account finances and management opportunities of these sides and various community-based services – where funding is covered by state, or independent party; social service providing may be managed by society, finances covered by others and supervised by state. These services may be funded by some companies or private persons.

CONCLUSIONS

The study found that despite widespread recognition of preschool education's importance, challenges exist in some regions, including limited kindergarten access and concerns about teacher qualifications. Participants mainly see the state as responsible for addressing these challenges, suggesting solutions such as constructing new facilities and increasing funding. However, there is less focus on civil society involvement, highlighting the importance of community participation. While there is limited awareness of

public-private cooperation practices and alternative education models, participants are willing to contribute to improving preschool education. However, there is uncertainty regarding effective engagement methods. Overall, the study underscores the necessity of collaborative efforts to address Georgia's preschool education challenges, by implementing and supporting PPP practice. In conclusion, the study assumes that respondents have readiness to involve, but do not know how to organise this. This underscores the importance of providing guidance, resources, and support to help individuals translate their willingness into meaningful engagement and participation in preschool education initiatives.

Based on these conclusions, several recommendations emerge: enhance collaboration, increase awareness, prioritise civil society involvement: encourage greater involvement of civil society in preschool education initiatives, recognising their potential to complement state efforts and provide innovative solutions, facilitate engagement, establish precedents and support initiatives like the "Gare-Gare" outdoor education hub and "Future Club" to create precedents for inclusive and cost-effective approaches to preschool education. This indicates a call for further research on the effectiveness of implemented strategies, understanding barriers to engagement, exploration of civil society models, assessment of long-term sustainability, and evaluation of innovative approaches in preschool education. By implementing these recommendations, Georgia can take significant strides towards improving its preschool education system and ensuring every child has access to quality early childhood education.

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CONFLICT OF INTEREST

None.

REFERENCES

- [1] Alessio, J. (2011). *Social problems and inequality: Social responsibility through progressive sociology*. London: Routledge. doi: 10.4324/9781315609591.
- [2] Ali, S., Bhutta, S.M., Ahmad, S., Ansari, A.N., Ahmed, A., & Qadir, Y. (2024). PROTOCOL: Effectiveness of public-private partnerships on educational access and quality of primary and secondary schooling in low- and middle-income countries: A systematic review. *Campbell Systematic Reviews*, 20(2), article number e1385. doi: 10.1002/cl2.1385.
- [3] An alternative education? Support for our most disengaged young people. (2023). Retrieved from <https://evidence.ero.govt.nz/documents/an-alternative-education-support-for-our-most-disengaged-young-people#read-online>.
- [4] Bertrain, T., & Pascal, C. (2016). *Early childhood policies and systems in eight countries findings from IEA's early childhood education study*. Hamburg: ECES International Study Center.
- [5] Birtvelashvili, L. (2024). "Future Club" was created on the basis of Tsromi Kindergarten. Retrieved from <https://mozaikanews.ge/2023/04/05/%E1%83%AC%E1%83%A0%E1%83%9D%E1%83%9B%E1%83%98%E1%83%A1-%E1%83%A1%E1%83%90%E1%83%91%E1%83%90%E1%83%95%E1%83%A8%E1%83%9D-%E1%83%91%E1%83%90%E1%83%A6%E1%83%98%E1%83%A1-%E1%83%91%E1%83%90%E1%83%96/>.
- [6] Builasheva, S. (2014). *Social constructions of early childhood care and education in the Kyrgyz Republic: Before and after independence*. (Master thesis, University of Oslo, Oslo, Norway).
- [7] Bunebare. (n.d.). Retrieved from <https://bunebare.com/>.
- [8] Child wellbeing in Georgia. (2023). Retrieved from <https://www.unicef.org/georgia/reports/child-wellbeing-georgia-2023>.

- [9] Children and adolescents. (2023). Retrieved from <https://www.geostat.ge/ka>.
- [10] Chou, J.-S., Tserng, H.P., Lin, Ch., & Huang, W.-H. (2015). Strategic governance for modeling institutional framework of public-private partnerships. *Cities*, 42, 204-211. doi: 10.1016/j.cities.2014.07.003.
- [11] Civitas Georgika. (2012). *Alternative education for the empowerment of local communities and rural territories*. Warsaw: Ministry of Foreign Affairs of the Republic of Poland.
- [12] Declaration of Helsinki. (2013). Retrieved from <https://www.wma.net/what-we-do/medical-ethics/declaration-of-helsinki/>.
- [13] Devidze, N. (2020). *Public-private partnerships in Georgia and impact assessment of infrastructure*. Tokyo: Asian Development Bank Institute.
- [14] Giunipero, R. (2021). *Public-private partnerships for skills development: A governance perspective*. Torino: European Training Foundation.
- [15] Jachowicz, A. (2016). *The effectiveness of public-private partnership in Poland*. *Entrepreneurship and Management*, 17(9), 87-99.
- [16] Kekelia, M., & Kitoshvili, N. (2023). *The challenges of preschool education and the need for alternative education*. In *International aegean conferences on social sciences & humanities-VII* (pp. 534-547). Izmir: IKSAD Global Publications.
- [17] Kyrgyzstan promotes USD 1.2 billion public-private partnerships project pipeline. (2022). Retrieved from <https://unece.org/circular-economy/news/kyrgyzstan-promotes-usd-12-billion-public-private-partnerships-project>.
- [18] Lam, P.T.I., & Yang, W. (2020). Factors influencing the consideration of public-private partnerships (PPP) for smart city projects: Evidence from Hong Kong. *Cities*, 99, article number 102606. doi: 10.1016/j.cities.2020.102606.
- [19] McCormack, M. (2018). *Snapshot: Preschool education in the Kyrgyz Republic: Context, costs, and legal framework*. Bishkek: Public Foundation "For Families".
- [20] Migration profile of Georgia. (2019). Retrieved from https://migration.commission.ge/files/mp19_eng_web3.pdf.
- [21] Mukherji, P., & Deborah, A. (2009). *Research methods in early childhood: An introductory guide*. London: SAGE Publications.
- [22] Naudeau, S., Kataoka, N., Valerio, A., Neuman, M.J., & Elder, L.K. (2011). *An early childhood development guide for policy dialogue and project preparation*. Washington: The World Bank. doi: 10.1596/978-0-8213-8526-5.
- [23] Okrasa, M. (2010). *Alternative forms of pre-school education as a criterion improving the quality of education in Poland*. *Problems of Education in the 21st Century*, 20(1), 109-114.
- [24] PPP agency in Georgia. (2019). Retrieved from <https://ppp.gov.ge/en/homepage/mission/>.
- [25] Preschool education: Early childhood education is crucial for every child. (n.d.). Retrieved from <https://www.unicef.org/georgia/preschool-education>.
- [26] Preschools in Poland. (2023). Retrieved from <https://www.ourkids.net/pl-en/>.
- [27] Putcha, V., Neuman, M., Zaplotynska, O., & Sofiy, N. (2018). *Supporting the early childhood workforce at scale: Preschool education in Ukraine*. Washington: Results for Development Institute.
- [28] Radsky, V., & Mikayilova, U. (2023). Exploring public-private partnership in preschool education provision: Potential for socio-economic development. *Khazar Journal of Humanities and Science*, 16(4), 5-25. doi: 10.5782/2223-2621.2013.16.4.5.
- [29] Ramanadhan, S., Galbraith-Gyan, K., Revette, A., Foti, A., Rackard James, C., Martinez-Dominguez, V., Miller, E., Tappin, J., Tracy, N., Bruff, C., Donaldson, S.T., Minsky, S., Sempasa, D., Siqueira, C., & Viswanath, K. (2021). Key considerations for designing capacity-building interventions to support evidence-based programming in underserved communities: A qualitative exploration. *Translational Behavioral Medicine*, 11(2), 452-461. doi: 10.1093/tbm/ibz177.
- [30] Sankar, D. (2021). *Uzbekistan education sector analysis: 2021*. Tashkent: UNICEF for Every Child.
- [31] The process of authorisation of kindergartens has been delayed for 9 years – when will it start and what is the authorisation plan. (2021). Retrieved from <https://edu.aris.ge/news/sabavshvo-bagebis-avtorizaciis-procesma-9-wlit-gadaiwia-rodis-daiwyeba-procesi-da-rogoria-gegma.html>.
- [32] These school buses double as mobile preschools in remote areas. (2022). Retrieved from <https://www.fastcompany.com/90750739/these-school-buses-double-as-mobile-preschools-in-remote-areas>.
- [33] Towards achieving universal early childhood education in the Republic of Uzbekistan. (2022). Retrieved from [https://www.unicef.org/uzbekistan/media/5046/file/Brief%20on%20ECE%20results%20\(eng\).pdf](https://www.unicef.org/uzbekistan/media/5046/file/Brief%20on%20ECE%20results%20(eng).pdf).
- [34] UNESCO. (2011). *International standard classification of education*. Montreal: UNESCO Institute for Statistics.
- [35] UNICEF. (2012). *Investing in early childhood education in Serbia*. Belgrade: UNICEF Country Office for Serbia.
- [36] United Nations. (2020). *Recovering better: Economic and social challenges and opportunities*. New York: Department of Economic and Social Affairs of United Nations.
- [37] Vandekerckhove, A., Trikić, Z., Miskeljin, L., Peeters, J., Lakicevic, O., & Koruga, D. (2013). *Manual for diversification of programs for pre-school education*. Belgrade: Ministry of Promotion, Science and Technology Development.

- [38] Zhang, M., Liu, Y., & Cheng, J. (2019). International experience and reference of PPP model in inclusive preschool education. *Advances in Social Science, Education and Humanities Research*, 371, 147-152. doi: [10.2991/assehr.k.191206.030](https://doi.org/10.2991/assehr.k.191206.030).

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Вивчення альтернативних методів дошкільної освіти в Грузії: покращення доступності

Анотація. Це дослідження є актуальним, оскільки розглядає державно-приватне партнерство у сфері дошкільної освіти в Грузії, шукаючи шляхи вирішення значних освітніх проблем, спільних для пострадянських регіонів. Воно оцінює придатність альтернативних освітніх моделей у суспільстві, яке все ще бореться з інфраструктурною спадщиною радянського минулого, надаючи цінні рекомендації щодо політичних реформ, необхідних для розширення доступу до дошкільної освіти та підвищення її якості. Метою дослідження було оцінити готовність грузинського суспільства до впровадження альтернативних освітніх практик. Спираючись на досвід пострадянських країн, а також на міжнародний досвід і місцеві перспективи, дослідження має на меті надати всебічне розуміння доцільності та ефективності альтернативних моделей у Грузії. Використовуючи змішаний підхід, що включає якісні інтерв'ю, опитування та аналіз даних, дослідження вивчає сильні сторони, виклики та перспективи впровадження різних альтернативних моделей в унікальному соціально-економічному та культурному контексті пострадянської Грузії. Дошкільна освіта у пострадянських та схожих країнах стикається зі спільними проблемами доступу та якості, незважаючи на різні політики, що включають законодавчі заходи та державно-приватне партнерство, спрямовані на подолання фінансових та географічних бар'єрів. Постійні розбіжності в системах дошкільної освіти в регіоні, про що свідчать реформаторські ініціативи та кадрові проблеми в Грузії, підкреслюють необхідність безперервних реформ. Ці фактори підкреслюють важливість постійних політичних зусиль, спрямованих на підтримку комплексних та ефективних середовищ раннього навчання. Результати дослідження підкреслюють нагальну потребу в альтернативних шляхах освіти в Грузії, особливо в регіонах, які стикаються з інфраструктурними та географічними бар'єрами, подібними до тих, що існують в інших пострадянських країнах. Висвітлюючи потенційні переваги моделей публічно-приватного партнерства, дослідження також визначає ключові проблеми, які необхідно вирішити для забезпечення їх успішної реалізації в пострадянському контексті. Практична цінність цієї роботи поширюється на політиків, освітян і громади в пострадянських країнах, які стикаються зі схожими освітніми проблемами. Пропагуючи законодавчі реформи, спрямовані на впровадження альтернативних підходів, це дослідження робить внесок у постійні зусилля, спрямовані на зміцнення дошкільної освіти та просування інклюзивності в пострадянській Грузії та за її межами

Ключові слова: дошкільна освіта; розширення можливостей дошкільної освіти; просування дошкільного розвитку; нові стратегії дошкільної освіти; розширення доступу до дошкільної освіти

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Training of future primary school and computer science teachers in the structure of information systems

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Abstract. The active renewal of teacher education is driven by the contradiction between the need for new specialists and the lack of a clear strategy for modernising the educational process. The purpose of this study was to highlight all aspects of the process of training future primary school and computer science teachers to implement digital systems in conjunction with pedagogical conditions. The study employed such research methods as comparison, synthesis, observation, analysis, and abstraction. The key findings suggest that Ukraine is undergoing educational reforms aimed at updating the content and improving teaching and learning methods. The study covered the objectives, content, methods, forms, means of teaching the discipline "Computer Science (Structure and Main Components of Information Systems)" studied by future primary school and computer science teachers who undergo their professional training in the educational programmes 013 "Primary Education and Computer Science", 014 "Secondary Education (Labour Training and Technologies. Computer Science)" at Oleksandr Dovzhenko Hlukhiv National Pedagogical University. The study analysed the latest publications on the subject matter of the study. Based on the analysis of the possibilities and concrete potentials of using information technologies, the expediency of their introduction into personal and professional development of future primary school specialists was determined, the principal conditions for their use and for the developed teacher in the educational information system were highlighted. The study highlighted the content of classes aimed at developing information and communication skills and other key competences of future primary school and computer science teachers in studying the subject "Computer Science (Structure and main components of information systems)". The conclusions of this study state that the methodological recommendations for the organisation of practical classes in the course provide pedagogical

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support to teachers and contribute to the creation of a favourable learning and cognitive atmosphere during training. The practical significance of this study is to build a qualitative model that aims to improve the training future primary school and computer science teachers to implement digital systems in conjunction with pedagogical conditions

Keywords: information and communication competence; IT system; primary education personnel training; data processing; training model

INTRODUCTION

In the context of rapid development of the global information infrastructure, digital technologies play a major role in the advancement of Ukraine's socio-economic environment. Digital transformation, globalisation, and absence of information barriers between countries contribute to the active implementation of the latest scientific and technical achievements in the field of information and communication in education. Computers have become essential tools in all key areas of human activity, and therefore modern pedagogical specialists must be oriented in this rapid information flow. Notably, primary school is undergoing considerable changes, one of the main reasons for which is the introduction of digital technologies into the educational process. This creates opportunities to improve the level and quality of students' knowledge, as well as to develop modern skills and competences, such as information and digital ones, and those related to foreign languages and entrepreneurship.

The introduction of innovative teaching methods is becoming increasingly necessary thanks to the latest technologies. The use of these technologies in primary schools not only contributes to the success of Ukraine's new schools, but also makes learning more flexible and personalised. This gives teachers new opportunities to interact with their students and enjoy an exciting learning experience (Ihnatenko, 2023). Even though the topic of training future primary school teachers and computer science is widely studied and discussed by researchers in different countries, there are still issues that need to be addressed. G. Nugent *et al.* (2022) discusses a professional development (PD) program for elementary school teachers to improve their computer science (CS) knowledge and skills. Teaching a high-level programming language, merging CS topic and pedagogy education, and enlisting experienced K-12 CS teachers and university faculty as instructors were important components of the curriculum. T. Holovatenko (2023) emphasises the value of mobile learning in teaching digital natives in primary school at the same time. The researcher offers a range of mobile-device-based activities that support visual and digital literacies while encouraging student autonomy, teamwork, and critical thinking. These activities include the use of images, audio, and QR codes. According to K. Kim & K. Kwon (2023), teachers felt least confident about their subject understanding, with technological and pedagogical expertise of artificial intelligence coming in close second. Five

major themes in AI education were found from interviews with thirteen teachers: emphasising instructional design, revamping the classroom, lowering anxiety levels among educators, growing computer science-based AI education, and developing a literate understanding of data, code, AI technology, and moral dilemmas. According to S. Sularso *et al.* (2024), the use of computer music technology in the classroom has had a wide range of effects on teaching strategies, classroom dynamics, and student learning. The shift in classroom dynamics, characterised by increased collaboration among students and personalised instruction, demonstrates how technology can transform music education. Early results from a research involving four elementary-level teachers who took part in a collaborative professional development program in addition to a seven-lesson computer science instructional unit were given by C. Stephens *et al.* (2021). The findings indicate that the collaborative PD and expansive framing approach were effective in supporting elementary teachers' understanding and implementation of the CS instructional unit. M. Bers (2021) and S. Alhazbi (2023) note that all primary school teachers should specialise in computer technology. Accordingly, more support is needed in terms of improving the pedagogical content of education and knowledge about information systems. L. Kindei *et al.* (2022) agree that successful training of future teachers in modern conditions has a substantial impact on informatisation of the educational process and focuses on the active use of information technology tools.

There are also scientific studies that point to the insufficient level of scientific teaching, the lack of experimental nature of teaching new information and communication technologies (ICTs). G. Nugent *et al.* (2022) notes that modern teachers are insufficiently prepared in scientific and pedagogical terms, and there is a need to focus on high-level competences needed to solve practical problems or to apply scientific knowledge in everyday situations. At the same time, Y. Xiang *et al.* (2021) note that information systems are currently developing rapidly, specifically in the areas of mobile technology, the Internet of Things, and artificial intelligence. S. Sularso *et al.* (2024) further explore this idea, finding that digital pedagogical systems that use interactive software, collaborative projects, gamified learning experiences and, accordingly, allow each higher education student to take an active part in learning, creating a dynamic and inclusive environment. All this requires

constant reform of the content and methodological techniques for training future primary school specialists.

I. Storjak *et al.* (2022) helped to conceptualise how the interaction of digital technology, artificial intelligence (AI), and programming can help educators avoid inconsistent experiences. The most successful educational tools for working with students should be highlighted. In line with this, a pilot study on the use of AI by E. Southgate *et al.* (2022) showed that the creation of educational content for younger students by future primary school teachers had a considerable potential for positive learning outcomes, but only if time and organisational constraints were eliminated. N.V. Olefirenko *et al.* (2020) point out the need to constantly update the system of teaching information technology skills in educational institutions. This is a common concern for scientists and businesses in many industries. The content level includes the integration and development of courses and projects, improving the quality of the learning process, collecting and selecting high-quality learning resources, managing and creating learning environments inside and outside the educational institution, and creating a multidimensional assessment system.

The purpose of this study was to highlight the problems of training future primary school and computer science teachers studying under the educational programmes 013 “Primary Education and Computer Science”, 014 “Secondary Education (Labour Training and Technology. Computer Science)” in the structure of information systems. In line with this purpose, the following tasks were identified:

- to cover the theoretical information on the methodology of teaching the features of information systems;
- to identify the structure, principles of operation, characteristics of the hardware components of a personal computer;
- to provide methodological recommendations for the organisation of practical classes in the course “Computer Science (Structure and Main Components of Information Systems)”.

MATERIALS AND METHODS

The analysis of the curricula for bachelors majoring in Primary Education at Oleksandr Dovzhenko Hlukhiv National Pedagogical University at the beginning of the study reflects a wide range of professionally oriented disciplines, as well as skills in the subject application of ICT, which can develop information and communication competence as a key one. Scientific research, analysis of the Single treasury account (n.d.), Bachelor of Primary Education programmes, the new edition of the State Standard of Primary Education, surveys of teachers and university experience have revealed the need to improve a range of components of the system of training future primary school teachers (Ihnatenko, 2023). The study analysed regulations, including Law of Ukraine No. 1556-VII “On Higher Education” (2014), Resolution of the Cabinet of Ministers of Ukraine No. 87-2018-p “On Approval of the State Standard of Primary Education” (2018), Order of the Ministry of Economic Develop-

ment, Trade and Rural Affairs of Ukraine No. 2736-20 “On Approval of the Professional Standard for the Professions of Primary School Teacher of a General Secondary Education Institution, Teacher of a General Secondary Education Institution, Teacher of Primary Education (With a Junior Specialist Diploma)” (2020).

According to preschool and primary education and based on the analysis of scientific literature, results of international research and teaching practice, a model of primary school teachers’ training for teaching future primary school teachers and computer science teachers the structure of information systems was developed. The model covers all stages of the educational process at universities, including the use of information and communication technologies, and forms an integral part of this process. Nevertheless, as already mentioned, old approaches to the use of ICTs no longer have the psychological and pedagogical features that are necessary for modern students and do not meet important educational expectations. Accordingly, new requirements and developments of modern courses are being put forward.

The model includes the following steps:

- subject – a set of knowledge, skills and abilities related to the subject content of the Steps to Informatisation course. The following competences are particularly important: a set of methodological, didactic skills, and knowledge of the relevant parts and topics of the subject; experience in applying certain stages of learning in practice; ability to effectively solve problematic and standard methodological tasks;
- students’ ability to organise the use of ICT;
- self-education is a personality quality of a successful teacher that develops competences and is characterised by readiness for continuous professional education. This is crucial in the context of the continuous and rapid development of ICT and the continuity of the vocational education system.

In the presented model, the methodological system of training future primary school teachers to teach the fundamentals of digital technologies is considered as a set of basic means and goals of education, methods, content, forms that allow applying the selected content and achieving the designated purpose. To formulate the system of competences necessary for teaching students the basics of information and communication technologies, the educational and qualification requirements for primary school teachers were analysed (Holovatenko, 2023), the learning objectives were defined, the methodology for selecting the content of learning is described, and the methods, forms, and means of learning were identified.

Therefore, the choice of research methodology was aimed at identifying the most complete and objective characteristics of the problem under study in terms of quality training of future primary school and computer science teachers in the structure of information systems. Generally, it is believed that the combination of materials and methods underlying the methodology of this study is optimised in terms of achieving its objectives and can be effectively used in the learning process.

RESULTS

In the context of informatised education, to adapt to the needs of society, the implementation of conventional learning requirements requires the prerequisites of scientificity, visibility, accessibility, problematic nature, systematic, and sequential learning, activity. The consciousness of students in the educational process, the intensity of knowledge acquisition, the development of education and training, and the integration of educational functions have reached a new level. These requirements can be well fulfilled by involving knowledge-based information systems in the learning process.

The use of information technology in the training of real professionals is defined as an integrated approach to identifying the basics, creating and implementing learning processes involving people, tools, methods aimed at motivated, active work (Sapanca *et al.*, 2022). The task of higher education teachers is to provide consultations and identify prospects for the use of relevant technologies, and the task of future primary school teachers is to acknowledge the need to acquire skills, knowledge, and successfully apply them in their practical work. The use of ICT in the organisation of primary school teachers' professional activities has two aspects. The first one is related to the use of ICT tools for organising teacher's professional activity at all stages of lesson creation and delivery, the second one is the use of new tools for organising teacher's extracurricular professional activity (creation of teaching and learning materials for students, creation of structure and organisation); for materials for teachers (Morse, 2004; Morais *et al.*, 2005).

Resolution of the Cabinet of Ministers of Ukraine No. 87-2018-p (2018) in Ukraine defines IT education as one of the key areas in the curriculum of a modern school and sets clear requirements for the mandatory learning outcomes and competences of students. The main purpose of this field is to develop information and communication competencies and key skills necessary for solving problems using digital devices and ICT. It promotes personal growth, creative expression, as well as personal and social well-being, and develops skills of safe and ethical behaviour in the information society.

The stages of training future primary school teachers include the use of digital tools in teaching primary school children, description and analysis of successful curricula and relevant software and methodological support (Kager & Marinšek, 2023). Higher education teachers should draw the attention of future primary school teachers to the fact that, at the heart of teaching, everyone must adapt to the

conditions of particular software and hardware, considering the primary school curriculum, younger students, and their developmental levels. It is necessary to guide students through a systematic analysis of the curriculum, which is explained by the fact that they need to clearly understand the status and role of a particular curriculum in the entire structure of education. Proceeding from the principles of analysing the methodological framework and content of computer science courses, it is impossible not to draw the attention of higher education students to their multidimensionality (Huang & Meng, 2022). Forming in their minds a vision of the triple goals of the processes of education, training and development of individuals is considered an essential stage of preparation for practical work. The training is mainly about spreading the basic concepts of computer science (information, algorithms) and developing project management skills, as well as the factual areas in which children receive (consolidation, repetition) of knowledge in other subjects (digital skills, number composition, word grammar analysis) in each lesson.

The discipline "Computer Science (Structure and Main Components of Information Systems)" provides information on digital technology, the structure of modern personal computers, peripherals, computer networks, preparation of presentations, organisation of group work using online services, organisation of video conferences with the introduction of distance learning. Future specialists are provided with expert support. The effectiveness of training future professionals depends on a range of factors, including the reliability of the equipment and software used, the interests of students, their ability to use remote information resources, computer skills, and motivation to use digital learning tools (Law of Ukraine No. 1556-VII, 2014). The use of digital learning tools by primary school teachers in the educational process is conditioned by the current level of education in primary general education and the principles of the New Ukrainian School (NUS). This is reflected in the professional standards for teachers, which emphasise the reasonable use of digital tools "according to the needs and objectives of professional activity". It is noted that the use of digital learning tools should not only be dominant, but also auxiliary and must be combined with other teaching methods and forms of education (Order of the Ministry of Economic Development, Trade and Rural Affairs of Ukraine No. 2736-20, 2020). The analysis of the elements of information and communication technologies in educational activities is presented in Table 1.

Table 1. ICT elements of primary school teachers' readiness to teach the fundamentals of computer science

ICT elements							
Methodological		Theoretical		Psychological		Practical	
Specialised knowledge	Psychological and pedagogical skills	Knowledge system in information disciplines	Motivational (emotional and volitional, and goal-oriented)	Orientation-based	Evaluation and result-based	Creative	Content and operational-based

Source: compiled by the authors

The introduction of the educational process and the constant use of knowledge-intensive information systems in it to assess the quality of mastering the set goals, their creation and production requires certain changes in the educational process, namely:

- teachers as expert consultants in the educational process;
- transferring part of the training materials to students for self-study;
- development of educational and methodological complexes considering the specifics of knowledge-intensive information systems for educational purposes;
- gradual abandonment of the conventional form of control and introduction of the role of individual indicators of accumulation, milestones, and current;
- final analysis of the acquisition of skills and knowledge.

Particular attention should be paid to the use of knowledge-based information systems to implement adaptive learning management. Thus, in the modern sense and in a broader sense, adaptation means not only the ability to adapt to function successfully in a certain environment, but also the ability to further develop psychological, personal, and social abilities in this environment. When creating an adaptive educational environment, it is also important to adapt to the conditions of the internal environment, i.e., the intellectual, emotional, evaluative, and behavioural spheres of each person involved in the educational process. However, a crucial feature of adaptability is the development of the ability to improve oneself, considering one's age, internal resources, and abilities. The introduction of the concepts of adaptive management of the educational system, based mainly on the provisions of modern theoretical

foundations of management and psychotherapy, provides prospects for transformation from a dogmatic and authoritarian educational system to the creation of a favourable educational system.

The training of applicants for education in the speciality of primary education and computer science is carried out under the educational programme 013 "Primary Education and Computer Science". As a result of its successful completion, students receive the following qualification: "Bachelor of Primary Education. Primary school teacher at a general secondary education institution. Primary school computer science teacher at a general secondary education institution". Future teachers of computer science are also trained at the first (bachelor's) level of higher education in the speciality 014 "Secondary Education (Vocational Training and Technology)", field of knowledge 01 Education/Pedagogy under the educational programme "Secondary Education (Vocational Training and Technology. Computer Science)". As a result of its completion, students receive a qualification: "Bachelor of Secondary Education (Vocational Education and Technology)". Students majoring in Primary Education and Computer Science consider the structure of information systems when studying the course "Computer Science (Structure and Main Components of Information Systems)", which is a mandatory component of these educational programmes, and which is allocated 4 credits of the European Credit Transfer and Accumulation System (ECTS). The above-mentioned educational programmes require the use of an improved educational model that defines the stages of the educational process in higher education institutions based on the use of ICT, which is ultimately a necessary part of this process (Fig. 1).

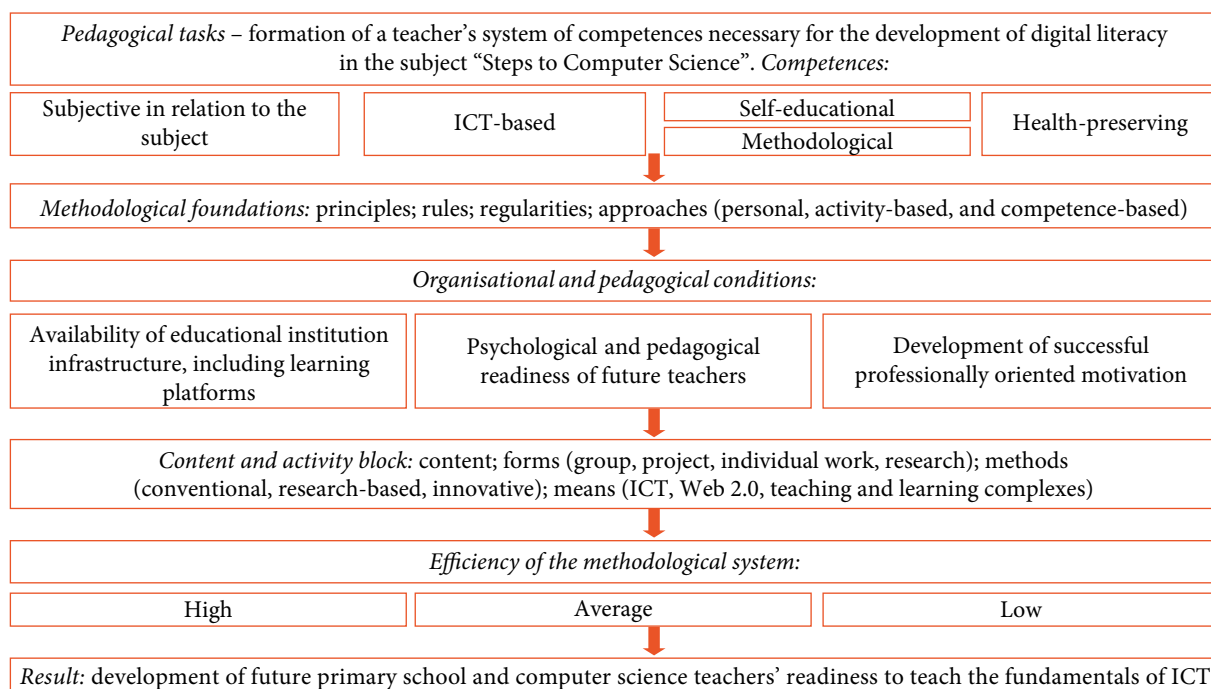


Figure 1. A model for preparing future primary school teachers for teaching fundamentals of information and communication technologies

Source: compiled by the authors

After studying the discipline “Computer Science (Structure and Main Components of Information Systems)”, future teachers should master the following: understanding of the concept of an information system, their types and main characteristics; knowledge of the architecture of a personal computer and the principles of its operation; ability to apply the acquired knowledge in further professional activities; information on the types of computer networks and the principles of their construction; understanding of the structure of a personal computer (PC), its main characteristics and functional purpose of its components (central processor, motherboard, RAM, storage devices, input and output devices).

Upon completion of the educational components, each applicant should acquire the following general competences: nationhood (liberal democracy) is the ability to understand the values of society and the need for its continuous development, to recognise the rule of law, human and civil rights and freedoms, and to exercise one’s responsibilities and rights as a member of society; to multiply and preserve cultural, moral, and scientific achievements, achievements of society based on an understanding of historical periods and patterns of development of the subject area, its place in the general system of knowledge about society and nature, as well as its place in social, technical and technological development; introduction of relevant forms and types of physical activity for a healthy lifestyle; assessing and ensuring the quality of work performed; work in teams; finding, solving, or formulating problems; searching, processing, and analysing certain information from various sources; practice in a socially conscious and responsible manner; work following ethical considerations.

In organising the educational process, preference is given to innovative forms of classes and methods of teaching, learning, and assessment. According to the Order of the Ministry of Economic Development, Trade and Rural Affairs of Ukraine No. 2736-20 (2020) and Resolution of the Cabinet of Ministers of Ukraine No. 87-2018-p (2018), innovations are changes or improvements that relate to competitive technologies, services, products, as well as organisational and technical solutions in production, administrative, commercial, or other areas of activity. These innovations are distinguished by their focus on substantially improving the quality and structure of production, as well as the social sphere. Research and innovation play a key role in developing the economy, enhancing the country’s competitiveness, and improving the quality of life.

A range of teaching methods are used to teach this discipline. Verbal methods: explanation: providing information in the form of verbal comments to help learners understand concepts or processes; narration: a teacher’s retelling of a story or material for the purpose of teaching; conversation: a discussion of a given topic between a teacher and students, aimed at active involvement of each; instruction: explaining procedures or rules for performing certain tasks. Visual methods: demonstration: showing real objects or processes to better understand the material; illustration: the use of images, diagrams, or charts to visualise concepts or information. Practical methods: observation:

the process of actively perceiving information through the observation of real situations; experiment: conducting controlled research to study certain phenomena or patterns; exercises: practical exercises or tasks aimed at consolidating knowledge and skills; practical work: an activity that includes practical skills and application of knowledge in a given area; work with information sources: searching, analysing, and using information from various sources for educational purposes; data analysis: processing and interpreting information to draw insights and conclusions.

The following types of evaluation are distinguished for monitoring and control. The oral form of assessment includes interviews, defence of laboratory works, presentations, and comments on the reference notes. These forms facilitate active interaction between the teacher and the student and allow assessing the level of understanding and comprehension of the material.

The written assessment method includes independent work according to the options, completion of an individual task, filling in a table, drafting a diagram, performing relevant exercises. These types of assessments allow assessing the degree of independence, understanding and comprehension of the material by the learner. The test form of assessment includes closed-question tests, matching tests, sequencing tests. These methods allow quickly and objectively assessing the level of mastery of particular knowledge and skills. Self-monitoring involves self-assessment of written work and other tasks. This method promotes active involvement of students in their own learning and development of self-regulation. The final control is carried out in the form of a test, which assesses the overall level of mastery of the educational material by the student and their readiness for further study or work in this field. The system of assessment of students’ learning achievements in the discipline “Computer Science (Structure and Main Components of Information Systems)” is based on competence-based approaches aimed at forming the relevant achievements of the programme learning outcome in the future specialist. This approach involves not only the acquisition of theoretical knowledge but also the development of practical skills necessary for successful professional activity.

The students’ academic achievements in this discipline are assessed using a module-rating system based on the principle of cooperative reporting. This means that the grade is formed not only based on a single exam or test, but also based on the results of various activities during the academic period, such as independent work, practical work, projects, and other assignments. Furthermore, the assessment system makes provision for mandatory module control, which makes it possible to systematically check the level of learning at each stage of learning. A cumulative system of assessment of the level of skills, knowledge, and abilities allows students to gradually improve their results and track their progress throughout the learning process. It is worth considering the basic theoretical information offered to students in the course “Computer Science (Structure and Main Components of Information Systems)”. The entire course is divided into 7 content modules, which include lectures, practical work, and independent work of the

student (Ihnatenko, 2022). During the first topic, students consider the concept of systems, information systems, their types and characteristics, history of development, examples of control systems, sign systems, ordinary languages as an example of a sign system, formal languages, programming languages. It is recommended that this material be studied in the form of a reference lecture and self-study material.

In the second lecture, students consider: a computer as an information system, the architecture of a personal computer, the functional diagram and principles of a modern computer. Basic concepts to be formed: computer as an information system, software interface, hardware interface, software, principles of computer operation, functional diagram, main-module principle of computer structure, principles of numerical data encoding, computer structural diagram, main components of computer hardware. The third topic is the structure, main characteristics, and functional purpose of the central processor, motherboard, and RAM. Key concepts: central processor, processor parameters, RAM, motherboard, ROM. The fourth topic is the structure and main characteristics of modern data storage devices. Key concepts: data storage media, punch cards, floppy disks and discs of various formats, hard disc drives, solid-state drives. The fifth topic is the structure, main characteristics, and functional purpose of information input devices. Key concepts: data input devices, keyboard, mouse, scanners of various types, microphones, game manipulators, graphics tablets, webcams. The sixth topic is the structure, main characteristics, and functional purpose of information output devices. Key concepts: monitors and their characteristics, types of matrices, printers and their types, multimedia projectors and their types. The final, seventh topic is computer networks, types and principles of construction. Key concepts: computer networks, their classification, technologies and equipment for organising computer networks, the Internet, data transfer protocols, modem operation, domain, domain zones. According to the theoretical information described above, students are offered to complete practical classes in the course "Computer Science (Structure and Basic Components of Information Systems)". The plan of each practical lesson consists of a topic, an objective, questions for discussion, a practical task, and test questions. Let us take a closer look at the methodology for conducting practical classes.

Topic of the practical session No. 1: "Computer central processing unit".

Purpose: To get to know the device "central processing unit". Consider the functional purpose, main types, and key characteristics of a computer's central processing unit.

Questions for discussion:

1. What is a computer's central processing unit?
2. The history of processor development.
3. Key features of processors.
4. World leaders in processor manufacturing.
5. Development prospects for processors.
6. Selecting a central processor depending on the task at hand.

Control questions:

1. What is computer architecture?
2. How do computer processors differ depending on the generation?
3. What are the main characteristics of computer processors?
4. What is the purpose of the computer processor cache?
5. What is a TCP processor?

The effectiveness of a computer science lesson depends on the correct selection of its type with a certain relevant structure of constituent elements. The choice of the form of teaching is influenced by the place of each lesson in the thematic logic of the subject, the purpose of the lesson, content, and tasks, age characteristics of students, students' experience. Today, there are the following types of lessons: introductory lessons (introduction to the topic), lessons on recognising the essence of the terminology of the topic and identifying important thematic patterns, lessons on repetition and generalisation, and practical lessons.

The lesson of acquiring new knowledge includes the acquisition of knowledge includes their perception, recognition, understanding of internal relations and dependencies of objects and phenomena, memorisation, generalisation, systematisation. Success in acquiring knowledge depends on the goals and motivation of the students and the teacher. With this in mind, this type of lesson includes the following elements: homework review, background knowledge, and review. The basis for designing the structure of such lessons is the pedagogical system of exercises and tasks, as well as their sequence, which contributes to the achievement of the educational purpose. Following the logic of the process, the lessons of mastering skills and abilities include repeating homework, using skills and abilities, applying new knowledge (test practice). This lesson involves independent application of knowledge in typical situations (diagrams, instructions, task-based training exercises) and creative transfer of knowledge and skills to new situations (creative exercises), lesson summary, homework assignment.

The lesson is designed to confirm knowledge, skills, and abilities. Depending on the purpose of the lesson, the content of the educational material, methods and means of teaching, the structure of this type of lesson varies. This knowledge, skills at various levels, from determining students' knowledge of factual material to formulating concepts to reveal a system of knowledge and applying this knowledge creatively in non-standard conditions, includes competence testing. In this approach, the structure of the lesson includes: a message about the topics, goals and objectives of the lessons, and motivation for learning. Combined lessons have several equivalent learning objectives, and the structure varies depending on which type of lesson and its components are combined. For instance, the structure of a learning unit that combines a review of what students have already learned. Furthermore, the acquisition of new knowledge may include communicating the topics, goals, and objectives of the unit, motivating learning,

review, assessment, reconstruction, modification of prior knowledge, recognition, understanding, generalisation, and systematisation of new knowledge, lesson summaries and homework assignments.

Therefore, in a competence-based methodological system, the training of a future computer science teacher includes revision of learning goals and objectives, considering the development of students' skills in different types of lessons, independent use of knowledge in professional activities at the level of established professional requirements and responsible performance of professional duties. The specificity of pedagogical activity and skills of primary school and computer science teachers, recognition of its social significance and personal responsibility for the results of this activity determine the continuity of the formation and development of professional abilities throughout life. In the context of distance learning, students are asked to prepare a report and develop a presentation on the issues discussed in preparation for practical classes. Students upload the prepared reports, e.g., to Google Classroom for review. One can defend their work during video conferences in Zoom or Google Meet. During online classes, it is recommended not only to listen to students' reports, but also to initiate discussions and debates on problematic issues.

Based on the coverage of theoretical information on the methodology of teaching the features of information systems, it was possible to systematise and summarise the key aspects of learning, which contributes to more effective learning of the material by higher education students. The definition of the structure, principles of operation and characteristics of the hardware components of a personal computer allowed students to improve their understanding of the principles of functioning and interconnection of information system components. The provided methodological recommendations for organising practical classes in the course provide pedagogical support to teachers and contribute to the creation of a favourable learning and cognitive atmosphere during classes. This includes the use of modern methods and techniques, active involvement of students in practical tasks, and interaction with educational materials. This approach helps to improve the quality of education and prepare students for real-world challenges in the field of information technology.

DISCUSSION

The discussion of the development and practical training of future primary school and computer science teachers in the structure of information systems allows comparing the findings of this study with the results of scientists conducting research in this area. This issue is a subject of much thought and debate and has been investigated many times using a variety of approaches.

Specifically, the opinion of L. Kindei *et al.* (2021) coincides with that of the author of this study and determines that the specific feature of teaching computer science in primary school is that it is unclear who is better suited to teach this subject to primary school children: primary

school teachers who do not have sufficient subject matter competence but are familiar with psychology, developmental levels, and other aspects of teaching primary school children, or computer science teachers who have sufficient subject matter knowledge but little experience of working with primary school children. An essential feature of teaching younger students is considering their age, physiological, and mental characteristics. This is crucial when teaching such complex subjects as computer science. It was found that the most difficult part of organising a course to prepare teachers for teaching computer science in primary education is the readiness of teachers for this type of educational activity. The format and methods of work during the course help prepare teachers for practical work with computers, but it is important to pay attention to the software and learning tools available in schools and suitable for teaching primary school children. These ideas are also reflected by J. Parham-Mocello *et al.* (2023), who noted that one of the main conditions for introducing computer science into the primary school educational process is the training of a new generation of teachers who are familiar with the technical characteristics of computers, strictly adhere to the rules and regulations of computer hygiene, are familiar with computer programs specially designed for students, are aware of the ethical rules of their use, and are familiar with innovative technologies. All of them recognise that the challenge is to train a new generation of teachers who are proficient in the methodology of using educational technologies.

Considering the views of researchers such as C.C. Chang *et al.* (2022), and L. El-Hamamsy *et al.* (2021), the use of information technology in the training of vocational education specialists can be interpreted as a comprehensive approach to the definition, development, and implementation of vocational education. This is an educational process that includes the function of personal, instrumental, and methodological means aimed at motivated and active acquisition of skills, knowledge, and abilities related to the optimised use of information technology in future activities. Future primary school teachers are faced with the task of demonstrating the potential of using information technology, acknowledging the significance of the knowledge and skills they have acquired and successfully applying them in their future professional activities. The opinions of D.D. Oh *et al.* (2024) and M. Fundi *et al.* (2024) on the organisation of primary school teachers' professional activities using ICT partially support the initial hypotheses of the author of this study. It should be added that this training is manifested in various aspects, namely, one is relevant to the organisation of qualified teacher activities at the stage of preparation and implementation of lessons using ICT tools; the other is related to the organisation of the use of innovative tools, the organisation of extracurricular professional activities of teachers (preparation of didactic materials for students and methodological and organisational materials for teachers).

On the one hand, M. Fundi *et al.* (2024) defines that one of the stages of training qualified primary school teachers

to use computers in teaching younger students is the characterisation and analysis of alternative curricula, relevant software, and methodological software. Teachers of pedagogical faculties should draw the attention of their students, future primary school teachers, to the fact that pedagogical practice should accommodate the curriculum of primary school children and their developmental level, each of which should be adapted to concrete programme and technical requirements. In other words, they should guide students to a systematic analysis of the learning process, i.e., to a clear understanding of the place and role of a particular lesson in the overall structure of learning. This is the only way to ensure that the material is correctly remembered and repeated. Following the principles of systematic analysis of the content and methodological foundations of the computer science course, one should draw students' attention to its multifaceted nature. Forming a vision of the three objectives of the course – to teach, up-bring, and develop – is of great importance as a preparatory stage for their implementation. On the other hand, T. Holovatenko (2023) suggests that teaching should encourage the development of fundamental computer science concepts (knowledge, algorithms) and programme management skills. Specifically, it is vital to ensure that in each lesson children learn material from other lessons (counting, number structure, grammatical analysis of words). From the very first lesson, a future primary school and computer science teacher should try to form an appropriate attitude towards computers in children. The above ideas of M. Fundi *et al.* (2024) and T. Holovatenko (2023) clearly reflect the significance of highlighting research findings.

M. Worsley (2022) complements the findings of the present study and addresses the development of practical exercises. At the initial stages of methodological training, it is important to teach students how to plan lessons. Both exemplary and imperfect lessons should be recorded on video and subsequently analysed: the structure of the lesson, the content of the non-computer part, and the relevance to the training software. This applies to the choice of organisational forms and methods, ways to control the quality of learning, and the emotional colouring of lessons and student activities. Experience shows that this type of training is positive. This is because issues often arise that have not been previously addressed in the classroom, such as knowledge control, consideration of individual characteristics of students when organising independent work with a computer, didactic principles of computer-based learning, and ways to maintain motivation to learn. Teachers and methodologists should also constantly remind students that a prerequisite for using computers in primary school is compliance with hygiene and sanitary requirements to protect the physical and mental health of young students. It was found that the use of ICT tools in future professional activities is an overall quality of a person characterised by knowledge, skills, abilities, qualities, and the ability to use these tools creatively in future professional activities. It is reflected in the intellectual, motivational, subject matter,

and practical spheres of a person's activity. The readiness of future primary school teachers to use ICT tools in their professional activities as a range of interrelated motivational, operational, affective-volitional, evaluative-reflective, and reflective criteria (Sinha *et al.*, 2023; Levitt *et al.*, 2024). Proceeding from the above criteria, the author of this study has further improved the information on the degree of readiness to use each digital technology tool in business activities, which can be divided into three levels.

1. The prominent level of readiness includes students who are purposeful, deeply aware of the need for pedagogical training, and are characterised by a desire for creative and search activities to improve their knowledge and professional skills. Such students demonstrate a positive and active attitude towards learning how to implement ICT in the educational and training process.

2. A sufficient level of future teachers' readiness to implement IT tools is characterised by the presence of active motivation to learn and work. Such students consciously fulfil the teacher's tasks in the classroom and in extracurricular activities, but do not show activity and creativity. They clearly recognise the activities that they find more important and interesting. In situations where students are not confident in their knowledge and skills, they do not show readiness to overcome problems.

3. The low level of readiness is reflected in weak positive motivation and low value of professional and educational activities using information systems. Cognitive interest is mostly short-term and situational.

These studies emphasise the significance of computer training for future teachers, specifically, teaching them to use ICT effectively in their professional activities. There is also a need to develop students' practical skills, increase their readiness to use these tools and consider hygiene and sanitary aspects when introducing ICTs into the educational process.

CONCLUSIONS

Consideration of the selection, development, and implementation of advanced technologies, models, and learning systems in Ukrainian higher education should be based on a thorough and comprehensive analysis of current trends, patterns of social life, achievements of Ukrainian and world philosophy, psychology and pedagogy, experience of methodologists and practitioners. The results of this analysis helped to identify relevant changes and promising ways to reform and improve the Ukrainian research and education system. It can be argued that the principal vector of teacher education development is a fundamental change in its content, which is focused on improving the quality of training teachers with professional knowledge, capable of replenishing it independently, and being competitive in the market of educational services. According to the analysis of the main studies devoted to determining the content of preparation for the professional activity of future computer science teachers, the development of professional competence of a teacher includes in-depth knowledge of the subject, teaching methods, pedagogy, psychology, didactics,

and pedagogical skills related to the teacher's behaviour in various pedagogical situations. It can also be concluded that it includes the development and formation of the necessary personal qualities, communication skills, the need for self-improvement and self-esteem.

The study considered the elements of the methodology for training students of higher pedagogical education institutions majoring in 013 "Primary Education and Computer Science", 014 "Secondary Education (Labour Training and Technology. Computer Science)" on the structure of information systems in studying the course "Computer Science (Structure and Main Components of Information Systems)". The theoretical information on the features of information systems; structure, principles of operation, characteristics of hardware components of a personal computer; methodological recommendations for practical work were presented. The findings of the study suggest that the introduction of innovations in the learning process plays a considerable role in the development of education, increasing the country's competitiveness and improving the quality of life of each future specialist. In the educational process in the discipline "Computer Science (Structure and Main Components of Information Systems)", it was found that various teaching methods are used, such as verbal, practical, and visual methods, which are aimed at developing students' competences. The basis for assessing students' academic achievements is a competence-based approach that involves not only the acquisition of theoretical knowledge but also the development of practical skills necessary for

successful professional activity. The assessment system is based on a module-rating system, which helps to objectively determine the level of learning and encourages students to work systematically throughout the entire academic period. Therefore, considering the significance of innovations in the modern educational environment, the course "Computer Science (Structure and Main Components of Information Systems)" sets standards of high-quality education and contributes to the training of qualified specialists in the field of information technology.

The findings of this study are limited to the analysis of the development of information and communication skills and other key competences of future primary school and computer science teachers while studying the subject "Computer Science (Structure and Main Components of Information Systems)". The scope of this study was limited to a single higher education institution where the study was conducted. Further areas for research include the development and testing of innovative training programmes for future teachers who teach computer science in primary schools, and the study of the use of the latest technologies, such as artificial intelligence or virtual reality, in professional training.

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CONFLICT OF INTEREST

None.

REFERENCES

- [1] Alhazbi, S. (2023). Bringing computer science education to schools in Qatar: Challenges of the implementation. In *2023 international conference on computer and applications (ICCA)* (pp. 1-4). Cairo: Institute of Electrical and Electronics Engineers. doi: [10.1109/ICCA59364.2023.10401793](https://doi.org/10.1109/ICCA59364.2023.10401793).
- [2] Bers, M. (2021). *Teaching computational thinking and coding to young children*. Hershey: IGI Global. doi: [10.4018/978-1-7998-7308-2](https://doi.org/10.4018/978-1-7998-7308-2).
- [3] Chang, C.C., Hwang, G.J., & Tu, Y.F. (2022). Concept mapping in technology-supported K-12 education: A systematic review of selected SSCI publications from 2001 to 2020. *Journal of Educational Computing Research*, 60(7), 1637-1662. doi: [10.1177/07356331211073798](https://doi.org/10.1177/07356331211073798).
- [4] El-Hamamsy, L., Bruno, B., Chessel-Lazzarotto, F., Chevalier, M., Roy, D., Zufferey, J.D., & Mondada, F. (2021). The symbiotic relationship between educational robotics and computer science in formal education. *Education and Information Technologies*, 26(5), 5077-5107. doi: [10.1007/s10639-021-10494-3](https://doi.org/10.1007/s10639-021-10494-3).
- [5] Fundi, M., Sanusi, I.T., Oyelere, S.S., & Ayere, M. (2024). Advancing AI education: Assessing Kenyan in-service teachers' preparedness for integrating artificial intelligence in competence-based curriculum. *Computers in Human Behavior Reports*, 14, article number 100412. doi: [10.1016/j.chbr.2024.100412](https://doi.org/10.1016/j.chbr.2024.100412).
- [6] Holovatenko, T. (2023). Enhancing elementary classroom learning experiences with mobile learning: Implications for practice. In *Impactful classroom experiences in elementary schools: Practices and policies* (pp. 25-49). Hershey: IGI Global. doi: [10.4018/978-1-6684-8551-4.ch002](https://doi.org/10.4018/978-1-6684-8551-4.ch002).
- [7] Huang, Y., & Meng, H. (2022). Research on information technology skills training and multi-dimensional evaluation system construction. In *2022 3rd international conference on education, knowledge and information management (ICEKIM)* (pp. 1033-1036). Harbin: Institute of Electrical and Electronics Engineers. doi: [10.1109/ICEKIM55072.2022.00224](https://doi.org/10.1109/ICEKIM55072.2022.00224).
- [8] Ihnatenko, O.V. (2022). *Structure and main components of information systems: Educational and methodological manual*. Sumy: Dream.
- [9] Ihnatenko, O.V. (2023). *Digitization of the process of training future primary school teachers*. In *Collection of abstracts of the II international scientific and practical conference "Modern approaches to problem solving in science and technology"* (pp. 310-313). Warsaw: International Science Unity.

- [10] Kager, D., & Marinšek, A. (2023). A gamified learning scenario for introducing pupils to the scientific method through experimentation and programming. In *2023 46th MIPRO ICT and electronics convention* (pp. 545-550). Opatija: Institute of Electrical and Electronics Engineers. doi: [10.23919/MIPRO57284.2023.10159900](https://doi.org/10.23919/MIPRO57284.2023.10159900).
- [11] Kim, K., & Kwon, K. (2023). Exploring the AI competencies of elementary school teachers in South Korea. *Computers and Education. Artificial Intelligence*, 4, article number 100137. doi: [10.1016/j.caeai.2023.100137](https://doi.org/10.1016/j.caeai.2023.100137).
- [12] Kindei, L., Nikitina, O., Baraniuk, I., Kotelianets, Y., & Kotelianets, N. (2022). The problem of methodological training of future teachers in the digital environment. *Journal of Curriculum and Teaching*, 11(5), 146-154. doi: [10.5430/jct.v11n5p146](https://doi.org/10.5430/jct.v11n5p146).
- [13] Law of Ukraine No. 1556-VII "On Higher Education". (2014, July). Retrieved from <https://zakon.rada.gov.ua/laws/show/en/1556-18#Text>.
- [14] Levitt, D., Garfus-Knowles, D., Khuu, W., & Siddappa, S. (2024). Using computational thinking to demystify computer science for elementary teachers. In *SIGCSE 2024: Proceedings of the 55th ACM technical symposium on computer science education* (pp. 1537-1538). New York: Association for Computing Machinery. doi: [10.1145/3626253.3631658](https://doi.org/10.1145/3626253.3631658).
- [15] Morais, A.M., Neves, I.P., & Afonso, M. (2005). Teacher training processes and teachers' competence – a sociological study in the primary school. *Teaching and Teacher Education*, 21(4), 415-437. doi: [10.1016/j.tate.2005.01.010](https://doi.org/10.1016/j.tate.2005.01.010).
- [16] Morse, N.V. (2004). *Methodology of teaching informatics*. Kyiv: Training Book.
- [17] Nugent, G., Chen, K., Soh, L.K., Choi, D., Trainin, G., & Smith, W. (2022). Developing K-8 computer science teachers' content knowledge, self-efficacy, and attitudes through evidence-based professional development. In *ITiCSE '22: Proceedings of the 27th ACM conference on innovation and technology in computer science education* (pp. 540-546). New York: Association for Computing Machinery. doi: [10.1145/3502718.3524771](https://doi.org/10.1145/3502718.3524771).
- [18] Oh, D.D., Rich, K.M., Bosch-Wilson, K.L., & Cunningham, H.L. (2024). Motivating and increasing the relevance of elementary computer science in rural communities: Exploring elementary teacher perspectives in Idaho. In *SIGCSE 2024: Proceedings of the 55th ACM technical symposium on computer science education* (pp. 1768-1769). New York: Association for Computing Machinery. doi: [10.1145/3626253.3635500](https://doi.org/10.1145/3626253.3635500).
- [19] Olefirenko, N.V., Kostikova, I.I., Ponomarova, N.O., Lebedieva, K.O., Andriievskaya, V.M., & Pikilnyak, A.V. (2020). Training elementary school teachers-to-be at computer science lessons to evaluate e-tools. *CTE Workshop Proceedings*, 7, 578-591. doi: [10.55056/cte.414](https://doi.org/10.55056/cte.414).
- [20] Order of the Ministry of Economic Development, Trade and Rural Affairs of Ukraine No. 2736-20 "On Approval of the Professional Standard for the Professions of Primary School Teacher of a General Secondary Education Institution, Teacher of a General Secondary Education Institution, Teacher of Primary Education (With a Junior Specialist Diploma)". (2020, December). Retrieved from <https://zakon.rada.gov.ua/rada/show/v2736915-20#Text>.
- [21] Parham-Mocello, J., Berliner, G., & Gupta, A. (2023). Manipulatives for teaching computer science concepts. In *2023 IEEE frontiers in education conference (FIE)* (pp. 1-9). College Station: Institute of Electrical and Electronics Engineers. doi: [10.1109/fie58773.2023.10343500](https://doi.org/10.1109/fie58773.2023.10343500).
- [22] Resolution of the Cabinet of Ministers of Ukraine No. 87-2018-p "On Approval of the State Standard of Primary Education". (2018, February). Retrieved from <https://zakon.rada.gov.ua/laws/show/87-2018-%D0%BF#Text>.
- [23] Sapanca, H.F., Kaya, O.S., Taşpolat, A., & Tezer, M. (2022). Investigation of prospective teachers' use of mobile technologies in teaching activities. *International Journal of Cognitive Research in Science, Engineering and Education*, 10(2), 121-132. doi: [10.23947/2334-8496-2022-10-2-121-132](https://doi.org/10.23947/2334-8496-2022-10-2-121-132).
- [24] Single treasury account. (n.d.). Retrieved from <https://index.minfin.com.ua/ua/finance/ekr/>.
- [25] Sinha, N., Evans, R.F., & Carbo, M. (2023). Hands-on active learning approach to teach artificial intelligence/machine learning to elementary and middle school students. In *2023 32nd wireless and optical communications conference (WOCC)* (pp. 1-6). Newark: Institute of Electrical and Electronics Engineers. doi: [10.1109/WOCC58016.2023.10139678](https://doi.org/10.1109/WOCC58016.2023.10139678).
- [26] Southgate, E., Grant, S., Ostrowski, S., Norwood, A., Williams, M., & Tafazoli, D. (2022). School students creating a virtual reality learning resource for children. In *2022 IEEE conference on virtual reality and 3D user interfaces abstracts and workshops (VRW)* (pp. 1-6). Christchurch: Institute of Electrical and Electronics Engineers. doi: [10.1109/VRW55335.2022.00060](https://doi.org/10.1109/VRW55335.2022.00060).
- [27] Stephens, C., Lee, V.R., Clarke-Midura, J., & Recker, M. (2021). Expansive framing and collaborative professional development: Supporting teacher learning. In *SIGCSE '21: Proceedings of the 52nd ACM technical symposium on computer science education* (pp. 1339). New York: Association for Computing Machinery. doi: [10.1145/3408877.3439575](https://doi.org/10.1145/3408877.3439575).
- [28] Storjak, I., Krzic, A.S., & Jagust, T. (2022). Elementary school pupils' mental models regarding robots and programming. *IEEE Transactions on Education*, 65(3), 297-308. doi: [10.1109/te.2022.3158472](https://doi.org/10.1109/te.2022.3158472).
- [29] Sularso, S., Yu, Q., Pranolo, A., & Hardiyanti P.C. (2024). [Advancing computer science in education: Integrating digital music technology into elementary school music programs](https://doi.org/10.1109/E3SWebConf.2024.101019). *E3S Web of Conferences*, 501, article number 01019.

- [30] Worsley, M. (2022). Exploring opportunities for connecting computer science and physical education in elementary school. In *IDC '22: Proceedings of the 21st annual ACM interaction design and children conference* (pp. 590-595). New York: Association for Computing Machinery. doi: [10.1145/3501712.3535293](https://doi.org/10.1145/3501712.3535293).
- [31] Xiang, Y., Tang, T., Su, T., Brach, C., Liu, L., Mao, S.S., & Geimer, M. (2021). Fast CRDNN: Towards on site training of mobile construction machines. *IEEE Access*, 9, 124253-124267. doi: [10.1109/ACCESS.2021.3110288](https://doi.org/10.1109/ACCESS.2021.3110288).

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Підготовка майбутніх учителів початкової школи та інформатики з будови інформаційних систем

Анотація. Активне оновлення педагогічної освіти зумовлено протиріччям між потребою у нових фахівцях та відсутністю чіткої стратегії модернізації освітнього процесу. Метою статті було виокремлення всіх аспектів процесу підготовки майбутніх учителів початкової школи та інформатики до реалізації цифрових систем в сукупності з педагогічними умовами. У роботі використано такі методи дослідження, як порівняння, синтез, спостереження, аналіз, абстрагування, порівняння. В основних результатах виявлено, що в Україні відбуваються реформи у сфері освіти, спрямовані на оновлення змісту та вдосконалення методів викладання і навчання. У статті розкрито цілі, зміст, методи, форми, засоби навчання дисципліни «Інформатика (Будова та основні складові інформаційних систем)», що вивчається майбутніми вчителями початкової школи та інформатики, які здійснюють свою фахову підготовку за освітніми програмами 013 «Початкова освіта та інформатика», 014 «Середня освіта (Трудове навчання та технології. Інформатика)» у Глухівському національному педагогічному університеті імені Олександра Довженка. Здійснено аналіз останніх публікацій з проблематики дослідження. На основі аналізу можливостей і конкретних потенціалів використання інформаційних технологій з'ясовано доцільність їх впровадження у процес особистісно-професійного розвитку майбутніх фахівців початкової школи, виділено основні умови їх використання та сформованого педагога в освітній інформаційній системі. Висвітлено зміст занять, направлених на розвиток інформаційно-комунікаційних навичок та інших ключових компетентностей майбутніх викладачів початкової школи та інформатики, під час вивчення навчального предмету «Інформатика (Будова та основні складові інформаційних систем)». У висновках зазначено, що методичні рекомендації до організації практичних занять з курсу забезпечують педагогічну підтримку викладачам та сприяють створенню сприятливої навчально-пізнавальної атмосфери під час навчання. Практичне значення роботи полягає у побудові якісної моделі, що має на меті покращити процес підготовки майбутніх учителів початкової школи та інформатики до реалізації цифрових систем в сукупності з педагогічними умовами

Ключові слова: інформаційно-комунікаційна компетентність; IT-система; підготовка кадрів початкової освіти; обробка даних; модель навчання

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