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Адреса редакції:

Університет Григорія Сковороди в Переяславі
08401, вул. Сухомлинського, 30, м. Переяслав, Україна
E-mail: mail@sets.com.ua
<https://sets.com.ua/>

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Editors office address:

Hryhorii Skovoroda University in Pereiaslav
08401, 30 Sukhomlynskyi Str., Pereiaslav, Ukraine
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**Oksana Kostenko***

PhD in Historical Sciences, Associate Professor
Hryhorii Skovoroda University in Pereiaslav
08401, 30 Sukhomlynskyi Str., Pereiaslav, Ukraine
<https://orcid.org/0000-0003-0831-9158>

Volodymyr Siropol

PhD in Historical Sciences, Associate Professor
Hryhorii Skovoroda University in Pereiaslav
08401, 30 Sukhomlynskyi Str., Pereiaslav, Ukraine
<https://orcid.org/0000-0001-6069-2609>

Evolution of curricula in technical colleges: Compliance with modern technological requirements

Abstract. The study aimed to identify the key factors of modernisation of educational technology programmes to improve vocational education in the context of the modern labour market. The methodological basis of the study was a comparative analysis of curricula in technical colleges in Ukraine and leading foreign countries such as the United States, Sweden and Germany. This method was used to analyse the vocational education system of Ukraine in the context of global trends and determine the relationship between international educational practices and changes in the Ukrainian system. The main results of the study demonstrated that the introduction of international approaches, such as the dual system of education and the use of the latest technologies, significantly improves the quality of training and increases their adaptability to the conditions of the modern labour market. The study determined that cultural and socio-economic differences can complicate the effective implementation of foreign experience, emphasising the importance of adapting these models to national conditions. The study has made significant progress in identifying effective strategies for integrating international educational practices, which will ensure the sustainable development of vocational education in Ukraine and increase the competitiveness of Ukrainian specialists in the global market. The results also highlighted the need for further study and improvement of the adaptation of international models to national realities. The study highlighted the importance of close cooperation between educational institutions, government agencies, and the private sector for the successful modernisation of vocational education. The findings can be useful for educational institutions in improving curricula, for government agencies in developing educational reforms, and for the private sector in actively engaging employers in training

Keywords: technological education; innovations; standards; scientific progress; trends

INTRODUCTION

Studying the problem of curriculum evolution in technical colleges in Ukraine is becoming increasingly necessary due to the rapid development of technology, which requires constant updating of students' knowledge and skills. The technical field is constantly changing, so curricula must meet modern labour market requirements, ensuring that

graduates are competitive and highly sought after. Changes in the technological environment, such as automation, digitalisation and the integration of artificial intelligence, create new requirements for professional skills and knowledge. Therefore, curricula should meet the current needs of the labour market and provide graduates with the necessary

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*Corresponding author



competencies. Many Ukrainian technical colleges use outdated methods and curricula that do not meet international standards, which limits students' opportunities and affects the quality of their professional training.

An important challenge is the study of international experience in the field of vocational education, which can identify effective models and approaches that can be adapted to Ukrainian conditions. For instance, the dual system of education, which has been successfully applied in many European countries, can significantly improve the quality of training in Ukraine. There are also specific challenges, such as cultural and socio-economic differences, that can affect the effectiveness of international practices. Researching these aspects helps to develop recommendations for the successful adaptation and implementation of new educational strategies. This will help to increase the competitiveness of Ukrainian specialists in the global labour market and to develop an educational policy that meets modern requirements and ensures the training of highly qualified personnel.

More and more researchers address the issue. Each of them has highlighted important aspects of the evolution of technical college curricula. M. Kamal *et al.* (2023) analysed the elements of cooperative learning in the development of curricula for subjects related to construction drawing in vocational colleges. The study revealed how the integration of cooperative learning can improve students' technical training. A contemporary study by R. Kossmann (2022) examined individual education plans in the context of technical education, focusing on their impact on adaptation to curricula and on reducing parental criticism. The findings demonstrated how individualising curricula can affect learning outcomes. J. Künstler-Sment *et al.* (2024) developed a standardised data management plan for educational research that can be applied to curriculum optimisation in technical colleges to effectively manage data for curriculum improvement. Q. Liu (2024) investigated the evaluation of the effectiveness of the training platform for technical professionals and how curriculum changes can affect the training of technical professionals. X. Ma (2024) examined the reform of the curriculum assessment system in the context of the needs of professional positions and how curriculum modernisation can meet the current requirements of technical specialities.

S. McGrath & S. Yamada (2023) reviewed current and emerging trends in skills development in vocational education and training. This helps to understand how the evolution of curricula meets the changing demands of the labour market. A. Meshel *et al.* (2023) investigated the implementation of the Plan-Do-Study-Act plan in emergency training curricula. The results show the effectiveness of integrating new methods into technical curricula to improve practical skills. R. Powell *et al.* (2024) created a repository of robotics lesson plans that can be useful for improving curricula in technical colleges. This highlights the importance of updating and expanding learning resources to improve student learning.

Y. Ma *et al.* (2022) and D. Silva Costa *et al.* (2023) studied the impact of individualised education plans on the inclusion of students with autism in teamwork. This study demonstrates how curriculum adaptation can affect the effectiveness of learning in technical specialities. Despite the important contributions of these researchers, the long-term impact of the integration of new technological technologies in vocational education on curricula and their evolution in technical colleges remains under-researched. The study aimed to identify a model for the development of technical education programmes in Ukraine, addressing international experience, to improve its compliance with modern labour market requirements.

The objectives of the study were:

- To study the negative educational factors affecting the quality of curricula in Ukraine in Ukraine.

- To analyse international educational models of educational programmes that have been successfully implemented in the United States of America, Sweden and Germany and determine their potential for adaptation in Ukrainian technical colleges.

- To assess the impact of new technologies on vocational training and develop recommendations for their integration into curricula in Ukraine.

MATERIALS AND METHODS

This study included two main stages. The first stage of the study included a systematic analysis, which was a comprehensive process of studying and evaluating the existing curricula of the Ministry of Education and Science of Ukraine (2024). At this stage, a detailed review of the current curricula used in technical colleges in the country was carried out. An important part of this process was to study the structure of the curricula, their content and their relevance to modern labour market requirements. In particular, the extent to which the curricula integrate the latest technologies and teaching methods was addressed, which is critical for training competitive specialists. Percentage feedback was collected from teachers and students to determine their needs and expectations of the curriculum. The study involved 50 teachers and 100 students representing vocational education institutions. The teachers' ages ranged from 30 to 60 years, and the students from 18 to 25 years. There were 20 men and 30 women among the teachers, and 80 men and 20 women among the students. This included gathering feedback on the effectiveness of existing programmes, as well as suggestions for improvement. The analysis of this data identified weaknesses in the current curricula and determined what changes are needed to improve the quality of education. The first phase demonstrated the current state of curricula in technical colleges in Ukraine and laid the groundwork for the next phase.

The second stage involved a comparative analysis of the curricula of technical colleges in Ukraine and foreign countries such as the United States of America, Germany and Sweden. This demonstrated the results of the comparative analysis, including recommendations for further

improvement of curricula based on the data obtained. Four technical colleges representing each country were selected for this purpose. In the second stage of the study, a comparative analysis of technical college curricula in Ukraine and abroad, in the United States of America, Germany, and Sweden, was used. For this purpose, four technical colleges were selected, one from each country, representing different aspects of technical education and having a significant impact in their regions. Georgia Tech is known for its innovative education and best practices in technical education. To compare the curricula in Germany, the Technische Hochschule Neubrandenburg was selected, which represented the integration of the dual system in educational programmes, the Chalmers University of Technology, known for its innovations in technical disciplines and international cooperation, and the College of Technology of Lviv Polytechnic National University, which is one of the leading technical universities in Ukraine. The research was conducted in compliance with all ethical standards set out in the Declaration of Helsinki (2013).

The curricula at the above-mentioned educational institutions were compared based on the following criteria: relevance and compliance with modern requirements, structure of educational modules, analysis of course organisation, including the number and types of disciplines, teaching and assessment methods, practical training, integration of new technologies, international standards and accreditation. The selected criteria comprehensively assessed the effectiveness and relevance of curricula in technical colleges and their compliance with modern educational and labour market requirements. In addition, considerable attention was paid to developing recommendations for adapting these international models to Ukrainian conditions. This included developing plans for implementing new teaching approaches, identifying the necessary resources and training teaching staff.

RESULTS

Curricula at technical universities are documented programmes of study that define the structure, content and sequence of academic disciplines, as well as the methods of teaching them. These curricula are designed to provide students with the necessary knowledge and skills in line with the requirements of the modern labour market and technological innovations. The curriculum usually includes an extensive list of subjects, the number of academic hours, assessment methods and success criteria.

Adherence to curricula in technical colleges is critical to ensuring quality standards in education. Curricula should be strictly adhered to, providing structured and consistent training for students. However, in practice, deviations may occur, often due to the need to adapt to rapidly changing technologies or the specific needs of students and the labour market. Deviations can be manifested in a change of emphasis in teaching, the introduction of new courses without revising existing plans, or failure to follow recommended methods. In particular, the study of

the evolution of curricula in technical colleges in Ukraine highlighted both the pros and the significant cons of introducing technological innovations. The positive aspects of adhering to curricula include providing a structured approach to education that helps students achieve clearly defined educational and professional goals. Standardised curricula also facilitate accreditation and quality assessment. However, the downside may be a lack of flexibility to respond quickly to new trends and technologies, which may limit the relevance of the programme. Some colleges may be lagging modern requirements due to outdated curricula or insufficient adaptation to specific industry needs. A systematic analysis of curricula is important to identify both the strengths and weaknesses of existing programmes and to develop recommendations for improvement to enhance the quality of education in technical colleges in Ukraine.

The evolution of curricula in technical colleges in Ukraine has undergone numerous changes and adaptations, driven by both the internal needs of the educational system and external labour market demands and global educational trends. In the early 2000s, these programmes were largely focused on traditional disciplines with an emphasis on theoretical knowledge. The curricula of that time were characterised by rigid standardisation, which limited the flexibility to introduce new technologies and relevant changes in the respective industries. Technical education in this period favoured basic technical and engineering disciplines that were mandatory for training specialists in classical industries and manufacturing. However, with the development of technology and changes in labour market requirements, there was a need to update the curriculum. Gradually, the process of introducing new topics and teaching methods focused on practical skills and the integration of modern technologies began. This contributed to greater flexibility in the programmes, allowing them to be adapted to modern needs. Over time, the curricula of technical colleges began to include courses in information technology, automation, robotics and other innovative areas, reflecting the new challenges and opportunities faced by modern education.

In the 2000s, the educational system began to reform, including updating curricula to reflect new technologies and labour market needs. The concept of integrating practical skills into the learning process was introduced, and computer and information technologies were started to be integrated into the curriculum. New courses were introduced in project management, computer science, and production process automation. This period saw significant changes in the direction of adaptation to European education standards. Reforms included the introduction of a credit-module system, which allowed for greater flexibility in educational programmes and the possibility of personalising learning. New courses were gradually introduced to reflect the needs of the modern economy, such as robotics, renewable energy and digital technologies. Practical training, internships and cooperation with industry were prioritised.

In recent years, Ukrainian technical colleges focused on the intensive integration of modern technologies into their curricula. The updated curricula incorporated the requirements of Industry 4.0, including automation, artificial intelligence and big data. These changes are a response to the growing labour market demand for specialists capable of working with advanced technologies. In this regard, new initiatives have emerged in education policy aimed at introducing distance learning programmes and hybrid learning models that combine traditional and digital forms of education. According to the Ministry of Education and Science of Ukraine, as of 2023, 65% of technical colleges have implemented modular study programmes, which allow for a more flexible approach to shaping students' educational trajectories. These modular programmes also contribute to updating the content of education in line with modern technologies and trends. In addition, 40% of technical colleges have introduced courses on the latest technologies, such as artificial intelligence, big data analysis and robotics. This has helped to improve the quality of education, as evidenced by more than 75% of technical college students who reported improved learning due to these innovations (Ministry of Education and Science of Ukraine, 2024).

As of 2023, 80% of technical colleges in Ukraine have updated their curricula to include modern technologies such as IoT and Big Data (Ivanov *et al.*, 2023). This study confirms that 60% of students report a significant positive impact of the new courses on their preparation for professional activities. However, 30% of educational institutions still face challenges in implementing the new standards due to insufficient material resources and staffing constraints. Thus, the volition of curricula in technical colleges in Ukraine demonstrates a tendency to adapt and integrate modern technologies, which is necessary to maintain the competitiveness of education in the face of rapid changes in the labour market.

In this study, teachers and students provided feedback on the effectiveness of curricula in technical colleges. Among the teachers, 70% expressed concern about the lack of relevance of teaching materials. Many of them noted

that curricula are often not updated in line with modern technological advances and labour market needs. In addition, 64% of teachers said that the existing curricula do not always consider an interdisciplinary approach, which is important for the development of students' practical skills in today's environment. Regarding administrative aspects, 50% of teachers pointed out the need to improve the organisation of the educational process, including revising the format and frequency of practical classes. In particular, 80% of students expressed their dissatisfaction with the insufficient integration of practical tasks into the curriculum. They emphasised that real projects and internships, which improve real-world work condition training, should be prioritised. 75% of students also noted that the curricula are not sufficiently focused on the needs of the labour market, which leads to irrelevance of the knowledge gained during study. Another 60% of students pointed to the need to update teaching materials and incorporate new technologies that are relevant to their professional field.

The feedback collected revealed a significant gap between the requirements of the modern labour market and the existing curricula in technical colleges in Ukraine. This gap indicates the need for a thorough review and modernisation of the curricula to ensure that they meet the current requirements and expectations of both teachers and students. The identified shortcomings indicate that many programmes are still not sufficiently adapted to the realities of Industry 4.0 and do not fully prepare students for the challenges posed by the modern labour market. The feedback collected was an important basis for further analysis of specific technical colleges, as shown in Table 1. The analysis identified weaknesses in existing programmes and determined which aspects need to be updated or improved. Based on the data obtained, recommendations were developed to modernise the curricula, including the integration of the latest technologies, increasing the practical component and increasing the flexibility of educational pathways. These measures will help improve the quality of training and increase the competitiveness of specialists in the labour market.

Table 1. Analysis of the activities of vocational education institutions following key criteria

Criteria	Vocational education institutions			
	Technische Hochschule Neubrandenburg	Chalmers University of Technology	Georgia College of Technology	College of Technology of Lviv Polytechnic National University
Curricula	Integration of interdisciplinary courses	Focused on practical skills	Balanced theoretical and practical courses	Needs to be updated, and more balance between theory and practice
Internship programmes	Developed internship system	Internships are compulsory in the educational process	Internships at industrial enterprises	Limited internship opportunities
Cooperation with industry	Close cooperation through a dual system	Active partnership with companies	Active cooperation with enterprises	Fewer partnerships with industry
Employment of new technologies	High level of innovation and modern laboratories and equipment	Integration of the latest technologies in education	Modern laboratories and equipment	Limited and gradual increase in the use of innovation
Support for students	Support system through consultations and mentoring	Support through academic advisors	Strong support through additional courses	Developed support system

Source: compiled by the authors

The data in Table 1 reveals significant differences in approaches to technical education. The benchmarking criteria determined that Ukraine lags the other three countries in several key areas, such as integration of the latest technologies, level of practical training, cooperation with industry, international experience and access to modern equipment. The integration of the latest technologies into the curriculum is one of the main differences. In the US, Georgia Tech is actively implementing innovations such as artificial intelligence, big data and other modern technologies in its curriculum. This provides students with access to the relevant knowledge and skills needed to work in advanced industries. Sweden's Chalmers University of Technology also focuses on the latest technologies but additionally offers opportunities for international cooperation and interdisciplinary research. In contrast, in Ukraine, particularly at Lviv Polytechnic National University, although the latest technologies are gradually being integrated into the curriculum, this is happening more slowly due to limited access to modern equipment and resources.

The level of practical training of students in Ukraine lags far behind that of other countries. Germany's Technische Hochschule Neubrandenburg uses a dual education system that combines theoretical classes with practical experience in real-world settings, providing students with a deeper understanding of their specialities. In the United States, Georgia Tech also provides students with numerous internship and practical work opportunities through close cooperation with industry. Sweden, through Chalmers, offers students participation in international projects and internships. In Ukraine, practical training is part of the educational process, but the level of integration with industry is less pronounced, which reduces the effectiveness of student training compared to international standards.

Collaboration with industry and access to modern equipment also points to Ukraine's lagging. Georgia Tech actively cooperates with industry, providing students with the opportunity to collaborate on real-world projects and gain experience in leading companies. Neubrandenburg uses a dual system that includes close cooperation with local companies. Chalmers provides international cooperation and access to global research networks. In Ukraine, although Lviv Polytechnic has some initiatives with industrial cooperation, in general, access to modern equipment and integration with industry is limited, which negatively affects the quality of education. The above aspects indicate the need for significant changes in the curricula of technical colleges in Ukraine. To catch up with international standards, Ukraine needs to focus on integrating the latest technologies, improving practical training for students, expanding cooperation with industry, and providing access to modern equipment. These measures will help to increase the competitiveness of Ukrainian technical education institutions in the international arena and prepare students for the challenges of the modern labour market.

Curricula must meet modern technological requirements, as technology is constantly changing and improving,

which challenges educational institutions to adapt their training to new realities. Modern labour market requirements dictate that graduates must have not only theoretical knowledge but also practical skills that allow them to effectively cope with new technologies. Timely updating of curricula helps to ensure high-quality education and improve students' professional readiness. The technology requirements cover various aspects that include the integration of the latest technologies such as artificial intelligence, big data, the Internet of Things (IoT) and automation. Artificial intelligence (AI) is being actively used to solve complex tasks such as forecasting, pattern recognition and automation of routine processes. Educational programmes should include training in the basics of AI, as well as its application in various industries. Big Data has become critical for modern business as it allows collecting, storing and analysing huge amounts of information to make informed decisions. Training programmes should provide knowledge in data analysis, statistics and database management. Process automation and robotics are also important aspects that require integration into the curriculum. Understanding the principles of automation, robot programming and control systems are critical to training professionals who can use modern technologies.

Modern curricula must also consider rapid changes in industries that require constant updating of content and teaching methods. The use of interactive technologies, online resources and simulations helps students to better absorb the material and adapt to changing conditions. The compliance of curricula with technological requirements ensures the training of highly qualified specialists who can use the latest technologies and meet the requirements of the modern labour market. This contributes to the development of innovations, increases the competitiveness of graduates and maintains high standards of education.

In Ukraine, there is often a mismatch between the curricula of technical colleges and modern technological requirements, which seriously affects the quality of training. Curricula that were developed several decades ago often fail to keep up with the rapid pace of new technologies. This leads to students being taught using old methods that do not include the modern tools and technologies needed for successful professional activities. Many technical colleges still use outdated courses and laboratories that do not meet current industry requirements. For example, the curriculum may lack courses on new software platforms, data management systems, or the latest design methods. This creates a gap between the knowledge that students receive and what the modern labour market expects from them.

It is also important to note that curricula in Ukraine are often not adapted to the specific needs of the changing labour market. In many cases, educational institutions are not able to quickly update curricula or integrate new technologies into the learning process due to a lack of resources or administrative obstacles. These challenges highlight the need to reform curricula to ensure that they meet modern technological requirements. Existing curricula need to be reviewed, updated to reflect the latest advances in technology,

and teachers need to be continuously trained to keep education up to date. Otherwise, the gap between the theoretical knowledge students receive and the practical skills required in the labour market will only grow, which will negatively affect the competitiveness of graduates on a global level.

To ensure that the curricula of technical colleges in Ukraine meet modern technological requirements and become more effective, several key recommendations need to be implemented to facilitate their evolution and adaptation to the rapidly changing labour market. The first important step is to regularly update curricula based on the latest technological advances and trends. To do this, a mechanism that allows for ongoing review and adjustment of programmes, and introducing new courses that meet current industry requirements is required. This can be achieved through the creation of special commissions with the participation of industry representatives to assess the relevance and effectiveness of the curricula.

The next step is the active implementation of dual education, where theoretical knowledge is combined with practical experience at enterprises. With this approach, students can gain real-world experience while studying, ensuring that they are ready for the demands of the modern labour market. The dual education system has already been successfully implemented in many European countries and can be an effective tool for improving the quality of technical education in Ukraine. Partnerships with industry and enterprises to create practical internships and projects allow students to work on real-world tasks, which contributes to their professional development.

In addition, regular professional development should be provided to keep teachers up to date with the latest developments in their field. Teachers need to have access to the latest technologies and methodologies to enable them to teach students effectively. Organising trainings, seminars and refresher courses for teaching staff will help ensure that they are competent and prepared to teach new subjects. Another necessary aspect is the integration of

new technologies into the learning process. Technical colleges should provide students with access to modern equipment and software used in industry. This includes updating laboratories, equipment and software to allow students to work with the real tools and technologies they will encounter in their professional lives. It is also necessary to develop an interdisciplinary approach to learning, allowing students to gain knowledge from different areas of science and technology. This will help to develop universal skills and abilities that can be applied in various fields of activity. Interdisciplinary programmes can include the integration of courses in project management, business analytics and other related disciplines, which will help to create a comprehensive approach to solving technical problems.

To ensure continuous monitoring of the effectiveness of curricula, it is important to organise feedback from graduates and employers. Regular surveys among graduates and analysis of feedback from employers will help identify weaknesses in educational programmes and promptly make the necessary changes. Such a mechanism will help create a dynamic educational system that will be able to respond quickly to new challenges and changes in technology and the labour market. This will not only improve the quality of education but also ensure that students' training meets modern requirements, making them competitive in the labour market.

Implementation of recommendations for improving curricula in technical colleges in Ukraine is an important step towards modernising education, but the process is complex and requires systematic efforts. Implementation requires a comprehensive approach, including updating teaching materials, professional development of teachers and the introduction of modern technologies. Table 2 shows the percentage of opportunities for implementing these recommendations in practice by Ukrainian technical colleges, which can be used to assess the level of readiness of educational institutions for change and identify key challenges in this process.

Table 2. Characteristics of the correlations between the possibilities of implementing the recommendation in practice by Ukrainian technical colleges

Recommendation	Realism of execution	Characteristic
Regularly updating the curriculum	60%	Will require resources to set up commissions and collect data, but there is scope for gradual implementation
Implementation of dual education	50%	Integration with enterprises and additional funding is required, which can be difficult to implement at the national level
Professional development of teachers	70%	Most colleges can organise training, but budget constraints may affect their regularity
Integration of new technologies into the educational process	55%	The cost of the latest hardware and software can be significant, but there are support programmes available
Interdisciplinary approach to learning	65%	Can be implemented through retraining and revision of programmes, but requires time to adapt
Feedback from graduates and employers	75%	Implementation through regular surveys and meetings is achievable but will require a systematic approach.

Source: compiled by the authors

Recommendations such as regular updating of curricula, introduction of dual education, professional development

of teachers, integration of new technologies and feedback from graduates are critical to ensure that education meets

modern technological requirements. These changes will not only improve the quality of training but will also contribute to better integration of graduates into the labour market. For example, regular updating of curricula will help to keep the knowledge and skills acquired by students up-to-date with rapidly changing technological trends. The introduction of dual education will provide students with practical experience while they are still studying, which will significantly improve their professional skills and readiness for real-world assignments.

However, the implementation of these recommendations is a difficult task for Ukraine. It requires not only financial expenditures but also significant organisational efforts. For instance, the integration of new technologies requires the purchase of modern equipment and software, which can be expensive. Professional development of teachers requires the organisation of trainings and courses, which also requires resources and time. Implementation of dual education requires close cooperation with industry, which can be difficult if partnerships are not well developed.

Despite these challenges, Ukraine has the potential to successfully implement the recommendations. Technical colleges in Ukraine have an established infrastructure and experience in training specialists. Many of them have modern laboratories, qualified teachers and a good academic reputation. There are government programmes and grants aimed at modernising education that can help finance the necessary changes. Ukraine is actively developing cooperation with international educational institutions, which opens opportunities for the exchange of experience and resources. Another important factor is the growing interest in technological innovation among Ukrainian students and young professionals. This interest can be used to stimulate changes in the curriculum, adapting it to new technologies and methodologies. In addition, there is an existing human resource potential, including young, ambitious teachers, who are ready to introduce new approaches and technologies into the learning process.

DISCUSSION

The results of the study showed that the modern world is characterised by rapid technological development, which necessitates changes in educational programmes, especially in technical colleges. In response to these transformations, curricula must constantly evolve to ensure that they meet the current requirements of the labour market. The study determined that technical college curricula have undergone a significant transformation in recent decades. In the beginning, technical education was focused on training skilled workers capable of performing routine tasks in plants and factories. Over time, curricula began to include more complex technical disciplines such as engineering and computer science, reflecting the growing role of technology in the economy. Later, however, radical changes to the curriculum became necessary. This is due to the emergence of new technologies such as artificial intelligence, big data, and the Internet of Things, as well as the

requirements for interdisciplinary knowledge and skills. These findings are in line with N. Rudhumbu (2021) and A. Pereira *et al.* (2023), who noted that the labour market now requires technical college graduates to have not only knowledge of specific technologies, but also critical thinking skills, creative problem-solving, and the ability to continuously learn throughout their lives.

The survey results showed that the curricula of technical colleges have changed significantly in recent years, towards greater integration of modern technologies and teaching methods. For example, the study of programming and data analysis has become mandatory in most technical specialities. This is confirmed by J. Rossmann *et al.* (2020) and J.I. Venegas-Muggli (2020), who noted that technical colleges in many countries have already adapted their programmes to include courses in big data, machine learning, and cybersecurity. Such changes demonstrate the readiness of educational institutions to meet the challenges of our time. Another important issue raised in this study is the interdisciplinary approach to education. According to a study by A. Venatius *et al.* (2023), modern employers expect graduates of technical colleges to have not only highly specialised knowledge but also skills in related fields. For instance, engineers are now expected to have a basic knowledge of economics and project management, as well as an understanding of the social sciences for effective communication and teamwork. R. Salhab (2024) and J. Albrecht *et al.* (2024) also confirmed this trend, noting that technical colleges are increasingly introducing courses to develop soft skills such as teamwork, communication, and time management. Changes in curricula are accompanied by the introduction of new teaching methods. As noted by X. Li *et al.* (2019), modern technical colleges are increasingly using innovative teaching approaches, such as project-based learning, problem-based learning, and simulations. This allows students not only to acquire theoretical knowledge but also to apply it in practice. These results are consistent with this study, which showed that higher education students who study using such methods are better prepared for the real world, which is positively noted by employers.

The results of the study showed that one of the key aspects is the importance of adaptability and flexibility of curricula in technical colleges. This correlates with the work of Y. Ma *et al.* (2022), who identified that given the rapid development of technology, educational institutions need to be able to change and adapt their programmes quickly. They added that traditional curricula that are updated only every few years can no longer meet the demands of the modern world. Therefore, they recommend the introduction of modular learning systems, where individual courses and units can be easily adapted to new technological trends. Studies by C. Winberg & S. Hollis-Turner (2023), P. Themba (2023), and M. Razi-ur-Rahim *et al.* (2024) also confirmed that technical colleges that use flexible modular programmes are better able to respond to labour market changes and provide their students with relevant knowledge and skills. For example, some colleges have already

introduced a system where students are offered several course options to choose from, allowing them to specialise in specific areas of technology, such as cybersecurity, robotics or artificial intelligence. This concurs with the findings of this study that the flexibility of training allows graduates to be competitive in the labour market and quickly adapt to new conditions.

In recent years, the concept of lifelong learning has been receiving more and more attention in the educational environment. This is especially true for technical specialities where technology is rapidly becoming outdated. As noted by A. Bejan *et al.* (2020), C. Saneewongnaayuttaya *et al.* (2021), technical colleges should not only provide students with current knowledge but also teach them independent learning and critical thinking skills that will allow them to constantly update their knowledge after completing formal education. This is supported by this study, as curricula must include elements that promote the development of such skills, such as courses on knowledge management, self-management and analysis of new technologies. Another important aspect considered in this study is the involvement of industry in curriculum development. The study by Y. Xu *et al.* (2023) noted that technical colleges are increasingly collaborating with enterprises to ensure the relevance of their programmes. For example, companies provide information on current knowledge and skill requirements, participate in the creation of teaching materials, and offer internships for students. Such interactions help to ensure that technical college graduates are better adapted to the needs of the labour market. This is supported by research by L. White *et al.* (2023) and J. Albrecht *et al.* (2024), which shows that students who complete internships during their studies have a higher chance of successful employment after graduation.

Despite the positive developments, this study also highlights some of the challenges faced by technical colleges in adapting their curricula to modern requirements. As noted by researchers A. Bopegedera (2021), C. Willis *et al.* (2024), one of these challenges is the constant need to update material and technical facilities and training equipment. This requires significant financial resources, which are not always available, especially in public colleges. This is consistent with this study. It was determined that there is a problem of insufficient qualification of teachers who do not always have time to master new technologies and teaching methods. It was added that there is a need to further improve the relevance of curricula to current requirements. To do this, it is necessary to ensure that curricula are constantly updated in line with current technological trends and labour market requirements. This implies regular updating of teaching materials and expanding cooperation with industry. More time should be devoted to the development of interdisciplinary programmes and the integration of soft skills courses into technical specialities. This will help graduates be more competitive in the labour market. These thoughts were confirmed by N. Siyam & S. Abdallah (2022), and M. Byrnes *et al.* (2024). They found that there

is a need to invest in teacher training and access to modern teaching materials and equipment. This will allow teachers to better respond to the challenges of the modern world and ensure a high level of student learning. It is equally important to increase the use of innovative teaching methods, such as project-based learning, simulations and distance learning, which will help students develop practical skills and increase their readiness to work in the real world.

Based on the analysis of the research results, it can be concluded that the curricula of technical colleges are evolving in response to modern technological challenges. They are increasingly focused on the integration of new technologies, the development of interdisciplinary knowledge, the use of innovative teaching methods and close cooperation with industry. Nevertheless, this process is accompanied by certain challenges, such as the need to constantly upgrade the material and technical base and improve the qualifications of teachers. Therefore, the evolution of curricula in technical colleges is necessary to ensure that they meet modern requirements. Various studies confirm that colleges that actively adapt their programmes, integrate new technologies and teaching methods, and collaborate with industry are better able to prepare their students for the challenges of the modern labour market. However, for further success, it is necessary to continue to invest in curriculum flexibility, interdisciplinary knowledge and self-learning skills, which will allow graduates to be prepared for the constant changes in the world of technology.

CONCLUSIONS

A comparative analysis of the curricula of technical colleges in Ukraine and leading foreign countries, such as the United States of America, Sweden and Germany, has shown that the integration of international approaches, such as the dual system of education and the introduction of the latest technologies, has a positive impact on the quality of training and increases their adaptability to the labour market. However, the study also revealed certain challenges. Cultural and socio-economic differences between countries can make it difficult to effectively implement foreign experience in the Ukrainian context. This underscores the need to adapt international models to national conditions, which requires additional research and in-depth analysis of the specifics of the Ukrainian labour market and education system. Despite the progress made in identifying effective strategies for integrating international educational practices, questions remain about the scale and sustainability of such changes. Particular attention should be paid to the development of partnerships between educational institutions, government agencies and the private sector, which will facilitate the exchange of experience and support the sustainable development of the educational system in Ukraine.

In addition, the survey results showed that teachers and students have different expectations and needs that need to be addressed when developing and modernising educational programmes. Teachers stressed the need for continuous professional development and access to

modern teaching materials, which would allow them to meet the high standards of education implemented in international practice. Students also pointed out the importance of practical orientation of training and the possibility of applying the acquired knowledge in practice during their studies. The feedback also revealed the need to update the technical support of educational institutions, which is an important component for the successful implementation of the latest educational technologies. In addition, the importance of support from employers was emphasised, who could become active partners in curriculum development by providing their recommendations and providing students with internship opportunities. The analysis of the findings identified specific steps to improve curricula, including the development of flexible educational pathways that would consider the individual needs of students and ensure their readiness for the challenges of the labour market.

Prospects for further research include a deeper analysis of the mechanisms for adapting international models to

national conditions exploring the possibilities of integrating practice-oriented teaching methods, developing new tools to measure the effectiveness of such changes, and creating strategies to overcome possible obstacles to modernisation. The practical significance of the work lies in the evolution of curricula in technical colleges that provide students with relevant knowledge and skills necessary to work with modern technologies, which can be used by educational institutions to optimise curricula, as well as by employers to determine the readiness of graduates to work in innovative fields.

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REFERENCES

- [1] Albrecht, J., *et al.* (2024). How much digital public health is there in public health degree programmes? A systematic module handbook analysis of full-time degree programmes at public colleges and universities in Germany. *Federal Health Journal*, 67, 339-350. [doi: 10.1007/s00103-024-03844-2](https://doi.org/10.1007/s00103-024-03844-2).
- [2] Bejan, A., Xi, M., & Parker, D. (2020). Outcomes of a safety and health educational intervention in auto body and machine tool technologies vocational college programs: The technical education curricula for health and safety (TECHS) study. *Annals of Work Exposures and Health*, 64(2), 185-201. [doi: 10.1093/annweh/wxz092](https://doi.org/10.1093/annweh/wxz092).
- [3] Bopegedera, A. (2021). Student-driven, curriculum-embedded undergraduate research experiences (SD-CUREs) in the senior chemistry curriculum and its impact on students. *Journal of Chemical Education*, 98(8), 2549-2558. [doi: 10.1021/acs.jchemed.0c01140](https://doi.org/10.1021/acs.jchemed.0c01140).
- [4] Byrnes, M., Jones, B., & Holt Foerst, E. (2024). Examining the motivational climate and student effort in professional competency courses: Suggestions for improvement. *Journal of Veterinary Medical Education*, 51(3), 326-348. [doi: 10.3138/jvme-2022-0100](https://doi.org/10.3138/jvme-2022-0100).
- [5] Declaration of Helsinki. (2013). Retrieved from <https://www.wma.net/what-we-do/medical-ethics/declaration-of-helsinki/>.
- [6] Ivanov, D., Alekseenko, V., & Yarmolenko, T. (2023). Peculiarities of interdependence of Big Data and Internet of things technologies. *Bulletin of the Azov State Technical University*, 46, 13-27. [doi: 10.31498/2225-6733.46.2023.288096](https://doi.org/10.31498/2225-6733.46.2023.288096).
- [7] Kamal, M., Salleh, R., Zulkifli, R., Jamil, M., & Othman, H. (2023). [Identification of cooperative learning component in designing lesson plan for building drawing subject in vocational colleges](https://doi.org/10.31498/2225-6733.46.2023.288096). *Journal of Technical Education and Training*, 15(1), 20-27.
- [8] Kossmann, R. (2022). Individual educational plans: Just a tool to immunise teaching from parental criticism?. *Cogent Education*, 9(1). [doi: 10.1080/2331186X.2022.2085628](https://doi.org/10.1080/2331186X.2022.2085628)
- [9] Künstler-Sment, J., Eckert, S., Favella, G., Kerwer, M., & Jansen, M. (2024). Standardised data management plan for educational research (Stamp) – a project-accompanying tool for research data management. *Educational Science*, 27, 1117-1140. [doi: 10.1007/s11618-024-01246-3](https://doi.org/10.1007/s11618-024-01246-3).
- [10] Li, X., Fan, X., Qu, X., Sun, G., Yang, C., Zuo, B., & Liao, Z. (2019). Curriculum reform in Big Data education at applied technical colleges and universities in China. *IEEE Access*, 7, 125511-125521. [doi: 10.1109/ACCESS.2019.2939196](https://doi.org/10.1109/ACCESS.2019.2939196).
- [11] Liu, Q. (2024). Based on FAHP-EWM fuzzy comprehensive evaluation of professional master industry cluster training platform construction. In *2024 6th International conference on computer science and technologies in education (CSTE)* (pp. 246-250). Xi'an: Institute of Electrical and Electronics Engineers. [doi: 10.1109/CSTE62025.2024.00053](https://doi.org/10.1109/CSTE62025.2024.00053).
- [12] Ma, X. (2024). Reform of the evaluation index system of civics teaching in higher vocational colleges and universities curriculum oriented to the demands of vocational positions in the context of deep learning. *Applied Mathematics and Nonlinear Sciences*, 9(1). [doi: 10.2478/amns-2024-0927](https://doi.org/10.2478/amns-2024-0927).
- [13] Ma, Y., Zhang, L., & Wu, M. (2022). Research on the influence of virtual reality on the learning effect of technical skills of science and engineering college students: Meta-analysis based on 32 empirical studies. *International Journal of Digital Multimedia Broadcasting*, 2022, article number 202370. [doi: 10.1155/2022/6202370](https://doi.org/10.1155/2022/6202370).

- [14] McGrath, S., & Yamada, S. (2023). Skills for development and vocational education and training: Current and emergent trends. *International Journal of Educational Development*, 102, article number 102853. doi: [10.1016/j.ijedudev.2023.102853](https://doi.org/10.1016/j.ijedudev.2023.102853).
- [15] Meshel, A., Iavicoli, L., Dilos, B., Agriantonis, G., Kessler, S., Fairweather, P., Nazarian, D., Lugassy, D., & Bentley, S. (2023). Strategic educational expansion of trauma simulation initiative via a plan-do-study-act ramp. *Western Journal of Emergency Medicine*, 24(2), 76-78. doi: [10.5811/westjem.2022.12.57735](https://doi.org/10.5811/westjem.2022.12.57735).
- [16] Ministry of Education and Science of Ukraine (2024). Retrieved from <https://mon.gov.ua/>.
- [17] Pereira, A., Moura, M., Gonçalves, L., & Da Costa Fernandes Curvelo, C. (2023). Repo-Educ: Repository of educational robotics lesson plans. In *2023 Latin American robotics symposium (LARS), 2023 Brazilian symposium on robotics (SBR), and 2023 Workshop on robotics in education (WRE)* (pp. 707-712) Brazil: IEEE. doi: [10.1109/LARS/SBR/WRE59448.2023.10332983](https://doi.org/10.1109/LARS/SBR/WRE59448.2023.10332983).
- [18] Powell, R., Schultz, J., Harvey, R., & Meaux, A. (2024). Maximizing student outcomes in schools: Data-driven individualized education program goals and objectives aligned to the standards. *Language, Speech, and Hearing Services in Schools*, 55(2), 303-322. doi: [10.1044/2023_LSHSS-23-00082](https://doi.org/10.1044/2023_LSHSS-23-00082).
- [19] Razi-ur-Rahim, M., Uddin, F., Dwivedi, P., & Pandey, D. (2024). Entrepreneurial intentions among polytechnic students in India: Examining the theory of planned behaviour using PLS-SEM. *The International Journal of Management Education*, 22(3), article number 101020. doi: [10.1016/j.ijme.2024.101020](https://doi.org/10.1016/j.ijme.2024.101020).
- [20] Rossmann, J., Sanford, K., Nicodemus, J., & Cohen, B. (2020). [The sociotechnical core curriculum: An interdisciplinary Engineering Studies degree program](https://doi.org/10.1109/ASEE58773.2023.10343294). *American Society for Engineering Education*, 1-18.
- [21] Rudhumbu, N. (2021). Implementation of the technical and vocational education and training curriculum in colleges in Botswana: Challenges, strategies and opportunities. *International Journal of Training Research*, 20(2), 160-177. doi: [10.1080/14480220.2021.1990106](https://doi.org/10.1080/14480220.2021.1990106).
- [22] Salhab, R. (2024). AI literacy across curriculum design: Investigating college instructor's perspective. *Online Learning*, 28(2). doi: [10.24059/olj.v28i2.4426](https://doi.org/10.24059/olj.v28i2.4426).
- [23] Saneewongnaayuttaya, C., Sangngoen, N., Kongin, M., Panhirun, P., & Saetung, K. (2021). Applying outcomes-based learning in mechatronics and robotics program: Case study of Singburi Technical College. In *Proceedings of the 29th international conference on computers in education*. (pp. 667-672) Asia-Pacific Society for Computers in Education (APSCE). doi: [10.58459/icce.2021.4307](https://doi.org/10.58459/icce.2021.4307).
- [24] Silva Costa, D., Schmidt, C., & Camargo, S. (2023). Individualized educational plan: Implementation and influence on collaborative work for the inclusion of students with autism. *Brazilian Journal of Special Education*, 28, article number e280098. doi: [10.1590/S1413-24782023280099](https://doi.org/10.1590/S1413-24782023280099).
- [25] Siyam, N., & Abdallah, S. (2022). A pilot study investigating the use of mobile technology for coordinating educational plans in inclusive settings. *Journal of Special Education Technology*, 37(4), 455-468. doi: [10.1177/01626434211033581](https://doi.org/10.1177/01626434211033581).
- [26] Sohokon, O., Donets, O., & Novik, S. (2024). [Trends in improving professional training of physical education specialists in Ukraine](https://doi.org/10.1177/19427751231181425). *Pedagogical Sciences*, 27(1), 39-45.
- [27] Themba, P. (2023). Understanding the demand for industrial skills through the national certificate (vocational) building and civil engineering programme. *International Journal of Learning, Teaching and Educational Research*, 22(5), 674-687. doi: [10.26803/ijlter.22.5.35](https://doi.org/10.26803/ijlter.22.5.35).
- [28] Venatius, A., Musta'amal, A., & Ekwok, O. (2023). Developing framework for teaching technical skills to metalwork undergraduates in vocational-based education in Nigeria. *Journal of Technical Education and Training*, 15(2), 11-20. doi: [10.30880/jtet.2023.15.02.002](https://doi.org/10.30880/jtet.2023.15.02.002).
- [29] Venegas-Muggli, J.I. (2020). The effects of first-generation status and financial aid on technical college students' academic performance: A longitudinal study. *Community College Journal of Research and Practice*, 46(6), 416-430. doi: [10.1080/10668926.2020.1863878](https://doi.org/10.1080/10668926.2020.1863878).
- [30] White, L., Jaison, D., Stanley, C., Hammond, T., & Watson, K. (2023). WIP: A novel methodology for assessing mechanical, electrical, and civil engineering programs with an emphasis on institutional type. In *2023 IEEE Frontiers in education conference (FIE)* (pp. 1-5). College Station: IEEE. doi: [10.1109/FIE58773.2023.10343294](https://doi.org/10.1109/FIE58773.2023.10343294).
- [31] Willis, C., LaVenja, K.N., & Galletta Horner, C. (2024). Wisdom of the outsiders within: How career technical education leaders can inform educational leadership preparation. *Journal of Research on Leadership Education*, 19(3), 332-351. doi: [10.1177/19427751231181425](https://doi.org/10.1177/19427751231181425).
- [32] Winberg, C., & Hollis-Turner, S. (2023). Renewable energy technologies: How technical curricula could enable a brighter future. *Southern African Journal of Environmental Education*, 39. doi: [10.4314/sajee.v39i.09](https://doi.org/10.4314/sajee.v39i.09).
- [33] Xu, Y., Zhao, B., Tung, S., & Hu, H. (2023). Infusing data science into mechanical engineering curriculum with course-specific machine learning modules. In *2023 ASEE Annual Conference & Exposition*. Baltimore: ASEE Conferences. doi: [10.18260/1-2--43958](https://doi.org/10.18260/1-2--43958).

Оксана Костенко

Кандидат історичних наук, доцент
Університет Григорія Сковороди в Переяславі
08401, вул. Сухомлинського, 30, м. Переяслав, Україна
<https://orcid.org/0000-0003-0831-9158>

Володимир Сіропол

Кандидат історичних наук, доцент
Університет Григорія Сковороди в Переяславі
08401, вул. Сухомлинського, 30, м. Переяслав, Україна
<https://orcid.org/0000-0001-6069-2609>

Еволюція навчальних планів у технічних коледжах: відповідність сучасним технологічним вимогам

Анотація. Метою дослідження було визначення ключових чинників модернізації освітніх технологічних програм для підвищення професійної освіти в умовах існування сучасного ринку праці. Методологічною основою дослідження став порівняльний аналіз навчальних планів у технічних коледжах України та провідних іноземних країн таких, як Сполучені Штати Америки, Швеція та Німеччина. Даний метод дозволив розглядати систему професійної освіти України в контексті глобальних тенденцій і зрозуміти взаємозв'язок між міжнародними освітніми практиками та змінами в українській системі. Основні результати дослідження показали, що впровадження міжнародних підходів, таких як дуальна система навчання та застосування новітніх технологій, значно покращує якість підготовки фахівців і підвищує їхню адаптивність до умов сучасного ринку праці. Було виявлено, що культурні й соціально-економічні відмінності можуть ускладнювати ефективне впровадження зарубіжного досвіду, підкреслюючи важливість адаптації цих моделей до національних умов. Дослідження досягло значного прогресу у визначенні ефективних стратегій інтеграції міжнародних освітніх практик, що дозволить забезпечити стійкий розвиток професійної освіти в Україні та підвищить конкурентоспроможність українських фахівців на глобальному ринку. Отримані результати також підкреслили необхідність подальшого вивчення та вдосконалення адаптації міжнародних моделей до національних реалій. У дослідженні з'ясовано важливість тісної співпраці між освітніми закладами, урядовими структурами та приватним сектором для успішної модернізації професійної освіти. Отримані результати можуть бути корисними для освітніх закладів у вдосконаленні навчальних програм та для урядових структур у розробці освітніх реформ та приватного сектору для активного залучення роботодавців до підготовки кадрів

Ключові слова: технологічна освіта; інновації; стандарти; науковий прогрес; тенденції

Svitlana Herasina*

PhD in Psychology, Associate Professor
Hryhorii Skovoroda University in Pereiaslav
08401, 30 Sukhomlynskyi Str., Pereiaslav, Ukraine
<https://orcid.org/0000-0002-8733-2600>

Influence of parental control on the academic independence of adolescents

Abstract. The study aimed to identify the level and nature of the influence of parental control on adolescents' academic independence. The study conducted a survey of adolescents at gymnasium No. 228 in the Dniproviskyi district of Kyiv. Total respondent number – 306. The results of the diagnostics demonstrated that parental control has a significant and at the same time ambiguous impact on the academic independence of modern adolescents, while the nature of this impact depends on how parents control their children's learning process and several other factors. The study determined that excessive parental involvement in the educational process, as well as complete indifference of parents, negatively affect the academic independence of adolescents, their motivation and academic results, while a high level of interest in educational and school processes has the opposite effect and serves as a motivation for adolescents to learn. The academic independence of secondary school students is enhanced when parents share their children's views, interests and hobbies, and are interested in, but do not interfere excessively with, their children's school life and educational processes. The study also noted the importance of finding the boundary between interest, sharing the problems of school life and the educational process and total control, as a high level of control is bad for relationships with adolescents, their stages of maturation, and academic performance, while it is necessary to address the individual characteristics of each child, as different approaches to parental control can have different effects on their motivation and academic achievement. This approach promotes the development of critical self-regulation and responsibility skills necessary for adolescents' future academic and professional achievements

Keywords: relationships with children; educational process; learning outcomes; educational strategies; level of responsibility

INTRODUCTION

Parental control is one of the key aspects of parental involvement in their children's education. Parental control is a multifaceted, not fully researched phenomenon and includes a wide range of family relationships related to children's academic development and education, parental behaviour and family relationships. Given the rapid development of science, technology, and engineering, constant rapid changes in the environment and the conditions in which schooling takes place, the success of the educational process is significantly influenced by the academic independence of adolescents. It consists of the ability of students to set learning goals independently and to effectively manage their learning process without constant external

influence. In addition, the development of academic independence contributes not only to the growth of motivation and the level of academic achievement but also forms the basis for future personal and professional independence. Adolescents with a high level of academic independence can think critically, manage material and time resources optimally, and solve complex problems that arise during the learning process. Thus, the development of academic independence in adolescence determines success in the educational process and later in the professional sphere.

In general, the issue of the impact of parental control on adolescents' academic independence is of great interest to the scientific community. Aspects of this phenomenon

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*Corresponding author



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have been repeatedly considered by Ukrainian and foreign scholars from different perspectives. M.M. Barger *et al.* (2019) conducted a meta-analysis examining the relationship between parental involvement in children's school life and their socio-emotional adjustment and underlined the importance of parental support for the overall well-being of the child, including their academic success. The researchers highlighted that adequate parental control can contribute to the formation of a positive attitude to learning, the development of self-discipline and academic motivation. At the same time, excessive or insufficient parental control can lead to stress, lower self-esteem and academic performance in adolescents. Therefore, it is important to study how different forms and intensities of parental control affect the development of academic independence. J. Coros & R. Madrigal (2021) examined the relationship between independent learning, self-confidence, and academic motivation among high school students. Their findings determine how self-perception affects academic behaviour. C.M. Hall (2020) assessed the impact of family involvement on students' academic achievement. The study confirmed that active parental involvement can improve children's educational outcomes. H.B.T. Lim & N.C.H. Ong (2024) investigated the relationship between perceived parenting styles and sports performance of young athletes in Singapore. These findings provide a deeper understanding of how parenting strategies affect other aspects of adolescents' lives, not just academics. A study by S. Bosacki *et al.* (2023) significantly contributed to the study of parental control. The study assessed how different aspects of parental control affect the formation of adolescents' academic identity. The authors have made a unique contribution to understanding how family relationships shape children's educational trajectories and affect learning outcomes. Authors such as N.V. Butalevich & O.I. Seleznyova (2021) assessed how child-parent relationships affect anxiety among school-age children. T.V. Dudarchuk (2019) conducted a study of the psychological characteristics of school anxiety in adolescents. S. Boele *et al.* (2020) investigated how changes in parental control affect adolescents' adaptation within the same family. A study by H. Wang *et al.* (2022) concluded that parental support for autonomy promotes positive behaviour in the digital environment by improving adolescents' ability to control their actions and understand prospects.

In general, the reviewed scientific works form a comprehensive view of various aspects of parental interaction, emphasising their importance for the development of adolescents in academic and social contexts, and determining the relevance of further research on this phenomenon. The study aimed to determine the specifics of the influence of parental control on the development of academic independence of adolescents. To achieve the goal, the following tasks were addressed:

- to conduct an empirical study of the impact of parental control on the academic independence of adolescents using regression analysis of data collected based on a metropolitan school;

- to assess the level of dependence between parental control styles and the level of academic independence of adolescents;

- to develop recommendations for parents and educational administrations on optimising parental control to support an effective level of academic independence of adolescents.

MATERIALS AND METHODS

The analysis of the level of influence of parental control on the academic independence of adolescents was conducted based on gymnasium No. 228 of Dniprovskiy district of Kyiv. The respondents were students of grades 7-9 without a specialised subject. The research project was implemented during one academic year and included 4 waves of surveys. A general sample was used, as the width of such a sample makes it possible to apply the knowledge gained to the general population. The total number of surveys conducted was 306, including 170 girls and 136 boys. For the final processing of the results, the computer program for processing statistical data SPSS Statistics was used.

As part of this study, a test list of 15 questions was developed:

- My parents chose my school independently.
- My parents are interested in the life of the school.
- My parents are interested in what subjects I study.
- My parents are interested in my current grades.
- My parents are interested in my final grades.
- I want to tell my parents about the events and situations that happened to me at school.
- I want to tell my parents what I have learnt in class.
- My parents make sure I attend school.
- My parents make sure I do my homework.
- My parents hire additional tutors for me.
- My parents keep in touch with the class teacher to monitor my progress.
- My parents suggest to me what to do after school.
- My parents discussed with me their plans related to my studies.
- My parents support and share my interests in school subjects.
- My parents support me and share my interests that are not related to school.

The scale of responses ranges from 1 to 5, where 1 is explained as strongly disagree and 5 is strongly agree. In the process of analysing the surveys conducted, Cronbach's alpha criterion (Coros & Madrigal, 2021) was used to assess the quality of the results obtained. The value of the coefficient obtained was within acceptable limits, which indicates the relevance of the chosen methodology for assessing the level of influence of parental control on adolescents' academic independence. All study participants were informed about how the information provided during the survey would be used, and all provisions of the Declaration of Helsinki (2013) were followed during the survey.

The study was conducted in the context of the influence of parental control on adolescents' academic independence.

The method used to process the results was regression analysis. To form the regression model, the average school grade was taken as the dependent variable, which was found as an arithmetic mean for all subjects for the first school term of the current year of study. The educational institution based on which the survey was conducted uses a 12-point grading system. To determine the degree of influence of parental control on students' academic independence, the regression model included variables for 15 questions as independent variables, which were recoded into binary variables, where 1 is when the respondent completely or almost completely agrees with the statement, and the rest of all variables correspond to 0. The following information was also used as variables in the model: parents' level of education, financial situation in the family, child's gender, and family composition (full/incomplete). In the variable "Gender", the number 1 corresponds to the female gender and 0 to the male gender. In the category "Family composition",

1 is a full family, and 0 is a child being raised in a single-parent family. In the "Financial situation" category, the variables are presented in a range from 1 to 6, where 1 is a situation where sometimes there is not enough money to buy the most necessary things, 6 is a financially secure family that can afford holidays, a car, etc. Parental education is represented by the following variables: 1 – higher education, 0 – incomplete higher education and lower levels.

RESULTS

At the first stage of the study, the following information about the respondents was assessed: gender, family composition, parental education, family financial situation, and place of residence. The survey involved 136 boys (44.4%) and 170 girls (55.6%). The survey involved 210 children from full families (68.6%) and 96 (31.4%) from single-parent families. The structure of respondents by family financial status is shown in Figure 1.

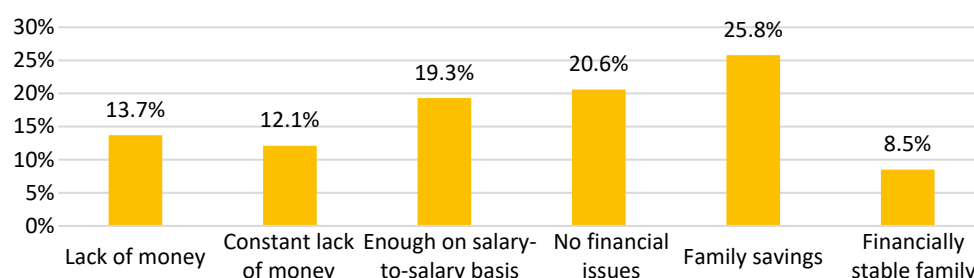


Figure 1. Structure of respondents by family financial status

Source: compiled by the author of the study

The data presented in the figure indicates a significant impact of family financial situation on students' educational outcomes, as respondents from families with savings (25.8%) or sufficient funds (20.6%) have better conditions for studying, which contributes to their academic independence. On the contrary, respondents from families with little money (13.7%) or money only from salary-to-salary (19.3%) may face additional

difficulties that negatively affect their motivation and academic performance. This is especially true for respondents whose families live in a situation where money is not always enough (12.1%), which indicates an unstable financial situation and possible related stresses that hinder successful learning. An important aspect that influences the level of parental control over children is the level of education of each parent (Fig. 2).

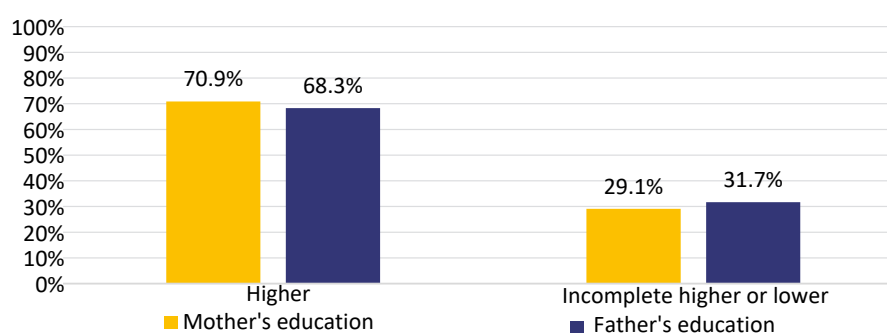


Figure 2. Parents' level of education

Source: compiled by the author of the study

Higher education of the mother (70.9%) and father (68.3%) dominates among the respondents, which indicates a high level of parental education, which usually correlates with greater support in the educational process

of children and the creation of a favourable educational environment. The statistical characteristics of the descriptive variables used to build the regression model are presented in Table 1.

Table 1. Statistical characteristics of descriptive variables used in the construction of the regression model

Variable	Sample size	Minimum value	Maximum value	Medium	Standard deviation
Dependent variable					
Average academic grade	306	5	9.19	7.1035	0.97295
Independent variables					
Gender	306	0	1	0.5951	0.49207
Financial situation	306	2	6	4.6765	0.95888
Family composition	306	0	1	0.6699	0.47139
Mother's level of education, %	306	0	1	0.7707	0.42139
Father's level of education, %	306	0	1	0.7187	0.45078

Source: compiled by the author of the study

According to the statistical characteristics of the descriptive variables, 7-9th grade students of gymnasium No. 228 in the Dniprovskyi district of Kyiv who participated in this survey have an average academic score of 7.1035 (the school uses a 12-point system of knowledge assessment), with moderate variability (standard deviation 0.97295), which indicates a variety of academic performance among the surveyed students. The findings

suggest that the average academic score of adolescents is relatively high and variable, the gender composition of respondents is balanced, and the financial situation, family composition and educational level of parents are moderately variable, indicating a variety of socio-economic and family conditions of respondents. At the next stage of the study, the answers to the 15 questions of the test list were analysed (Table 2).

Table 2. Respondents' answers about how parents control the learning process

Statement	Number of responses (%)				
	Fully disagree (1)	Almost agree (2)	Partially agree (3)	Agree (4)	Fully agree (5)
My parents chose my school independently (P1)	65 (21.4)	43 (14.1)	56 (18.4)	49 (16)	92 (30.1)
My parents are interested in the life of the school (P2)	143 (46.6)	52 (17)	43 (14.1)	24 (7.8)	45 (14.6)
My parents are interested in what subjects I study (P3)	30 (9.7)	47 (15.5)	67 (21.8)	70 (22.8)	92 (30.1)
My parents are interested in my current grades (P4)	30 (9.7)	36 (11.7)	64 (20.9)	70 (22.8)	107 (35)
My parents are interested in my final grades (P5)	7 (2.4)	3 (1)	39 (12.6)	66 (21.7)	191 (62.3)
I want to share with my parents what is happening to me at school (P6)	39 (12.6)	45 (14.6)	68 (22.3)	61 (19.9)	94 (30.6)
I want to share with my parents what I have learnt in class (P7)	52 (17)	47 (15.5)	89 (29.1)	61 (19.9)	56 (18.4)
My parents make sure I attend school (P8)	117 (38.2)	76 (24.8)	47 (15.5)	27 (8.7)	39 (12.6)
My parents make sure I do my homework (P9)	193 (63.1)	50 (16.5)	40 (13.1)	6 (1.9)	16 (5.3)
My parents hire additional tutors for me (P10)	7 (2.4)	6 (1.9)	7 (2.4)	25 (8.3)	261 (85.4)
My parents keep in touch with the class teacher to monitor my progress (P11)	10 (3.4)	5 (1.5)	6 (1.9)	16 (5.3)	269 (87.9)
My parents suggest to me what to do after school (P12)	114 (37.4)	55 (18)	89 (29.1)	28 (9.2)	19 (6.3)
My parents discussed with me their plans related to my studies (P13)	49 (16)	39 (12.6)	77 (25.2)	64 (20.9)	77 (25.2)
My parents support my academic interests (P14)	18 (5.8)	22 (7.3)	65 (21.4)	78 (25.2)	122 (43)
My parents support me in my interests that are not related to school (P15)	13 (4.4)	16 (5.3)	55 (18)	72 (23.3)	150 (49)

Source: compiled by the author of the study

The analysis of the respondents' answers shows that most often parents selected their children's school independently, with 46.1% of students responding. This indicates a significant level of parental control over education from the beginning, which can affect children's perception of education, their sense of autonomy and motivation to learn. At the same time, 21.4% of respondents strongly disagree with this statement, which indicates that a significant number of adolescents have some freedom in choosing an educational institution. Parent's interest in the life of the chosen school was less widespread, as 46.6% of

respondents strongly disagreed with this statement. Only 14.6% fully agree that their families are highly interested in school life. Parents do not actively monitor news about school life in social media, the media and other sources, which may indicate a lower level of direct control over the life of the school. At the same time, parents show a high interest in the educational process and their children's progress, as 52.9% of respondents say that parents are interested in what subjects they study at school, and 57.8% of parents know their children's current grades, which emphasises the importance of current academic results for

many families. Parents are most interested in final grades (84.0%), which indicates a special focus on the results of adolescents' education.

It is also necessary to identify the attitudes of adolescents to the fact that parents control or try to control their school life and the learning process. Almost half of the surveyed students are willing to share certain aspects of school events with their parents, while 38.4% of respondents are willing to share knowledge gained during their studies with their parents, indicating a positive emotional connection between adolescents and their parents. Parental control over school attendance is moderate, as 38.2% of respondents strongly disagree with this statement. Only 12.6% strongly agree that parents closely monitor their attendance at school. These figures suggest that parents attach more importance to academic achievement and results than to regular attendance. Parental control is also evident in the fact that most parents hire additional tutors for their children and keep in touch with the classroom teacher

about their children's progress. Such data indicate a high level of parental interest in the academic achievements of students. The level of imposition of a future profession by parents is moderate, as 37.4% of respondents strongly disagree with this statement. Only 6.3% fully agree that parents determine their future careers. An important aspect of this study is the way modern parents support and develop their children's interests, as 68.2% of students answered "My parents support my academic interests" in the affirmative. Parental support for non-school-related interests is also important, as 49.0% of respondents strongly agree with this statement, which highlights the wide range of parental support in adolescents' lives. To determine the impact of various factors on adolescents' academic independence, a regression analysis was conducted on the data based on such variables as gender, family composition, parents' educational level, family financial situation, and various aspects of parental control (P1-P15). The results of this analysis are presented in Table 3.

Table 3. Regression analysis results

Metric	Values of non-standardised ratios		Values of standardised ratios	t	Level of significance
	B	Standard deviation	Beta		
(Constant)	6.899	0.41		16.844	0
Gender	0.334	0.14	0.165	2.377	0.019
Family composition	0.053	0.154	0.025	0.348	0.728
Mother's level of education, %	0.417	0.173	0.172	2.408	0.017
Father's level of education, %	0.135	0.163	0.061	0.827	0.409
The financial situation of the family	-0.174	0.075	-0.166	-2.321	0.021
BK1	0.121	0.167	0.061	0.724	0.47
BK2	-0.003	0.184	-0.001	-0.017	0.986
BK3	-0.533	0.163	-0.269	-3.269	0.001
BK4	0.226	0.161	0.113	1.402	0.163
BK5	0.866	0.208	0.316	4.172	0
BK6	0.33	0.176	0.167	1.873	0.063
BK7	-0.209	0.163	-0.103	-1.284	0.201
BK8	-0.028	0.192	-0.012	-0.146	0.884
BK9	-0.604	0.302	-0.155	-2	0.047
BK10	-0.67	0.393	-0.119	-1.707	0.09
BK11	-0.134	0.353	-0.027	-0.378	0.706
BK12	-0.377	0.199	-0.141	-1.891	0.06
BK13	-0.012	0.159	-0.006	-0.077	0.938
BK14	0.379	0.247	0.183	1.534	0.127
BK15	-0.387	0.24	-0.177	-1.612	0.109

Source: compiled by the author of the study

The analysis shows P3, P5, and P9 were statistically significant at the level of 1%, while the significance level of 5% corresponds to such criteria as "Respondent's gender", "Mother's education level", and "Family financial situation". The variable "Parental interest in final grades" (P5) has a strong positive impact on the process of forming academic independence among modern adolescents, with a value of 0.866. In the school process, students' academic performance is measured primarily by final grades, which determines why parents' interest in such results is one of the motivating factors for children to achieve good

educational results. Parental interest in what subjects adolescents study (P3) and tracking homework (P9) have a negative impact (coefficients -0.533 and -0.604, respectively). The negative values of these variables show that when parents are too involved in the educational process, the level of their children's independence decreases, and they lose the desire to be responsible for their educational process. This phenomenon can also be explained by the fact that strong pressure on children is typical for parents whose children demonstrate poor academic performance, which in turn leads to increased control over their

educational processes and school results. In contrast, students with high grades do not provoke increased parental control over the organisation of their education.

The obtained value of the "Gender" variable indicates that girls usually get higher grades than boys in the study. Another indicator that is reflected in the academic independence of modern adolescents is the level of education of their mothers. A correlation was found that demonstrates that in most cases if the mother has higher education, the child has better grades at school. This can be attributed to the fact that mothers with higher education have a stronger awareness that children need more knowledge and that they need to get good academic grades to be successful in the future. The level of education received by the parent does not have a significant impact on the child's academic independence. This can be explained by the fact that mothers tend to focus more on their children's school and educational life than fathers. At the same time, there is a statistically significant relationship between the level of education of both parents, the significance level is 0.01, while the correlation coefficient is 0.3. There is a relationship between the level of family income and children's academic performance, as it turned out that the higher the level of family income, the lower the academic performance of adolescents. This can be explained from the point of view that children from poor families try to get better grades at school, as education can become their support for achieving success in the future, while in wealthier families, parents can provide for their child's future in other ways.

The hypothesis put forward at the beginning of the study was confirmed in the context of the fact that the type of parental control in which adolescents have autonomy contributes to a higher level of academic independence of adolescents, while the authoritarian style of parental control reduces the academic independence of adolescents. The study noted that the interaction between the style of parental control and the individual characteristic of the adolescent determines the degree of influence of control on academic independence. Summing up the results of the regression analysis of the influence of parental control on the academic independence of modern adolescents, it is worth noting a sufficient level of influence of the independent variables of the presented model (the level of variance is 31%), while it is also worth because the model presented in the study was not expanded by such criteria as the level of motivation of students, their abilities and developmental features, which can still be considered one of the strongest predictors of academic success of a modern student. These aspects were not addressed as are outside the scope of this study.

The study demonstrates the importance of the impact of parental control on the academic independence of modern adolescents. The significance of this issue is determined by the fact that modern education requires students not only high knowledge but also the ability to learn independently and manage the learning process independently. Parental involvement in their children's education is often seen as a key factor contributing to academic achievement,

but the results of the study show that the effect of parental control can be twofold. The results show that different aspects of parental attention can have different effects on adolescents' academic autonomy. Such a criterion as "Parental interest in final grades" has a positive effect on children's school performance, while excessive control over homework has a negative effect, indicating the importance of finding a balance between parental control and support.

DISCUSSION

The results obtained in the study showed that parental control significantly affects adolescents' academic independence; the regression analysis revealed that the nature and characteristics of this control determine its impact: excessive or almost absent parental involvement negatively affects motivation and learning outcomes, while interest in children's school life stimulates them to learn, and it is important for parents to find a balance between support and control, as excessive control can worsen relationships with adolescents and their academic success.

The results of this study are similar to the findings of N.L. Alston-Abel & V.W. Berninger (2018) and K.L. Roberts & S.E. Rochester (2023), whose research has shown that parental involvement in the educational process can have both positive and negative effects on the formation of students' academic independence. Parental interest in final grades contributes to improved academic performance, as students feel supported and recognised by their parents, which motivates them to study harder. It also increases their responsibility for their academic achievements, as they realise that their efforts do not go unnoticed. However, researchers also note that excessive parental involvement in the learning process can have the opposite effect. For example, when parents are overly controlling or intervene too often, it can lead to a decrease in students' autonomy and decision-making ability, and students may feel overly pressured and lose motivation to learn independently, which in turn can negatively impact their academic achievement in the long run (Guo *et al.*, 2021; Petrytsa, 2024).

Similar results were obtained by other researchers. In particular, M.M. Barger *et al.* (2019) concluded that parental interest in their children's final grades is an important factor that contributes to improved academic performance. They emphasise that parental attention to children's progress at school can create a positive emotional climate at home, which contributes to better learning and academic skills. However, the findings of N.L. Alston-Abel & V.W. Berninger (2018), and M.M. Barger *et al.* (2019) noted that a balance in parental involvement is a substantial factor. Excessive control and interference can lead to negative consequences, such as reduced motivation to learn and student autonomy. On the other hand, parental support and involvement that gives students the freedom to make decisions and encourages them to work independently can lead to better academic results and the development of vital independence skills. Thus, the findings of the present study confirm the conclusions of previous research and

emphasise the importance of a balanced approach to parental involvement in the educational process. Parents should be attentive to their children's academic achievements, provide them with the necessary support and encourage them to solve learning tasks independently and avoid excessive control, which can lead to a decrease in academic independence and motivation of students (Forresi *et al.*, 2023).

C.S. Cheung *et al.* (2016) concluded that controlling parental behaviour can reduce children's motivation and independence. In this study, one of the conclusions is that parental control over homework harms adolescents' independence. The same conclusions are reached in the work of J. Coros & R. Madrigal (2021) they emphasise that excessive parental control can negatively affect students' motivation to learn, self-esteem and independence. J. Scull *et al.* (2020) and J.Y. Kim & E. Kim (2021) demonstrated that parenting styles such as supportive and encouraging parenting have a positive impact on student achievement by increasing self-esteem and engagement in learning. The present study shows similar results, demonstrating the importance of parental support and interest in their children's academic achievement.

M. Joussemet *et al.* (2008) also noted that parental support for autonomy contributes to better academic performance and emotional well-being of children. This is supported by data on the positive impact of parental interest in final grades and interest in school life. E.R. Louderback & O. Antonaccio (2021) and S. Kim (2022) in a study on parental involvement and student achievement emphasise that parental involvement is an important factor that affects student achievement. The study also shows that certain aspects of parental control can have both positive and negative effects, depending on the context and how control is exercised. In addition, the author pointed out the importance of a long-term study of the relationship between parental involvement and student achievement. The study is a step in this direction, but more research is needed to identify the long-term effects of different aspects of parental control. J. Li & Y. Hu (2021) tracked the relationship between parental involvement and student achievement and concluded that positive parental involvement improves academic achievement through increased confidence in learning and improved parent-child relationships. The results are consistent with these findings, demonstrating the importance of parental support and involvement rather than simply exerting total control over adolescents' lives.

N. Steinfeld (2021) and H.B.T. Lim & N.C.H. Ong (2024) highlighted that parenting style affects not only the academic but also the sporting achievements of young people. Their research has shown that different parenting approaches can have a significant impact on the motivation and performance of young athletes, as well as on school performance. This demonstrates the wide range of impact of parenting styles on various aspects of the younger generation's lives, including their physical, emotional and social achievements. Researchers emphasise that parental support and encouragement of autonomy are key

elements that contribute to the development of independence and responsibility in various areas of life. For example, in sports, parents who empower their children to make their own decisions, set their own goals and develop strategies to achieve them contribute to the formation of more sustainable motivation and self-confidence, which in turn leads to improved sports performance and enjoyment of sports. The presented research focuses on academic independence but confirms the importance of supporting autonomy for achieving high educational outcomes. The ability of adolescents to organise their learning process independently, make decisions about the allocation of time and resources, and take responsibility for their achievements is critical for successful learning. Parents should understand that their role is not only to control and supervise but also to create an environment that will foster the development of these skills.

Parents who encourage and support their children's efforts to solve learning problems independently create a positive environment for academic independence. This approach helps students develop important critical thinking, time management, and self-control skills that are essential for achieving high educational outcomes (Smith *et al.*, 2020). Notably, autonomy support does not mean a complete rejection of parental involvement, but rather constructive support that helps students develop as independent and responsible individuals. Thus, the results of the study are consistent with the findings of H.B.T. Lim & N.C.H. Ong (2024) and emphasise the importance of a balanced approach to parenting, which includes supporting autonomy and developing independence in both academic and other areas of adolescents' lives. The results of the study also coincide with the findings of C. Erdem & M. Kaya (2020), who noted that, in general, parental involvement has a positive effect on student's academic achievement, although the magnitude of this effect may vary depending on specific forms of involvement and contextual factors such as family socioeconomic status and cultural characteristics.

CONCLUSIONS

The results of the study confirmed that parents have significant control over their children's school life and learning processes. The regression analysis showed that parental control has an ambiguous effect on adolescents' academic independence. Parents can have both positive and negative influences on educational processes, and the result of such influence primarily depends on the nature and characteristics of the chosen type of control. For instance, excessive parental involvement in educational processes, as well as the almost complete absence of parental involvement, negatively affect adolescents' academic independence, motivation and academic performance, while parents' interest in their children's school life and educational process, on the contrary, motivate adolescents to study. Parents should find the line between interest, separation of problems of school life and the educational process and control, as

control in its purest form spoils relationships with adolescents, negatively affecting both the stages of growing up and school performance. It is possible to conclude that parental control has a high level of influence on children's learning outcomes and the formation of their academic independence, but parents should understand that in the process of studying at secondary school, adolescents try to show some independence, separate from their parents, and show that they are adults and can already make independent decisions.

In summary, the results of the study indicate the need for a deeper understanding of the impact of different aspects of parental involvement on adolescents' academic achievement and autonomy. It is important to continue research in this area to identify optimal parenting approaches that will contribute to the development of independent, motivated and successful students. Further research could

focus on the differential impact of different aspects of parental control on adolescent autonomy and motivation in different cultural contexts. It is also necessary to investigate the relationship between parental control and other factors, such as school climate and student characteristics, and their impact on the educational outcomes and academic autonomy of today's adolescents.

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References

- [1] Alston-Abel, N.L., & Berninger, V.W. (2018). Relationships between home literacy practices and school achievement: Implications for consultation and home-school collaboration. *Journal of Educational and Psychological Consultation*, 28(2), 164-189. doi: 10.1080/10474412.2017.1323222.
- [2] Barger, M.M., Kim, E.M., Kuncel, N.R., & Pomerantz, E.M. (2019). The relation between parents' involvement in children's schooling and children's adjustment: A meta-analysis. *Psychological Bulletin*, 145(9), 855-890. doi: 10.1037/bul0000201.
- [3] Boele, S., Denissen, J., Moopen, N., & Keijsers, L. (2020). Over-time fluctuations in parenting and adolescent adaptation within families: A systematic review. *Adolescent Research Review*, 5, 317-339. doi: 10.1007/s40894-019-00127-9.
- [4] Bosacki, S., Talwar, V., & Lecce, S. (2023). Critical review: Secondary school climate and adolescents' emotional well-being. *Adolescents*, 3(3), 508-523. doi: 10.3390/adolescents3030036.
- [5] Butalevich, N.V., & Seleznyova, O.I. (2021). Influence of parent-child relationships on the features of school anxiety in adolescents. *Bulletin of Taras Shevchenko National University of Kyiv. Series "Social Work"*, 1(7), 51-56. doi: 10.17721/2616-7786.2021/7-1/10.
- [6] Cheung, C.S., Pomerantz, E.M., Wang, M., & Qu, Y. (2016). Controlling and autonomy-supportive parenting in the United States and China: Beyond children's reports. *Child Development*, 87(6), 1992-2007. doi: 10.1111/cdev.12567.
- [7] Coros, J., & Madrigal, R. (2021). Self-directed learning, self-efficacy in learning, and academic motivation of public senior high school students. *Asian Journal of Educational and Social Studies*, 21(2), 19-34. doi: 10.9734/AJESS/2021/v21i230503.
- [8] Declaration of Helsinki. (2013). Retrieved from <https://surl.li/pdgwoj>.
- [9] Dudarchuk, T.V. (2019). *Psychological features of school anxiety in adolescents*. In *Personality and society: Methodology and practice of modern psychology: Materials of the VI International scientific and practical Internet conference* (pp. 132-135). Lutsk: V.P. Ivanyuk
- [10] Erdem, C., & Kaya, M. (2020). A meta-analysis of the effect of parental involvement on students' academic achievement. *Journal of Learning for Development*, 7(3), 367-383. doi: 10.56059/jl4d.v7i3.417.
- [11] Forresi, B., Giani, L., Scaini, S., Nicolais, G., & Caputi, M. (2023). The mediation of care and overprotection between parent-adolescent conflicts and adolescents' psychological difficulties during the Covid-19 pandemic: Which role for fathers?. *International Journal of Environmental Research and Public Health*, 20(3), article number 1957. doi: 10.3390/ijerph20031957.
- [12] Guo, M., Li, X., Wang, W., & Fang, X. (2021). The relations of parental autonomy support, parental control, and filial piety to Chinese adolescents' academic autonomous motivation: A mediation model. *Frontiers in Psychology*, 12, article number 724675. doi: 10.3389/fpsyg.2021.724675.
- [13] Hall, C.M. (2020). The impact of family engagement on student achievement. *Networks: An Online Journal for Teacher Research*, 22(2), article number 4. doi: 10.4148/2470-6353.1327.
- [14] Joussemet, M., Landry, R., & Koestner, R. (2008). A self-determination theory perspective on parenting. *Canadian Psychology*, 49(3), 194-200. doi: 10.1037/a0012754.
- [15] Kim, J.Y., & Kim, E. (2021). Effect of positive parenting styles as perceived by middle school students on academic achievement and the mediation effect of self-esteem and academic engagement. *Sustainability*, 13(23), article number 13233. doi: 10.3390/su132313233.

- [16] Kim, S. (2022). Fifty years of parental involvement and achievement research: A second-order meta-analysis. *Educational Research Review*, 37, article number 100463. doi: [10.1016/j.edurev.2022.100463](https://doi.org/10.1016/j.edurev.2022.100463).
- [17] Li, J., & Hu, Y. (2021). Study on the relationship between parents' learning participation and academic performance of primary and secondary school students – analysis of a mediated regulatory model based on parent-child relationship and learning confidence. *Journal of East China Normal University (Educational Sciences Edition)*, 39(7), 72-83. doi: [10.16382/j.cnki.1000-5560.2021.07.007](https://doi.org/10.16382/j.cnki.1000-5560.2021.07.007).
- [18] Lim, H.B.T., & Ong, N.C.H. (2024). The relationship between perceived parenting styles and youth athletes' sporting achievement in Singapore. *Youth*, 4(2), 288-303. doi: [10.3390/youth4010020](https://doi.org/10.3390/youth4010020).
- [19] Louderback, E.R., & Antonaccio, O. (2021). New applications of self-control theory to computer-focused cyber deviance and victimization: A comparison of cognitive and behavioral measures of self-control and test of peer cyber deviance and gender as moderators. *Crime & Delinquency*, 67(3), 366-398. doi: [10.1177/0011128720906116](https://doi.org/10.1177/0011128720906116).
- [20] Petrytsa, Y. (2024). Development of creative abilities of primary school students by means of project-based technologies in foreign countries. *Scientific Bulletin of Mukachevo State University. Series "Pedagogy and Psychology"*, 10(2), 51-61. doi: [10.52534/msu-pp2.2024.51](https://doi.org/10.52534/msu-pp2.2024.51).
- [21] Roberts, K.L., & Rochester, S.E. (2023). Learning through everyday activities: Improving preschool language and literacy outcomes via family workshops. *Journal of Early Childhood Literacy*, 23(4), 495-528. doi: [10.1177/14687984211005081](https://doi.org/10.1177/14687984211005081).
- [22] Scull, J., Mackenzie, N.M., & Bowles, T. (2020). Assessing early writing: A six-factor model to inform assessment and teaching. *Educational Research, Policy and Practice*, 2, 239-259. doi: [10.1007/s10671-020-09257-7](https://doi.org/10.1007/s10671-020-09257-7).
- [23] Smith, T.E., Sheridan, S.M., Kim, E.M., Park, S., & Beretvas, S.N. (2020). The effects of family-school partnership interventions on academic and social-emotional functioning: A meta-analysis exploring what works for whom. *Educational Psychology Review*, 32, 511-544. doi: [10.1007/s10648-019-09509-w](https://doi.org/10.1007/s10648-019-09509-w).
- [24] Steinfeld, N. (2021). Parental mediation of adolescent Internet use: Combining strategies to promote awareness, autonomy and self-regulation in preparing youth for life on the web. *Education and Information Technologies*, 26, 1897-1920. doi: [10.1007/s10639-020-10342-w](https://doi.org/10.1007/s10639-020-10342-w).
- [25] Wang, H., Geng, J., Liu, K., Wei, X., Wang, J., & Lei, L. (2022). Future time perspective and self-control mediate the links between parental autonomy support and adolescents' digital citizenship behavior. *Youth & Society*, 54(6), 1077-1096. doi: [10.1177/0044118X211020778](https://doi.org/10.1177/0044118X211020778).

Світлана Герасіна

Кандидат психологічних наук, доцент

Університет Григорія Сковороди в Переяславі

08401, вул. Сухомлинського, 30, м. Переяслав, Україна

<https://orcid.org/0000-0002-8733-2600>

Вплив батьківського контролю на академічну самостійність підлітків

Анотація. Метою дослідження було виявлення рівня і характеру впливу батьківського контролю на академічну самостійність підлітків. В дослідженні проведено опитування підлітків гімназії № 228 Дніпровського району м. Києва. Загальна кількість респондентів – 306. Результати проведеної діагностики показали, що батьківський контроль має суттєвий і в той же час неоднозначний вплив на академічну самостійність сучасних підлітків, при цьому характер даного впливу знаходиться в залежності від того, як саме батьки контролюють навчальний процес своїх дітей та ряду інших факторів. Виявлено, що надмірна участь батьків в навчальному процесі, так само як і практична байдужість батьків, негативно впливають на академічну самостійність підлітків, їх мотивацію та учбові результати, в той час як високий рівень їх зацікавленості в навчальних і шкільних процесах мають протилежний ефект і виступають в якості мотивації підлітків до навчання. Академічна самостійність учнів середньої школи підвищується в тих випадках, коли батьки розділяють з дітьми їх погляди, інтереси і захоплення, цікавляться, але надмірно не втручаються в шкільне життя та освітні процеси своїх дітей. Також в дослідженні була відмічена важливість знаходження границі між зацікавленістю, розділенням проблем шкільного життя і освітнього процесу і тотальним контролем, так як високий рівень контролю погано відображається на стосунках з підлітками, етапах їх дорослішання, академічній успішності, при цьому важливим є врахування індивідуальних особливостей кожної дитини, оскільки різні підходи до батьківського контролю можуть мати різний вплив на їхню мотивацію і навчальні досягнення. Такий підхід сприяє розвитку критично важливих навичок саморегуляції та відповідальності, необхідних для подальших академічних та професійних досягнень підлітків

Ключові слова: взаємовідносини з дітьми; освітній процес; навчальні результати; виховні стратегії; рівень відповідальності

**Mariia Shchedrina***

PhD Student, Lecturer

Institute of Higher Education of the National Academy of Educational Sciences of Ukraine
01014, 9 Bastionna Str, Kyiv, Ukraine

Nanyang Polytechnic

569830, 180 Ang Mo Kio Ave., Singapore, Singapore

<https://orcid.org/0000-0002-0214-2024>**Yue Man Judy Yip**

Senior Lecturer

Nanyang Polytechnic

569830, 180 Ang Mo Kio Ave., Singapore, Singapore

<https://orcid.org/0009-0002-3377-6609>

Evaluating ChatGPT in Japanese language education and essay assessment

Abstract. The relevance of the study stems from the growing need to introduce artificial intelligence into the educational process, particularly in teaching non-Latin languages, such as Japanese. The combination of optical character recognition and AI-based analysis opens up new opportunities to improve the efficiency of writing assessment, the quality of feedback, and the individualisation of learning. This study aimed to investigate the use of ChatGPT to improve the effectiveness of Japanese language teaching through the automated checking of student essays. Methodologically, educators used the OCR function of ChatGPT to digitise handwritten student essays, enabling analysis of grammar, vocabulary, sentence structure, and kanji. A mixed-methods approach was adopted, combining quantitative error analysis with qualitative insights from instructors. The study revealed that ChatGPT effectively detected eight major error categories, with the most common being insufficient kanji usage, overuse of basic sentence structures, and a limited vocabulary range. The tool's ability to generate instant error summaries and targeted feedback significantly reduced the time educators spent on marking, ensuring consistent and individualised support for learners. However, the study also identified limitations, including occasional inaccuracies in OCR processing, especially for stylised or unclear handwriting. Despite these challenges, the findings suggested that ChatGPT can serve as a valuable complementary tool to traditional teaching methods, enhancing feedback quality, supporting differentiated instruction, and promoting learner autonomy. The findings offer practical guidance for language educators, curriculum designers, and edtech developers seeking to integrate AI into the teaching and assessment of less commonly taught languages, such as Japanese

Keywords: generative AI; language proficiency evaluation; AI in education; automated feedback; Japanese language pedagogy

INTRODUCTION

The integration of artificial intelligence (AI) into education has opened new pathways for enhancing teaching and learning across disciplines. Among the most widely

discussed tools is ChatGPT, a large language model developed by OpenAI, which has shown significant potential in supporting language acquisition through real-time

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*Corresponding author



feedback, error correction, and learner engagement. While much of the discourse around AI in education has focused on English or widely taught European languages, there remains limited research on its application in the context of Japanese as a foreign language, particularly in assessing student writing and supporting educators in managing feedback.

At Nanyang Polytechnic (NYP) in Singapore, students have the opportunity to study Japanese as an optional elective. These modules attract self-motivated learners from various academic backgrounds, creating a dynamic learning environment where innovation in pedagogy is highly encouraged. However, Japanese poses unique challenges due to its complex writing systems (hiragana, katakana, and kanji), context-dependent grammar, and nuanced vocabulary. These challenges often manifest in student essays, where issues with coherence, kanji accuracy, and grammar can hinder effective communication.

Recent scholarly efforts have explored the multifaceted role of ChatGPT in education, extending beyond surface-level implementation to examine its pedagogical, ethical, and technological implications across diverse learning contexts. Researchers such as D. Baidoo-Anu & L. Owusu Ansah (2023) have highlighted the influence of ChatGPT on academic writing practices, prompting a reconsideration of assessment and originality in higher education. In parallel, Y.K. Dwivedi *et al.* (2021) examined how generative AI is transforming business education, specifically in terms of curriculum design and instructional methods. Concerns about academic integrity have been raised by T. Susnjak & T.R. McIntosh (2024), who warned of ChatGPT's potential to enable AI-assisted cheating, thereby challenging the validity of traditional assessment models.

Technical studies have also begun to evaluate ChatGPT's functional effectiveness in discipline-specific learning. The model's perceived educational utility among pre-service teachers has been explored by M.A. Pesce & D. Fernández Blanco (2024), who identified both promise and scepticism in its classroom applications. Similarly, I.S. Chaudhry *et al.* (2023) argued that the emergence of ChatGPT challenges the effectiveness of traditional performance-based evaluation systems in higher education, necessitating a fundamental re-evaluation of assessment methods, academic integrity safeguards, and institutional policies to ensure the ethical and purposeful integration of AI tools into learning.

Inclusion and accessibility have also emerged as themes of interest. G.B. Mohan *et al.* (2024) proposed that ChatGPT can support inclusive education by simplifying complex content. M. Li (2024) demonstrated that ChatGPT can reliably assist in marking written assessments, particularly subjective tasks such as reflective writing, when guided by well-crafted prompts and averaged outputs. However, its limitations in assessing objective or low-quality submissions indicate that it should function as a supporting tool rather than a sole evaluator. Ethical dimensions and institutional readiness were explored by F. Kamoun *et al.* (2024), who assessed faculty attitudes and concerns regarding the

integration of ChatGPT into academic workflows. In terms of instructional innovation, K. Woodruff *et al.* (2023) contributed to the K-12 discourse by identifying the practical barriers faced by teachers adopting the tool in early education. Regional applications have also been studied: M.T. Pham & T.X.T. Cao (2025) reviewed ChatGPT's use in blended language learning in Southeast Asia, noting both infrastructural challenges and pedagogical gains. K.T. Kotsis (2024) critically evaluated ChatGPT's accuracy in answering science-related conceptual questions, comparing its output with that of conventional educational tools.

Together, these studies reflect a growing interest in applying AI and OCR technologies to support Japanese language education, particularly in the assessment of handwritten student work. While significant progress has been made, ongoing research continues to refine these tools to better serve the evolving needs of educators and learners. The research ultimately aimed to evaluate ChatGPT's potential as a complementary tool to traditional teaching methods for enhancing student learning outcomes.

MATERIALS AND METHODS

This study employed a mixed-methods research design to examine the effectiveness of ChatGPT in evaluating handwritten Japanese essays and supporting educators through automated feedback. The research was conducted within the Japanese Optional Elective Level 3 (OE3) module at Nanyang Polytechnic, Singapore, and involved 28 student participants from diverse academic backgrounds who had opted to study Japanese as a foreign language. As part of the classroom task, students were instructed to write essays by hand on the topic 私のたんじょうび ("My Birthday"), drawing upon the vocabulary, kanji, and grammatical structures acquired during the course. Once collected, the handwritten essays were scanned and digitised using ChatGPT's OCR technology, which enabled the text to be processed in a machine-readable format suitable for AI-driven analysis. These digitised texts were then analysed using the GPT-4 version of ChatGPT through a tailored prompt that guided the model to identify common linguistic issues and generate feedback.

Specifically, the model was instructed to detect grammatical errors (e.g. misuse of particles, incorrect verb forms), lexical limitations (such as repetition of basic vocabulary and lack of variation), syntactic simplicity (e.g. overuse of elementary sentence patterns), and kanji-related issues (such as the omission or misuse of kanji characters). Based on this analysis, ChatGPT provided two forms of feedback: individual feedback tailored to each student, offering correction suggestions and learning tips, and cohort-level summaries that identified frequent errors and writing trends across the group. A qualitative content analysis was conducted on the AI-generated feedback to assess its clarity, specificity, and pedagogical relevance. A quantitative error frequency analysis was employed to categorise and count the most prevalent types of errors identified by the model. This methodological combination enabled the

study to evaluate ChatGPT's capability not only in identifying linguistic errors in handwritten Japanese texts but also in offering meaningful, formative feedback that could inform instruction and enhance student learning.

During the study, the ChatGPT generative tool (version GPT-4, developed by OpenAI) was used to analyse digitised handwritten texts. The model was accessed between April and September 2024 using a query designed to identify grammatical errors, repetition of basic vocabulary, simplified syntactic constructions, and errors in the use of kanji. The AI-generated feedback included individualised advice to students as well as generalised error patterns observed within the sample. The authors of the study were responsible for verifying the content and interpreting the results. No generative AI tools were used to create visual materials.

RESULTS AND DISCUSSION

This study examined the application of ChatGPT in analysing handwritten Japanese essays and providing individualised and group-level feedback. It contributes to the growing body of research on AI in education, offering new insights into its application in the context of Japanese as a foreign language – an area that remains underexplored. Nanyang Polytechnic, Singapore, offers four foreign languages – French, German, Japanese, and Korean – as optional elective modules. Students can choose any of these languages based on their interests, academic goals, or career plans. As these modules are not mandatory, students who enrol are often assumed to be more intrinsically motivated than those in compulsory courses. These optional electives, commonly referred to as OEs, provide students with the flexibility to explore subjects beyond their core curriculum. They also bring together learners from various schools across the polytechnic, including the School of Engineering, Applied Sciences, Information Technology, Business Management, Health and Social Sciences, and Design and Media. This diversity contributes to a rich and engaging learning environment built around a shared interest in language learning.

The OE modules are structured across four levels. Levels 1 and 2 offer two-hour weekly sessions and carry two credits, while Levels 3 and 4 involve four-hour weekly classes and are worth four credits. Since October 2022, the Centre for Innovation and Life Skills (CILS) has adopted a hybrid teaching format for these modules, with 40% of sessions conducted live online and 60% held in person. This blended approach aims to enhance flexibility, promote active engagement, and better prepare students for a future shaped by remote work and digital collaboration.

The integration of AI tools such as ChatGPT for assessing handwritten essays offers several pedagogical benefits. Firstly, the use of optical character recognition (OCR) technology ensures that handwritten submissions are accurately digitised, minimising the risk of transcription errors that could arise from manual input. This allows instructors to focus on providing meaningful feedback rather than spending time on basic transcription tasks. Secondly, the AI's ability

to generate personalised comments and suggestions for improvement ensures that students receive targeted feedback specific to their language proficiency level. This individualised approach aligns with best practices in language education, where tailored feedback is recognised as a key factor in learner development. Furthermore, the automated analysis of essays enables consistent and unbiased assessment, thereby reducing the likelihood of subjective grading discrepancies. The scalability of AI-assisted assessment also makes it feasible for educators to efficiently manage large class sizes without compromising the quality of feedback.

Despite its advantages, the use of AI tools for assessing handwritten essays also presents several challenges. One primary concern is the accuracy of OCR technology, which can struggle with poorly written or stylised handwriting, resulting in incorrect transcriptions. Additionally, while ChatGPT can provide relevant feedback, there is a risk that its suggestions may not always align with the instructor's pedagogical intentions – particularly if the AI-generated feedback is overly generalised or contextually inaccurate. Educators must, therefore, maintain oversight of the AI's feedback to ensure that it aligns with course objectives. Another significant challenge involves the ethical consideration of data privacy, as student essays uploaded to an AI system must be handled in compliance with institutional data protection policies. Lastly, there is the potential for over-reliance on AI-generated feedback, which may reduce the instructor's direct engagement with student writing and limit the development of critical teacher-student interactions in language learning.

A practical demonstration of AI-assisted text recognition and transcription in the Japanese Optional Elective Level 3 course involved a handwritten essay by Student A on the topic “私のたんじょうび” (“My Birthday”). This essay was uploaded to ChatGPT, where OCR technology accurately converted the handwritten text into a digital format. Figure 1 demonstrates that the digital transcription closely matches the original handwritten content, achieving a 99% accuracy rate. This high level of accuracy highlights the reliability of AI tools in digitising student submissions, preserving textual integrity while enabling efficient processing and feedback generation. Figure 2 presents another example of AI-assisted text recognition and transcription applied to a handwritten Japanese essay submitted by Student B, focusing on the same topic, “私のたんじょうび” (“My Birthday”). The handwritten text was digitised by ChatGPT, resulting in a digital transcription displayed on the right. Unlike the previous example with a 99% match, this transcription achieved approximately 90% accuracy, as shown in Figure 2. The highlighted sections in the digital text reveal discrepancies, such as incorrect or missing characters, which reflect the limitations of OCR technology in accurately recognising handwritten text – particularly when dealing with variations in handwriting style, character spacing, or alignment. These errors underscore the importance of maintaining instructor oversight when utilising AI tools for educational assessment, as automated

transcription can misinterpret student input, potentially compromising the quality of feedback. The reduced accuracy in this case also emphasises the need for consistent handwriting standards or preprocessing techniques to

optimise OCR performance. This example provides a critical perspective on the reliability of AI-assisted assessment, illustrating that while technology can significantly enhance assessment efficiency, it is not without its limitations.

Essay of Student A

The student chose the topic 私のたんじょうび

4. Essay
Compose an essay of one of the topics below. At least 12 sentences.

- ① 好きな人 (好きなひと)
② 私のたんじょうび (わたしのたんじょうび)

Topic: 私のたんじょうび

私はナンヤン ボリテクニクの三年生です。
ビジネスマネジメントが主の学生です。
私のたんじょうびは 3月 21日です。
それとまた 12時にオーチャード駅で会いました。
それから わたしは えきから ラーメン 店へ行
きました。
みそは あまり 大きく ありませんが、ラーメンは とても
おいしかったです。
たべた 後で、カラオケに 行きました。
カラオケの へや は 大きくて、たのしかったです。
あとで、わたしは 私の 友達に 会いました。
はが ケーキ を 買って、わたしは 私のたんじょうびを
祝いました。
そして、かき 友達が 私に プレゼント を 送りました。
私のたんじょうび は とても たのしく、おもしろい 日です。

私はナンヤン ボリテクニクの三年生です。
ビジネスマネジメント学部の学生です。
私の誕生日は3月21日です。
私と友達12時にオーチャード駅で会いました。
それから、私たちは駅から4階のラーメン屋まで歩きました。
店はあまり大きくありませんが、ラーメンはとても美味しかったです。
食べた後で、カラオケに行きました。
カラオケの部屋は大きくて、楽しかったです。
あとで、私たちは私の家に帰ります。
母がケーキを買って、私たちは私の誕生日を祝いました。
そして、家族が私にプレゼントをあげました。
私の誕生日はとても楽しかった。特別な日です。

99% match

Figure 1. Essay by Student A and its transcribed version by ChatGPT

Source: ChatGPT

Essay of Student B

The student chose the topic 私のたんじょうび

4. Essay
Compose an essay of one of the topics below. At least 12 sentences.

- ① 好きな人 (好きなひと)
② 私のたんじょうび (わたしのたんじょうび)

Topic: 2

わたしのたんじょうびは七月にしています**。
かぞくともだちからのゆくふくやプレゼントがたの
しみです。
たんじょうびというべつなじょうりをたり**、がい
ゆくりします。
毎年、友だちがうちに来るなら、プレゼントをもって
きます。
それは私の大好きなほんです。
ほかのたんじょうびはかぞくといっしょに12さいです。
お母さんはわたしがよいこどもであるようにケーキを
つくります。
友だちといっしょにお祝いします。
私のたんじょうびにはたくさんのお金が**。
それはやちがたんじょうびであり、わたしのじんせ
いにおけるたねびであります。
私はその日をさいしゅうにまちっています。
たんじょうびはかぞくや友だちからのあいじょうやサ
ポートをかんじることができるのでとてもくべつな
日です。

わたしのたんじょうびは七月にしています**。
かぞくともだちからのゆくふくやプレゼントがたの
しみです。
たんじょうびというべつなじょうりをたり**、がい
ゆくりします。
毎年、友だちがうちに来るなら、プレゼントをもって
きます。
それは私の大好きなほんです。
ほかのたんじょうびはかぞくといっしょに12さいです。
お母さんはわたしがよいこどもであるようにケーキを
つくります。
友だちといっしょにお祝いします。
私のたんじょうびにはたくさんのお金が**。
それはやちがたんじょうびであり、わたしのじんせ
いにおけるたねびであります。
私はその日をさいしゅうにまちっています。
たんじょうびはかぞくや友だちからのあいじょうやサ
ポートをかんじることができるのでとてもくべつな
日です。

~90% match

Figure 2. Essay by Student B and its transcribed version by ChatGPT

Source: ChatGPT

Essay of Student C

The student chose the topic 私のたんじょうび

Topic: 私のたんじょうび

私のたんじょうびはじゅうがつにじゅうさんにちです。
じゅうぎょうのあとで、ともだちは私のうちにきました。
みんないっしょにひるごはんをたべて、ケーキをたべ
ました。
ケーキはとてもおいしかったです。
私はともだちからおきいおもちゃをもらいました。
そのあとで、私たちは家でついでにカパートにいました。
あたらしいけいを買って、しずかな世でおちやのあそびました。
ともだちは私にでがきをあげました。
いっしょにでがきをよんで、パンをたべました。
私のともだちはとてもしんせつとおもいました。
ごじゅうじにうちにえきました。
あのひはとてもたのしかったです。

私のたんじょうびはじゅうがつにじゅうさんにちです。
じゅうぎょうのあとで、ともだちは私のうちにきました。
みんないっしょにひるごはんをたべて、ケーキをたべ
ました。
ケーキはとてもおいしかったです。
私はともだちからおきいおもちゃをもらいました。
そのあとで、私たちははかってにちかいデパートにい
きました。
あたらしいけいを買って、しずかな世でおちやの
のみました。
ともだちは私にでがきをあげました。
いっしょにでがきをよんで、パンをたべました。
私のともだちはとてもしんせつとおもいました。
ごじゅうじにうちにえきました。
あのひはとてもたのしかったです。

~99% match

Figure 3. Essay by Student C and its transcribed version by ChatGPT

Source: ChatGPT

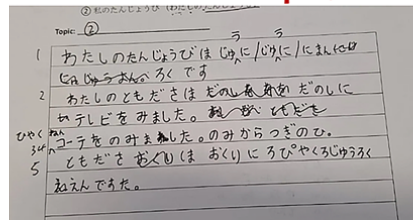
The high accuracy is evident in the minimal discrepancies between the handwritten text and the digital output presented in Figure 3, with only a minor difference highlighted in the phrase “はかつてに” (mistakenly digitised), reflecting the system’s capacity to accurately recognise and replicate student writing. The result further supports the argument that AI-driven transcription can significantly enhance assessment efficiency, reducing the manual effort required for text digitisation while preserving the authenticity of student submissions.

The text recognition applied to a handwritten Japanese essay by Student D achieved approximately 99% transcription accuracy using ChatGPT, as illustrated in Figure 4. While the digital text closely mirrors the handwritten version, a notable discrepancy is observed in the

transcription of the phrase “でした” (highlighted in red), where the OCR technology has incorrectly added unnecessary symbols (**). This inaccuracy likely resulted from the misinterpretation of handwriting characteristics, such as excessive spacing, overlapping strokes, or stray marks, which the OCR system misidentified as additional characters. Such minor but significant deviations highlight the need for careful oversight when using AI-driven OCR for educational purposes, ensuring that automated transcriptions are verified for accuracy before being used for feedback or assessment. This example illustrates that even with a high overall accuracy rate, minor recognition errors can occur, potentially altering the intended meaning of the student’s text, thus emphasising the importance of maintaining instructor validation in AI-assisted assessment workflows.

Essay of Student D

The student chose the topic 私のたんじょうび



わたしのたんじょうびはじゅうにに
じゅうよろこです。わたしのとも
だちはたのしいと思い**、たのし
んでテレビをみました**。コーヒ
ーをのみました。のみから次の日**、と
もだちはおくりのろびやくろじゅう
ろくえんでした**。

~99% match

Figure 4. Essay by Student D and its transcribed version by ChatGPT

Source: ChatGPT

The findings indicate that ChatGPT performs well in identifying a range of surface-level language errors in handwritten Japanese essays, particularly those related to grammar, vocabulary use, and sentence structure. For instance, the tool successfully flags incorrect verb conjugations, such as *たべますでした* instead of the correct *たべました*, or the misuse of particles, such as *が* in place of *は* (e.g. *わたしが学生です* instead of *わたしは学生です*). It also detects the overuse of basic expressions such as *たのしい* or *おいしい* without lexical variation, encouraging students to diversify their vocabulary. Similarly, insufficient use of kanji (e.g. writing *たんじょうび* entirely in hiragana instead of the expected *誕生日*) is identified as an area for improvement. These capabilities demonstrate the model’s utility in providing consistent and timely feedback on recurring linguistic patterns, particularly in beginner- and intermediate-level writing.

However, the study reveals several limitations in ChatGPT’s ability to accurately assess context-dependent or stylistically flexible language use. In some cases, the model incorrectly flags idiomatic or casual expressions as errors, such as *じゃあね* or *よろしくね*, even when they are appropriately used in informal narratives. Moreover, OCR-related errors result in the misreading of handwritten characters; for example, *ぬ* may be misrecognised as *め*, or the kanji *話* might be transcribed incorrectly due to stroke overlap or spacing inconsistencies. Such misreadings can lead to false feedback or overlooked mistakes, highlighting

the risk of relying solely on automated transcription without human verification. These findings emphasise the continued need for educator supervision to validate AI output and maintain alignment with the learner’s intended meaning and writing style.

Beyond structural accuracy, ChatGPT also demonstrates a limited ability to assess higher-order writing features, such as tone, creativity, and cohesion. For example, it may not recognise inconsistencies in register within a single essay (e.g. switching between *です・ます* form and plain form: *うれしかったです*。でも、ねむい), or fail to comment on the appropriateness of emotional expressions in contextually rich writing. In narrative essays such as *私のたんじょうび*, students may include personal reflections, humour, or cultural references that the AI cannot meaningfully interpret or evaluate. Additionally, the tool does not assess coherence or flow between paragraphs, which are critical in longer written compositions. These limitations suggest that while ChatGPT enhances efficiency in detecting formal errors, it should function as a supplementary resource to human assessment, ensuring that language learning remains both accurate and pedagogically holistic.

Unexpectedly, while OCR-assisted transcription achieved high accuracy rates (approximately 90%-99%) in most cases, notable discrepancies were observed in instances involving irregular handwriting styles or poorly spaced characters, such as the misreading of *でした* or the misidentification of *ぬ* as *め*. These errors underscore

the limitations of OCR in handling nonstandardised scripts and suggest that visual noise – such as overlapping strokes or stray marks, can distort recognition accuracy. Moreover, ChatGPT occasionally flagged idiomatic or informal expressions (e.g. じゃあね, よろしくね) as incorrect despite their appropriateness in narrative contexts, revealing a lack of contextual and stylistic sensitivity. These findings may be attributed to the model's training on formal text corpora and insufficient exposure to learner-specific or culturally embedded language usage, thereby highlighting the need for human oversight in interpreting nuanced writing features.

This study demonstrates that ChatGPT, combined with OCR technology, can assist in identifying common language errors in handwritten Japanese essays, making it a useful tool for language instructors. It offers a practical method for quickly converting handwritten texts into digital form and providing students with individualised feedback. This approach is particularly beneficial in large or hybrid classes, where instructors may not have the capacity to offer detailed feedback to every student. At the same time, the results underscore the limitations of AI, such as difficulties with informal language or unclear handwriting, reinforcing the importance of teacher review to ensure accurate and meaningful feedback.

Based on the findings of this study, several policy-level recommendations can be made to support the effective and ethical integration of AI tools in language education. First, institutions should consider incorporating AI-assisted assessment technologies – such as ChatGPT in combination with OCR – into their official teaching and evaluation frameworks. This integration can enhance assessment efficiency and improve the quality of feedback. To ensure consistency and accountability, it is essential to develop institutional guidelines that define the scope of AI use, including when and how AI-generated feedback should be reviewed or supplemented by instructors. Second, data privacy and student consent protocols must be established and aligned with national and institutional data protection standards. Given that student work is uploaded and processed through AI systems, policies should clearly address the storage, sharing, and deletion of student-generated content to safeguard personal information.

Finally, professional development programmes should be offered to educators to strengthen their digital literacy and equip them with the skills needed to critically evaluate and interpret AI-generated outputs. This will help maintain the balance between automation and pedagogical intent, ensuring that AI remains a support tool rather than a replacement for human feedback in educational assessment. While the study demonstrates the potential of ChatGPT and OCR technology in supporting language assessment, several gaps remain. Notably, the system struggles with informal expressions, creative writing elements, and varied handwriting styles, raising questions about its applicability across diverse learner populations and writing genres. This study demonstrates that ChatGPT holds significant promise

as a support tool for language educators assessing handwritten Japanese essays, particularly at beginner and intermediate levels. As no existing studies were found that directly explore ChatGPT's application to handwritten Japanese as a foreign language, this research addresses a clear gap in AI-assisted language assessment and contributes original evidence from a linguistically underrepresented context.

The institutional push towards AI-enhanced formative assessment is further evidenced in national policy developments. Singapore's National AI Strategy 2.0 prioritises the development of human-centric AI applications in education to improve instructional effectiveness and learner outcomes (Smart Nation and Digital Government Office, 2023). In alignment with this, the Ministry of Education (2023) advocates for the responsible use of AI to support differentiated instruction and reduce teacher workload.

In the evolving field of Japanese language education, researchers have been exploring the integration of AI and OCR technologies to improve the assessment and support of student writing. Y. Jing (2020) highlighted the potential of natural language processing (NLP) in personalising learning experiences and enhancing teaching efficiency in Japanese instruction. Similarly, W. Huang (2020) developed a machine learning-based scoring system focused on lexical and grammatical features to assist learners in developing their writing proficiency. P. Taele *et al.* (2025) introduced the “Kanji Workbook”, an intelligent tutoring system designed to simulate teacher feedback and guide students in mastering kanji characters. These innovations reflect a growing recognition of AI's role in supplementing traditional language instruction through automated support tools. Building on this trajectory, the present study extends the discussion by applying ChatGPT to handwritten Japanese essays – an area previously underexplored. Unlike systems that rely solely on rule-based scoring or fixed feature analysis, ChatGPT provides dynamic, context-sensitive feedback, supporting both grammatical accuracy and learner reflection. By evaluating how ChatGPT responds to authentic handwritten texts, this research offers pedagogically meaningful insights and underscores the importance of balancing automation with instructional sensitivity in AI-mediated language learning environments.

Building on the conceptual research of J. Li *et al.* (2024), which outlined ChatGPT's potential in second language (L2) writing – from feedback and assessment to collaborative learning – this study offers classroom-based validation. It affirms J. Li's vision of ChatGPT as a feedback and assessment tool while advancing the discourse by examining how the model performs with handwritten input. Notably, it identifies limitations in ChatGPT's capacity to interpret stylistic nuance and context, thereby contributing a balanced and practice-oriented perspective to the growing field of AI-enhanced language education.

Other recent studies support the relevance of ChatGPT across broader educational domains. T. Aydin Yıldız (2024) demonstrated its role in fostering 21st-century teaching skills, while the present study shows its utility from

the learner's perspective, reinforcing ChatGPT's value across the teaching-learning spectrum. Similarly, J. Ilić *et al.*'s (2024) review of AI in higher STEM education highlights personalisation and engagement – two features echoed in the feedback capabilities observed in this research. Technologically, this study differs from the JESS system developed by T. Ishioka & M. Kameda (2004), which scores Japanese essays based on fixed metrics such as structure, vocabulary complexity, and passive constructions, independent of human input. In contrast, ChatGPT offers dynamic, interactive feedback, functioning not as a replacement for educators but as a supplementary tool to support formative assessment and reflective learning.

C. Tsai's (2024) study using convolutional neural networks (CNNs) to recognise Japanese characters complements this study by addressing another facet of handwritten text processing. While Tsai emphasises technical recognition accuracy, the present research approaches handwritten language from an instructional feedback perspective. Together, these studies highlight the multifaceted benefits of AI: precise character-level recognition and meaningful, pedagogically relevant feedback at the learner level. Thus, this study aligns with concerns raised by O. ZawackiRichter *et al.* (2024), who critiqued the dominance of STEM-driven, theory-light AIED research. By presenting a theory-informed, classroom-tested use case of ChatGPT, this research exemplifies how AI can be thoughtfully integrated into pedagogical practice. It underscores the importance of maintaining a learner-centred and educator-guided approach to AI deployment – one that enhances rather than replaces human interaction.

Therefore, this study builds on prior research by demonstrating ChatGPT's potential as a valuable tool for educators in assessing handwritten Japanese essays, providing dynamic, contextsensitive feedback that surpasses the limitations of rule-based systems. It highlights how ChatGPT can support teachers in delivering timely, formative insights while preserving the educator's central role in guiding student learning and interpretation.

CONCLUSIONS

The study found that ChatGPT is a valuable tool for analysing students' handwritten essays in Japanese, offering both individualised and cohort-level feedback that can support more targeted and efficient language instruction. Through its evaluation, ChatGPT consistently identified eight recurring categories of language difficulties: limited or incorrect use of kanji, grammatical errors (especially with particles and verb tenses), basic and repetitive sentence structures, narrow vocabulary range, spelling and phonetic transcription errors, redundancy, incoherent phrasing, and inappropriate contextual usage. Quantitative analysis showed that the most frequent issues were the lack of kanji (25%), overuse of basic sentence structures (20%), and limited vocabulary (15%). These

were followed by repetition (10%), grammatical issues (10%), misused words (10%), tense inconsistency (5%), and redundancy (5%). ChatGPT's ability to highlight these patterns enabled teachers not only to address individual learning gaps but also to make data-informed decisions on adjusting instruction at the group level. Additionally, ChatGPT's rapid generation of error summaries and suggested improvements helped reduce the time educators spent on marking, while enhancing the quality and consistency of feedback. Teachers were able to track common trends, observe progression across drafts, and design supplementary exercises targeting frequently occurring issues. However, the research also noted limitations: ChatGPT was not capable of assessing students' emotional engagement, creativity, or psychological factors, all of which can influence language performance. Therefore, the integration of AI proved most effective when combined with teachers' professional judgement and pedagogical expertise.

Overall, the findings suggest that ChatGPT can significantly optimise the essay feedback process, enhance learners' awareness of their own mistakes, and contribute to more personalised and responsive language education when used as a complementary tool rather than a replacement for human instruction. The results underscore the pedagogical potential of generative AI to support formative assessment through personalised, timely feedback, while also prompting critical reflection on the role of human-AI collaboration in instructional design. Notably, the study identifies key technological limitations, such as OCR sensitivity to handwriting variation, which may affect transcription accuracy and, consequently, the reliability of assessment. Ethical considerations surrounding student data privacy and the potential for pedagogical over-reliance on AI further emphasise the necessity of instructor oversight. In addition, the research highlights the imperative of strengthening digital competence among educators to ensure the informed and responsible adoption of AI tools. Despite promising results, further research is required to better understand ChatGPT's effectiveness and limitations in supporting educators, including its performance across various languages and scripts, the long-term impact of AI-assisted feedback, and user perceptions compared to human evaluation. Interdisciplinary efforts are also needed to improve OCR accuracy, integrate AI into institutional assessment frameworks, and ensure alignment with ethical, legal, and pedagogical standards.

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REFERENCES

- [1] Aydın Yıldız, T. (2024). Exploring the impact of ChatGPT on improving 21st-century skills for future English teachers during lesson planning. *Computers in the Schools*, 1-24. doi: [10.1080/07380569.2024.2429534](https://doi.org/10.1080/07380569.2024.2429534).
- [2] Baidoo-Anu, D., & Owusu Ansah, L. (2023). Education in the era of generative artificial intelligence (AI): Understanding the potential benefits of ChatGPT in promoting teaching and learning. *Journal of AI*, 7(1), 52-62. doi: [10.61969/jai.1337500](https://doi.org/10.61969/jai.1337500).
- [3] Chaudhry, I.S., Sarwary, S.A.M., El Refae, G.A., & Chabchoub, H. (2023). Time to revisit existing student's performance evaluation approach in higher education sector in a new era of ChatGPT – a case study. *Cogent Education*, 10(1), article number 2210461. doi: [10.1080/2331186X.2023.2210461](https://doi.org/10.1080/2331186X.2023.2210461).
- [4] Dwivedi, Y.K., et al. (2021). Artificial Intelligence (AI): Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy. *International Journal of Information Management*, 57, article number 101994. doi: [10.1016/j.ijinfomgt.2019.08.002](https://doi.org/10.1016/j.ijinfomgt.2019.08.002).
- [5] Huang, W. (2020). Machine learning approach of Japanese composition scoring and writing aided system's design. *arXiv Preprint*, 225-230. doi: [10.48550/arXiv.2008.11488](https://doi.org/10.48550/arXiv.2008.11488).
- [6] Ilić, J., Ivanović, M., & Klačnja-Milićević, A. (2024). The impact of ChatGPT on student learning experience in higher STEM education: A systematic literature review. In *2024 21st International conference on information technology based higher education and training (ITHET)* (pp. 1-9). Paris: IEEE. doi: [10.1109/ITHET61869.2024.10837649](https://doi.org/10.1109/ITHET61869.2024.10837649).
- [7] Ishioka, T., & Kameda, M. (2004). Automated Japanese essay scoring system: Jess. In *Proceedings of the 21st international conference on computational linguistics and 44th annual meeting of the association for computational linguistics* (pp. 4-8). Zaragoza: IEEE. doi: [10.1109/DEXA.2004.1333440](https://doi.org/10.1109/DEXA.2004.1333440).
- [8] Jing, Y. (2020). Research on the application of artificial intelligence natural language processing technology in Japanese teaching. *Journal of Physics: Conference Series*, 1682, article number 012081. doi: [10.1088/1742-6596/1682/1/012081](https://doi.org/10.1088/1742-6596/1682/1/012081).
- [9] Kamoun, F., El Ayeb, W., Jabri, I., Sifi, S., & Iqbal, F. (2024). Exploring students' and faculty's knowledge, attitudes, and perceptions towards ChatGPT: A cross-sectional empirical study. *Journal of Information Technology Education: Research*, 23, article number 4. doi: [10.28945/5239](https://doi.org/10.28945/5239).
- [10] Kotsis, K.T. (2024). Correcting students' misconceptions in physics using experiments designed by ChatGPT. *European Journal of Contemporary Education and E-Learning*, 2(2), 83-100. doi: [10.59324/ejceel.2024.2\(2\).07](https://doi.org/10.59324/ejceel.2024.2(2).07).
- [11] Li, J., Jangamreddy, N.K., Hisamoto, R., Bhansali, R., Dyda, A., Zaphir, L., & Glencross, M. (2024). AI-assisted marking: Functionality and limitations of ChatGPT in written assessment evaluation. *Australasian Journal of Educational Technology*, 40(5), 56-72. doi: [10.14742/ajet.9463](https://doi.org/10.14742/ajet.9463).
- [12] Li, M. (2024). Leveraging ChatGPT for second language writing feedback and assessment. *International Journal of Computer-Assisted Language Learning and Teaching*, 14(2), 1-11. doi: [10.4018/IJCALLT.360382](https://doi.org/10.4018/IJCALLT.360382).
- [13] Ministry of Education. (2023). Retrieved from <https://www.moe.gov.sg>.
- [14] Mohan, G.B., Kumar, R.P., Krishh, P.V., Keerthinathan, A., Lavanya, G., Meghana, M.K.U., Sulthana, S., & Doss, S. (2024). An analysis of large language models: Their impact and potential applications. *Knowledge and Information Systems*, 66, 5047-5070. doi: [10.1007/s10115-024-02120-8](https://doi.org/10.1007/s10115-024-02120-8).
- [15] Pesce, M.A., & Fernández Blanco, D. (2024). Perceptions of pre-service teachers on the use of ChatGPT during their training and the future implications for their future role in high schools: A research in progress. *Research Square*, 1-28. doi: [10.21203/rs.3.rs-4542918/v1](https://doi.org/10.21203/rs.3.rs-4542918/v1).
- [16] Pham, M.T., & Cao, T.X.T. (2025). The practice of ChatGPT in English teaching and learning in Vietnam: A systematic review. *International Journal of TESOL & Education*, 5(1), 50-70. doi: [10.54855/ijte.25513](https://doi.org/10.54855/ijte.25513).
- [17] Smart Nation and Digital Government Office. (2023). Retrieved from <https://file.go.gov.sg/nais2023.pdf>.
- [18] Susnjak, T., & McIntosh, T.R. (2024). ChatGPT: The end of online exam integrity?. *Education Sciences*, 14(6), article number 656. doi: [10.3390/educsci14060656](https://doi.org/10.3390/educsci14060656).
- [19] Taele, P., Koh, J.I., & Hammond, T. (2020). Kanji workbook: A writing-based intelligent tutoring system for learning proper Japanese kanji writing technique with instructor-emulated assessment. In *Proceedings of the AAAI conference on Artificial Intelligence* (vol. 34(08), pp. 13382-13389). Washington: AAAI Press. doi: [10.1609/aaai.v34i08.7053](https://doi.org/10.1609/aaai.v34i08.7053).
- [20] Tsai, C. (2016). *Recognizing handwritten Japanese characters using deep convolutional neural networks*. Retrieved from https://cs231n.stanford.edu/reports/2016/pdfs/262_Report.pdf.
- [21] Woodruff, K., Hutson, J., & Arnone, K. (2023). Perceptions and barriers to adopting artificial intelligence in K-12 education: A survey of educators in fifty states. In *Reimagining education: The role of e-learning, creativity, and technology in the post-pandemic era*. InTechOpen. doi: [10.5772/intechopen.1002741](https://doi.org/10.5772/intechopen.1002741).
- [22] Zawacki-Richter, O., Marín, V.I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education – where are the educators?. *International Journal of Educational Technology in Higher Education*, 16(1), article number 39. doi: [10.1186/s41239-019-0171-0](https://doi.org/10.1186/s41239-019-0171-0).

Марія Щедріна

Аспірант, викладач

Інститут вищої освіти Національної академії педагогічних наук України

01014, вул. Бастіонна, 9, м. Київ, Україна

Наньянська політехніка

569830, просп. Анг Мо Кіо, 180, м. Сінгапур, Сінгапур

<https://orcid.org/0000-0002-0214-2024>

Юе Ман Джуді Іп

Старший викладач

Наньянська політехніка

569830, просп. Анг Мо Кіо, 180, м. Сінгапур, Сінгапур

<https://orcid.org/0009-0002-3377-6609>

Оцінювання ChatGPT у викладанні японської мови та перевірці есе

Анотація. Актуальність дослідження зумовлена зростаючою потребою у впровадженні штучного інтелекту в освітній процес, зокрема у викладанні мов із нелатинським письмом, як-от японська. Поєднання оптичного розпізнавання символів і аналізу на базі ШІ відкриває нові можливості для підвищення ефективності перевірки письмових робіт, якості зворотного зв'язку та індивідуалізації навчання. Метою дослідження було вивчення можливостей використання ChatGPT для підвищення ефективності викладання японської мови шляхом автоматизованої перевірки студентських есе. У методологічному плані викладачі використали ChatGPT для оцифрування рукописних есе студентів, що дозволило проаналізувати граматику, лексику, структуру речень і вживання канджі. Було застосовано змішаний підхід: кількісний аналіз типових помилок поєднано з якісною оцінкою викладачів. Результати дослідження показали, що ChatGPT ефективно ідентифікує вісім основних категорій помилок, зокрема недостатнє використання канджі, надмірне застосування базових граматичних конструкцій і обмежений лексичний запас. Здатність інструмента створювати миттєві резюме помилок і надавати цільовий зворотний зв'язок суттєво зменшила час перевірки, забезпечуючи послідовну та персоналізовану підтримку студентів. Результати свідчать про те, що ChatGPT може стати цінним доповненням до традиційних методів викладання, покращуючи якість зворотного зв'язку, підтримуючи диференційоване навчання та сприяючи автономії здобувачів освіти. Отримані висновки можуть стати корисними для викладачів мов, розробників навчальних програм і фахівців з освітніх технологій, які прагнуть інтегрувати штучний інтелект у викладання та оцінювання рідковживаних мов, зокрема японської

Ключові слова: генеративний штучний інтелект; оцінювання мовних знань; ШІ в освіті; автоматизований зворотний зв'язок; методика викладання японської мови

**Liubov Lohvytska***

PhD in Pedagogical Sciences, Professor
Hryhorii Skovoroda University in Pereiaslav
08401, 30 Sukhomlynyskyi Str., Pereiaslav, Ukraine
<https://orcid.org/0000-0001-6852-5477>

Nataliia Levinet

PhD in Pedagogical Sciences, Associate Professor
Institute of Pedagogy of the National Academy of Sciences of Ukraine
04053, 52-D Sichovykh Striltsiv Str., Kyiv, Ukraine
<https://orcid.org/0000-0002-5191-4940>

Nataliia Martovytska

PhD in Pedagogical Sciences, Associate Professor
Bohdan Khmelnytsky Cherkasy National University
18031, 81 Shevchenko Blvd., Cherkasy, Ukraine
<https://orcid.org/0000-0002-7258-3458>

Tetiana Sheleh

PhD in Psychological Sciences, Teacher
University of Versailles Saint-Quentin-en-Yvelines
78000, 55 de Paris Ave., Versailles, France
Bilingual Montessori Preschool in Vincennes
94300, 51 rue de Lagny Str., Vincennes, France
<https://orcid.org/0000-0001-8481-2628>

Maria Montessori's concept in action: Implementation in preschool education institutions in Ukraine and France

Abstract. The relevance of the study implements current trends in finding effective ways to improve the quality of preschool education. The research problem involved identifying the leading conceptual ideas of the theoretical and practical work of the Italian scholar Maria Montessori and their efficiency in the preschool education system in different countries. The purpose of the research was to analyse and interpret the main provisions of Maria Montessori's concept of organising the educational process with children of early and preschool age and their implementation in preschool education in Ukraine and France, as well as to substantiate the specifics of training specialists to work in institutions based on Maria Montessori's ideas in these countries. To achieve the aim of the study, a set of theoretical methods were used: analysis and synthesis, chronological method, pedagogical historiography, specification, systematisation, comparison, generalisation and prognosing. The article outlined the leading ideas of Maria Montessori's pedagogical theory and educational practice, which are fundamental to the current changes taking place in the global dimension of preschool education; describes views on the priority principles of personality development that emphasise the value of preschool childhood. The key principles of the scientist's concept in the context of organising the educational space of institutions for children of early and preschool age operating in Ukraine and France were highlighted; the common and different in their activities in applying the heritage of Maria Montessori's scientific pedagogy were determined: adherence to the

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*Corresponding author



basic provisions, development of a specially prepared environment, use of authentic didactic material and ensuring the professionalism of personnel. The specifics of teacher training for work in Montessori institutions of both countries, based on the implementation of the curriculum, which contains two mandatory components: theoretical and practical, were clarified. The scientific value and practical significance of the study is seen in the deepening of the content of the educational component "History of Preschool Pedagogy" for applicants for the specialty A2 Preschool Education and the educational component "Foreign Language for Professional Purposes" for future pedagogical specialists

Keywords: history of preschool pedagogy; scientific approach; Montessori method; early childhood and preschool age children; personality development; Ukrainian system of preschool education; French system of preschool education

INTRODUCTION

Changes in the education system taking place around the world are directly relevant to its first component – preschool education. The preschool education sector is characterised by educational content presented to children improvement and the search for effective methods of organising the educational process aimed at improving the quality of preschool education. The scientific community and preschool teachers increasingly turn to the works on the preschool education development. The work of the outstanding Italian scientist, doctor, psychologist, and teacher – Maria Montessori – who organised institutions for preschool children and developed the concept of the educational process in them, enjoys exceptional popularity compared to others. The scholar was a pioneer in organising institutions for preschool children and developing the concept of the educational process. Many countries around the world have institutions for preschool children based on the system developed by Maria Montessori. Teachers are trained to work in these institutions, and Maria Montessori Associations have been established. Scientific research focuses on understanding the phenomenon of this outstanding personality, whose psychological and pedagogical ideas and guidelines for the development, upbringing and education of preschool children have remained relevant for many decades. This has determined the need to study the conceptual provisions of Maria Montessori's scientific and practical work and their implementation in preschool education institutions in different countries.

Based on the analysed number of sources, it has been established that institutions for preschool children that implement the educational process according to Montessori's system exist in a number of countries around the world. According to research by M. Debs (2022), educational policy in India is aimed at implementing Montessori's conceptual principles, as they are defined as fundamental to the development of the nation. Maria Montessori's stay and teaching activities in India had a positive impact on the spread of unique approaches to the implementation of free education and consideration of children's natural characteristics. In the work by M. Efe & I. Ulutas (2022), the authors highlighted the preschool teachers' positive experience of applying Montessori's educational system in Turkey. The variety of materials and the involvement of children in productive activities stimulate active exploration of the surrounding environment. This forms the basis of Maria Montessori's philosophy, which is considered to be a complex process, but,

nevertheless, is widely practiced by Turkish teachers. The Montessori-method is also popular in the preschool education system of Portugal, as noted by authors L. Moreira & T.Q.F. Barata (2022). They emphasised the use of toys aimed at developing children's sensory perception, which highlighted the significant contribution of Montessori's method to their design. The materials suggested by the scholar are of reference value and stand out as exemplary "sensory products". The study by B. Bednarczuk (2023) characterises the experience of Montessori institutions in the Republic of Poland. It emphasised the importance of providing an educational environment, the guiding principle of which, according to the researcher's concept, was to support the individual's potential. This key principle of Maria Montessori's pedagogy, as emphasised by B. Bednarczuk (2023), should be fundamental to the education system and the paradigm of lifelong learning. The work of M. Laure & K. Habe (2024) presented the achievements of educational institutions for early childhood and preschool age children working under the Maria Montessori system in Slovenia. The focus of these authors' research is on the development of rhythmic abilities in preschool children based on the use of Maria Montessori's materials, which had a significant positive result. The monograph by N. Yakobchuk (2023) noted that the ideas of the outstanding Italian scientist are actively applied in Ukraine, where the number of Montessori institutions is constantly growing. However, there is a need to study the key ideas of legacy and strengthen implementation measures for practical application. A special niche is reserved for the translation of Maria Montessori's scientific works into Ukrainian. The study by A. Demangeon *et al.* (2023) revealed the impact of Montessori's educational system on the preschool children's development and learning, using the example of schools in France. The study analysed the impact of Montessori Education (ME) on five dimensions of personal growth: cognitive abilities, social skills, creativity, motor skills and academic achievement. The researchers proved the efficiency and necessity of introducing ME into the educational process of preschool institutions. The conclusions of studies on the effectiveness of Montessori preschool classes, which operate widely in the United States, are of significant scientific interest. The authors A. Lillard *et al.* (2025) pointed out that, according to Maria Montessori's system, it is important for children to interact with their environment, which allows them to freely choose activities and work with different materials.

Organising the educational process in this way promoted both academic and emotional support, which has a positive effect on children's well-being and success and proves the effectiveness of Maria Montessori's theory in practice.

Therefore, researchers emphasised that in the context of reforming the preschool education system, it is important to find effective psychological and pedagogical tools that will contribute to its improvement. These tools should align with societal development trends and ensure the formation, from an early age, of a free and independent individual capable of expressing their own unique abilities. Based on the position of P. Frierson & L. Paolo (2025), it can be concluded that Montessori pedagogy is extremely relevant in the context of achievements in cognitive science and philosophy of mind. It is on this important thesis that Maria Montessori's concept is based, which determines its popularity throughout the world and requires a deep understanding and practical implementation. Given the spread of the Maria Montessori's psychological and pedagogical ideas, who defended scientific positions on the implementation of the principles of child-centredness, anthropocentrism and a humanistic approach as fundamental in the organisation of the educational process with preschool children, it is important to specify the scientist's original paradigms. This will enable teachers to discover new opportunities in developing subject-subject interaction precisely by considering the characteristics of personality development and its nature (abilities and opportunities) to the maximum extent possible, and to provide appropriate training and education, adapting it to the individual growth of each child. This aspect was the research issue of the presented thematic study. The purpose of the article was to analyse the conceptual foundations of Maria Montessori's "scientific method" and to compare the characteristics of the functioning of Montessori institutions and the training of personnel for them in Ukraine and France. The tasks were as follows:

- 1) to outline the leading ideas of Maria Montessori's pedagogical theory and practice by describing the priority principles of personality development, which are based on recognising the intrinsic value of childhood as a central creative-based principle;

- 2) to determine the state of implementation of Maria Montessori's concept in the organisation of the educational process in preschool institutions in Ukraine and France; to identify the similarities and differences in the activities of institutions based on the principles of Maria Montessori's pedagogy in both countries;

- 3) to figure out the specifics of training teaching staff for work in pre-school educational institutions working according to the Maria Montessori system in both countries (Ukraine and France).

The scientific novelty lies in the formulation of the key ideas of Maria Montessori's concept in accordance with the trends in the development of modern preschool education, which are relevant for implementation in the content of the educational and professional programme for students

of the first (bachelor's) level of higher education in the speciality A2 Preschool Education, in particular in the educational component "History of Preschool Pedagogy" and the educational component "Foreign Language for Professional Purposes" for students of pedagogical specialities, and the definition of the evidence base for arguments regarding the need to develop a selective educational component in the context of professional training of teachers to work with preschoolers in institutions operating under the Maria Montessori system.

MATERIALS AND METHODS

The research was carried out in the following main stages. The first (preparatory) stage involved specifying the research topic in accordance with the outlined scientific issue, defining the key provisions of Maria Montessori's concept in accordance with the studied arsenal of scientific and pedagogical sources (Table 1), conducting a preliminary analysis of psychological and pedagogical sources, which made it possible to formulate the research goal and objectives. The second (main) stage consisted of defining the main ideas of Maria Montessori's pedagogical theory and practice, outlining the priority principles of personality development in early childhood and clarifying the essence of the Montessori method in the organisation of the educational process; characterising the state of implementation of the Maria Montessori concept in preschool educational institutions of Ukraine and France; clarifying the peculiarities of professional training of specialists in both countries to work in preschool educational institutions according to the Maria Montessori system. The third (final) stage involved summarising the findings and presenting a schematic overview of the similarities and differences based on the analysis of the organisation of the educational process with preschool children in institutions operating according to the principles of Maria Montessori pedagogy in Ukraine and France; outlined the strong points of the Maria Montessori's system; and formulating conclusions based on the conducted scientific research, which will contributed to expanding the content of the educational component "History of Preschool Pedagogy" and promoted the further popularisation of the progressive principles of Montessori's concept. Justification of the research methods used: theoretical methods – analysis and synthesis – during the selection and processing of the scientific source base related to the historical and pedagogical aspect under study; chronological method – in the process of highlighting brief biographical data on Maria Montessori, events and phenomena of the historical period of Montessori's life; pedagogical historiography – in the course of comprehending and interpreting Maria Montessori's main views on the development, upbringing and education of preschool children; concretisation – to outline the main conceptual provisions of Maria Montessori's scientific work and pedagogical legacy; systematisation – in describing the implementation of Maria Montessori's concept in the educational process of preschool education institutions in Ukraine

and France in accordance with current trends in preschool education; comparison – in identifying the similarities and differences in the functioning of institutions operating according to the Maria Montessori system in both countries; generalisation – in establishing the specific features of

training teachers to work with preschoolers based on Maria Montessori's pedagogy and in making conclusions regarding the results of the study; prognosing – in predicting the prospects for further scientific research to enrich the educational content on the history of preschool pedagogy.

Table 1. Thematic description of the studied scientific and pedagogical sources

Contents of the material presented	Sources
Practical achievements in applying Maria Montessori's principles in a particular country	Bednarczuk, B. (2023). Potential and actual significance of Montessori learning Environment. Debs, M. (2022). Montessori in India: Adapted, competing, and contested framings, 1915-2021. Demangeon, A., Claudel-Valentin, S., Aubry, A., & Tazouti, Y. (2023). A meta-analysis of the effects of Montessori education on five fields of development and learning in preschool and school-age children. Efe, M., & Ulutas, I. (2022). Beyond teaching: Montessori education initiatives of public preschool teachers in Turkey. Laure, M., & Habe, K. (2024). Stimulating the development of rhythmic abilities in preschool children in Montessori kindergartens with music-movement activities: A quasi-experimental study. Lillard, A.S., LeBoeuf, L., Borgman, C., Martynova, E., Faria, A.-M., & Manship, K. (2025). When bigger looks better: CLASS results in public Montessori preschool classrooms. Moreira, L., & Barata, T.Q.F. (2022). Inclusive product design: Applying the Montessori methodology into the design conception of children's products. Yakobchuk, N. (2023). Pedagogical views of Maria Montessori in Sofia Rusova's scientific research.
Historiography of Maria Montessori's life and heritage	American Montessori Society. (n.d.). History of Montessori education. Association Montessori Internationale. (n.d.). Biography of Maria Montessori. Frierson, P. (2021). Maria Montessori. Harrises, D. (2024). The Maverick known as Montessori. Moussy, B. (2007). Between Pauline Kergomard and Maria Montessori. Murray, A.K., Johnston, L.C., Sabater, A., & Clark, K. (2020). Hidden black voices in the history of Montessori education. Quarfood, C. (2022). Situating Montessori. Pironi, T. (2011). From Ellen Key to Maria Montessori: The design of new educational spaces for children. Romano, A. (2020). Maria Montessori: A complex and multifaceted historiographical subject. Santini, G. (2024). The best weapon for peace. Maria Montessori, education, and children's rights by Erica Moretti.
Theoretical analysis of Maria Montessori's psychological and pedagogical ideas	Culclasure, B.T., Daoust, C.J., Cote, S.M., & Zoll, S. (2019). Designing a logic model to inform Montessori research. Gutek, G.L., & Gutek, P.A. (2020). The fifth woman: Maria Montessori. Fabri, M., & Fortuna, S. (2020). Maria Montessori and neuroscience: The trailblazing insights of an exceptional mind. Frierson, P., & Paolo, L. (2025). Montessori, math, and materials: A case of extended cognition. Hopta, S.M. (2020). Pedagogical ideas of Maria Montessori in the context of modern educational space. Lillard, A.S., Heise, M.J., Richey, E.M., Tong, X., Hart, A., & Bray, P.M. (2017). Montessori preschool elevates and equalizes child outcomes: A longitudinal study. Montessori, M. (1950). The discovery of the child. Montessori, M. (1957). The child in the family. Montessori, M. (2016). Self-education in teaching schools. Montessori, M. (2017). The mind of the child. Noordzij, F. (2023). Werken volgens Montessori. Raimondo, R. (2021). Maria Montessori and Anna Freud: Links and influences between pedagogy and psychoanalysis. Richardson, S. O. (1997). The Montessori preschool: Preparation for writing and reading. van Niekerk, J. (2024). Maria Montessori.

Source: developed by the authors

RESULTS AND DISCUSSION

The main principles of Maria Montessori's concept

Without going into a detailed and extensive review of the biographical data of the world-famous doctor, psychologist and pedagogue Maria Montessori (1870-1952), which

is presented in a number of sources (Moussy, 2007; Murray *et al.*, 2020; Frierson, 2021), this study focused on Maria Montessori's educational and scientific activities throughout life (Fig. 1 shows a portrait of Maria Montessori). In studying Maria Montessori's educational projects, scholars

T. Pironi (2011), A. Romano (2020) and G. Santini (2024) reveal the original paradigms of the psychological and pedagogical ideas of this outstanding Italian woman. As A. Romano (2020) rightly points out: “her experiences in different parts of the world are composed of numerous contributions characterised by different focuses and purposes”. Based on the analysed source base, it is worth noting that Maria Montessori made a significant contribution to the development of the “trajectory of internationalist philosophy” (Santini, 2024). Maria Montessori’s concept was based on the principles of humanism and respect for the personality of each pupil, on commitment to social responsibility and dedication to children with special educational needs (Gutek & Gutek, 2020). Founded by Montessori in rural areas around Rome, San Lorenzo Casa dei Bambini played a key role in shaping scientific principles regarding the education of children in the context of their physical and mental development and considering the influence of the environment (Association Montessori Internationale, n.d.). It contributed to the development of an educational method based on keen observation of children’s behaviour as they learn naturally (Lillard *et al.*, 2017; Murray *et al.*, 2020).



Maria Montessori, Barcelona, 1926.
Photograph courtesy of the Archives
of the Association Montessori Internationale.

Figure 1. Portrait of Maria Montessori

Source: A.S. Lillard *et al.* (2016)

In order to implement the proposed educational project, Maria Montessori gave a series of lectures in various countries (the United States, Spain, the Netherlands, etc.), in which the scholar taught the fundamentals of Maria Montessori’s philosophy on the development, upbringing and education of children (American Montessori Society, n.d.). Between 1932 and 1939, Maria Montessori held conferences in European cities, emphasising the uniqueness and singularity of childhood, calling children agents of peace, a unifying force capable of securing the future of society. Thanks to Maria Montessori’s efforts, a series of educational reforms were implemented in India, where the scholar lived with son Mario Montessori between 1939 and

1946 and 1947-1949 (Debs, 2022). According to research by C. Quarfood (2022), it was appropriate to define the concept of “Montessorism as a special worldview and social programme of the movement”. Currently, Montessori Associations operate in many countries around the world, organising activities for preschool children based on Maria Montessori’s system and providing professional training for teaching staff according to relevant programmes.

The key principles of preschool education according to Maria Montessori’s concept were: giving children freedom and developing their autonomy, which allowed them to satisfy their own inner need for full development through self-growth, self-learning and self-education; providing an optimally prepared structured educational environment with accessible and pedagogically appropriate didactic materials that they can freely choose to satisfy their cognitive interests, which thus developed the basis of their self-development; development of sensory, muscular and practical skills that stimulate intellectual and language abilities, as well as awareness of moral behavior norms in the environment (Montessori, 1950; 1957). The organisation of the educational environment in one of the institutions founded by Maria Montessori in 1924 is shown in Fig. 2.



Figure 2. Educational environment
of Montessorischool in de Hasebroekstraat 113
in Oud-West (Italy), founded in 1924

Source: Montessorischool (2019)

Maria Montessori’s experience as a scientist, pedagogue and physician, combined with knowledge of psychology and determination, enabled the scholar to create an educational environment that stimulated children’s emotional and sensory spheres and developed their interest. Researchers have termed this the “Montessori method” (Murray *et al.*, 2020; Harris, 2024). The implementation of Maria Montessori’s concept is one of the models of preschool education, which provides for both free activities chosen by the child independently and appropriately guided by the teacher, which includes educational content presented in a non-instructive manner, and the development of curiosity and expansion of knowledge, i.e. the “cognitive process” (Lillard *et al.*, 2025; Frierson & Paolo, 2025). As

noted by D. Harris (2024), “the Montessori method recognised sensitive periods of development in human life”, as its implementation was based on the idea that each pupil is an individual with their own abilities, desires, demands and needs, and focused on conducting scientific observations that made it possible to monitor progress in development. Maria Montessori’s philosophy essentially pursues the main goal – “all children have the potential to become self-motivated, independent, and lifelong learners given an appropriate environment in which to flourish” (Murray *et al.*, 2020). The renowned scientist pursued this goal by devoting Maria Montessori’s entire life to serving children and their successful development. A fragment of the educational environment for children’s independent activities is shown in Fig. 3.



Figure 3. Australian Montessori classroom

Source: National Museum Australia (n.d.)

In Maria Montessori’s concept, an educational environment that encompasses various connections with the material, social and cultural world should, above all, promote the self-affirmation of the growing personality. In such an environment, as noted by researcher of pedagogical legacy B. Bednarczuk (2023), children have the opportunity to realise their aspirations and desires and to cooperate with others. This ensures a relative balance of motives, as some of them encourage the child to interact with others, while others encourage self-improvement, supporting the potential of the personality. The importance of the environment in supporting balanced child development and promoting full learning is reflected in the stimulation of psychological growth, which has a direct impact on speech acquisition, the development of object manipulation skills, and physical development through physical exercise, which is closely linked to the development of the brain and nervous system (Fabri & Fortuna, 2020). In other words, the educational model based on Maria Montessori’s concept supports the natural and balanced development of the individual, their ability to align personal interests with the goals of others, and also develops the ability to take responsibility for joint activities at both the personal and social levels (Gutek & Gutek, 2020; Bednarczuk, 2023).

Montessori institutions are based on elements for exploring objects and materials, which encourages children to visually examine and investigate them, applying volitional effort (Culclasure *et al.*, 2019; Raimondo, 2021). In turn, this shapes children’s personality traits and teaches them to follow the rules of behaviour in their environment (Frierson, 2021). According to B. Bednarczuk (2023) and J. van Niekerk (2024), Maria Montessori developed a theory of self-development considering both internal (natural abilities, opportunities, inclinations) and external factors (social conditions, cultural foundations of the environment). The result should be the achievement of a personality state of volitional subjectivity, a conscious direction of one’s own attitude towards oneself and others (in general, towards the world), which occurs in the process of learning and upbringing. Thus, the essence of the Montessori method for implementing educational tasks lies in providing children with unique assistance in developing their individual life potential and developing independence and self-affirmation (Bednarczuk, 2023; Noordzij, 2023).

Maria Montessori considered sensitive periods, relying on them as “windows of opportunity” (Montessori, 2017). These are the age periods when children are particularly receptive in terms of developing certain skills: motor, sensory, speech, mathematical, etc. It is especially important to pay attention to them before the age of 6, because the most critical periods occur at this age (Montessori, 2016). As proven by the results of S. Richardson (1997), Maria Montessori, who was a keen observer of the processes of children learning and growth, noted the sensitivity of speech development and the implementation of intellectual (sensory) and moral education tasks at the age of up to 6 years. To achieve this, the scientist developed exclusive teaching materials.

The key elements of Montessori’s method were educational (didactic) materials and the way in which the teacher, in a prepared environment, facilitated the child’s self-directed interaction with them (educational materials). Researchers of Montessori’s pedagogical ideas call didactic materials “golden”, emphasising their uniqueness and educational and developmental effectiveness (Marshall, 2017). It includes a set of objects, interaction with which helps children to acquire sensory standards (colour, shape, size, texture) and form primary logical and mathematical concepts, ideas about the natural and material world, etc. Mastering the materials most often takes place individually, and later in pairs or small groups, during a three-hour “work cycle” (Marshall, 2017). It is supervised by an adult, but children are given the freedom to choose their own activities. They choose what to work on, where and for how long, alone or with someone else, following the rules of the group. There is no competition between children and no system of external rewards or punishments. This significantly distinguishes Montessori educational institutions from others, as they focus on the harmonious development of the personality in all areas, as opposed to focusing on the child’s academic success.

It should be noted that the educational (didactic) materials alone do not constitute the Maria Montessori method; what is essential is the way they are used. Maria Montessori justified the concept of the “work cycle” based on own observations of sustained activity in children, which arose from their spontaneous interests (Montessori, 2016). The presence of spontaneous interest significantly affects the duration of the activity. This allows us to identify two specific features regarding the involvement of children in educational (didactic) materials that support their focus on a particular activity: “internal and external work cycles” (Marshall, 2017). The first feature is characterised by repeated and independent engagement with the material, the absence of breaks, and the need to prepare the space and the material itself (for example, to build a pink tower, you need to take ten bricks, place them on a mat, then take them apart and put them back in place). This approach focuses on developing the child’s concentration (Montessori, 2017). The second feature is the three-hour duration of the activity cycle. During this time, children can choose activities independently or together with others, find their own rhythm, and move freely around the room. The teacher’s task is to guide children who have difficulty choosing materials or who are ahead of others in learning how to interact with the physical world to work in small groups. The level of support for a child is based on an understanding of their individual needs and interests. The teacher has the opportunity to flexibly adapt the preliminary general plan of educational work in the group in accordance with the spontaneous interests that arise in children (Montessori, 2017).

This significantly distinguishes the Montessori environment from a strictly regulated, approved work plan for an institution, in which the teacher directs and controls the children’s compliance with certain rules and types of activities. As P. Frierson (2021) rightly points out, Maria Montessori became the founder of a new “scientific pedagogy” based on careful observation of children and a special approach to “evolutionary psychological science”. A properly organised “prepared environment” according to Maria Montessori’s concept provides the very context in which “cognitive tasks are performed in interaction between the brain, body and specific mathematical materials” (Frierson & Paolo, 2025). Thus, according to Maria Montessori’s concept, the environment is viewed as a holistic approach to teaching and raising a child, contributing to their harmonious development, independence and confidence. It is a specially organised educational space designed to ensure the personal growth of the pupil by giving them freedom in choosing materials, the opportunity to work with them according to their individual needs and interests and satisfying their desire to learn about the environment.

Introduction of Maria Montessori’s concept in preschool education institutions in Ukraine and France

The implementation of Maria Montessori’s pedagogical concept into preschool education practice began in 1992 with the opening of the state-run “Montessori School for Ages 3 to 7” in Kyiv (Radul *et al.*, 2023). It became an experimental platform, the results of which were extended to state, municipal and private educational institutions and child development centres in 17 regions of the country (Fig. 4).



Figure 4. Map of Montessori institutions in Ukraine

Source: Montessori UA (n.d.)

The distribution of Montessori institutions shown in Fig. 4 provides regional coverage of nearly all oblasts of Ukraine, serving as platforms for the dissemination of

Maria Montessori's pedagogy within the educational space. The highest number of such institutions operates in the city of Kyiv, Ukraine (Fig. 5).

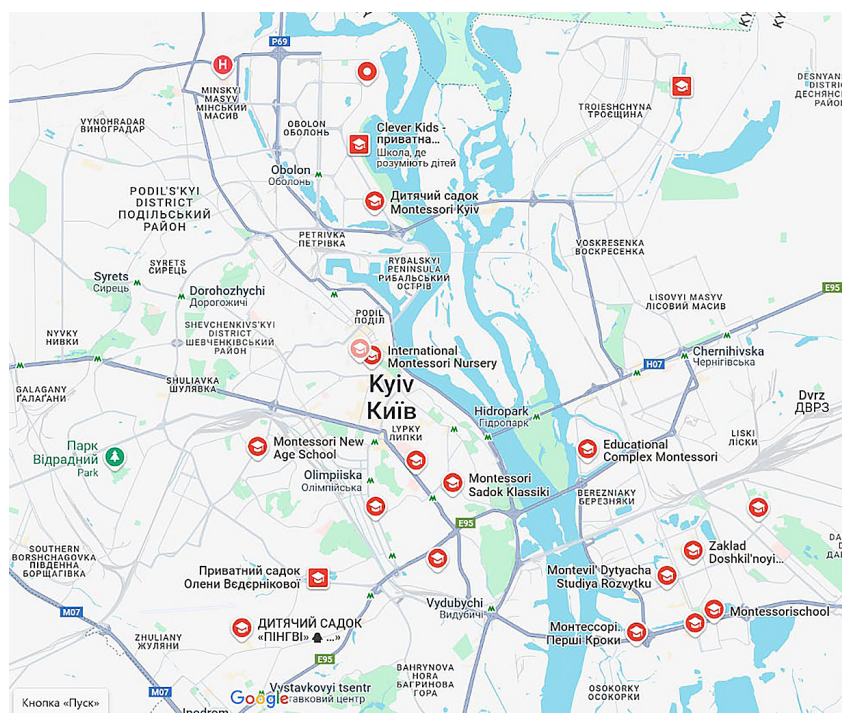


Figure 5. Location of Montessori kindergartens in Kyiv (Ukraine)

Source: Map of Montessori kindergartens in Kyiv (n.d.)

The location of Montessori institutions in Kyiv, shown in Fig. 5, indicates their significant popularity. The spread of the ideas of the outstanding Italian scholar in educational practice was facilitated by the Ukrainian model of the Montessori school for children aged 1.5 to 9 years (Radul *et al.*, 2023). Its main features were digital technologies and multilingualism. Particular attention was paid to finding effective ways to preserve and strengthen children's health and ensure their artistic and aesthetic development. Ukrainian preschool educational institutions that operate according to the Maria Montessori system (Radul *et al.*, 2023) adhere to a unique division into classes: infant (children under 1 year old), toddlers (children aged 1 to 3 years) and preschoolers (children aged 3 to 6 years). Each group/class is characterised by the development of a specially prepared Montessori environment. It is divided into zones according to the areas of child development and includes:

- the practical life area;
- sensory development area;
- the area of speech development;
- the area of mathematical development;
- space area or culture area.

In each zone, children can independently choose the type of activity and material, work at their own pace and explore. About 90% of the time is devoted to independent work with educational material. Noticing that a child has chosen material for the first time to implement their own

idea of activity, the Montessori teacher offers them a plan of action with it. Great importance is attached to the performance of sensory education tasks. Specially designed teaching materials and games are used to develop the senses, which are the basis for further mental development. "Golden" didactic material is focused on helping children learn sensory standards, independently perform sensory and intellectual tasks, and conduct research, during which, through trial and error, the growing personality draws elementary conclusions about the material and social world (Hopta, 2020). The efficiency of social interaction skills development is ensured by the functioning of mixed-age groups. Children aged 3 to 6 are in the same group/class. Younger children learn from older children how to behave in everyday situations, while older children develop leadership skills (Radul *et al.*, 2023). An individual approach to children is equally important. Maria Montessori's method considers the individual needs and interests of each child, allowing them to develop at their own pace and maximise their potential (Yakobchuk, 2023).

The results of the study (Radul *et al.*, 2023) made it possible to identify the areas in which the Maria Montessori method is being implemented in Ukraine:

- 1) curriculum development and adaptation;
- 2) the organisation of mixed-age groups, which allows Montessori teachers to observe children's nature and understand the laws of their psychophysical development.

In such groups, older children learn to help younger ones, while younger children gain life experience by observing the work of older children;

3) creating and maintaining an environment rich in developmental materials;

4) holding unconventional classes and lessons using the Maria Montessori method;

5) conducting extra classes in addition to the compulsory ones: theatrical performances, “illustrated classes” in English, use of digital resources;

6) developing the basis of a healthy lifestyle, which involves teaching children to treat nature and all living things on earth with respect;

7) establishing a partnership-based interaction with parents includes creating shared rules for a democratic and humane environment for the upbringing of the child both at home and in the educational institution; organising seminars to introduce parents to the fundamentals of Maria Montessori’s philosophy and pedagogy; holding parent meetings in various forms and formats (lectures with role-playing games, discussions, experience-sharing among families); familiarising parents with new pedagogical and psychological literature; enabling parents

to attend lessons conducted according to the Montessori system; and providing individual consultations with teachers and psychologists.

Maria Montessori’s method has gradually established itself as the most well-known alternative pedagogy in France and Europe. As of early 2025, there are approximately 200 preschool institutions in France that apply the Montessori method, regardless of whether they are accredited by the Association Montessori Internationale (AMI) (Association Montessori Internationale, n.d.). In France, preschool institutions operating based on Maria Montessori’s pedagogy have varying degrees of independence and managerial autonomy. Some are fully independent, but most are united within a single network. Examples include mini-institutions (mini-nurseries) belonging to the “Baby Trees” network, which are characterised by a harmonious combination of the Maria Montessori method and language learning (implementing a bilingual approach), as well as micro-Montessori crèches, where the Maria Montessori method is adapted to bilingual or eco-oriented approaches (Montessori pour tous, n.d.). For illustration, we provide a map showing the operation of Montessori institutions in the city of Paris, France.

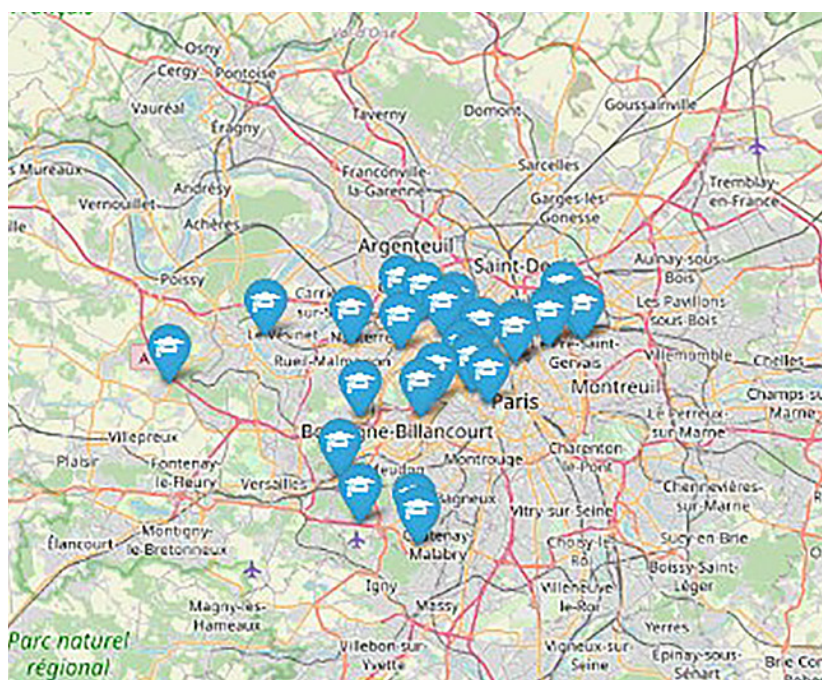


Figure 6. Map of Montessori Institutions Operating in France (Paris)

Source: List of every School Paris France (n.d.)

As can be seen in Fig. 6, Montessori institutions are popular and their number satisfies parents’ demands for access to quality preschool education for their children. Children are supervised by teacher-facilitators. The distribution of children by number in groups is as follows: in the Nido group, there is one teacher for every five children; in the Grand Nido group, there is one teacher for every seven children and one teacher for every eight children in the children’s community

(considered a type of group). In addition to teachers, a therapist who monitors psychomotor development, a nurse, a hygiene specialist, and an administrator are also involved in the children’s development. This team of qualified specialists is capable of ensuring the functioning of a developmental Montessori environment (Le Centre Préscolaire Montessori, n.d.).

The French Montessori Association/Association Montessori de France (AMF) was founded in 1950 by

Maria Montessori together with Mario Montessori and Georgette Bernard. It has the status of an association of general interest under the 1901 law, and since its foundation has been an affiliated member of the Association Montessori Internationale (AMI), which began operating in 1929 (Association Montessori Internationale, n.d.). It is independent of any political or religious movement. The AMF (*in French*: L'Association Montessori de France) is part of the international Montessori movement approved by AMI and training centres for teachers operating in France (l'Institut Supérieur Maria Montessori (ISMM) and Le Centre de Formation Montessori Francophonie (CFMF) (Association Montessori de France, n.d.).

In 2024, the AMF developed a new Charter for Montessori institutions in France to promote the development of good practices in institutions in accordance with Maria Montessori's educational philosophy. Educational institutions that sign the charter must:

- ➔ ensure that the Montessori institution complies with the criteria set by the International Montessori Association for children, families, institutions and supervisory and/or control bodies;
- ➔ ensure ethics and integrity through ethical practices and standards of moral behaviour, such as honesty, fairness and compliance with laws;
- ➔ encourage transparency in communication within the organisation and with external stakeholders;
- ➔ promote professionalism through quality standards, best practices and competence that every member must adhere to, helping to improve the reputation of the profession and Montessori institutions or companies;
- ➔ reduce risks by establishing clear rules to prevent abuse, inappropriate behaviour and legal or financial risks (Association Montessori de France, n.d.).

Educational institutions that sign this charter must have more than three years of experience, after which they can voluntarily commit to continuously improving the quality of education and respecting the values of Maria Montessori. Montessori institutions focus on developing children's autonomy (independence), senses, self-organisation, concentration, satisfaction from effort, and self-esteem. This is achieved through adherence to a consistent routine, ample opportunities for sensory improvement, speech development, provision of conditions for optimal motor activity, and the formation of social interaction skills.

The environment in a Montessori preschool is a reflection of the world of a child aged 2,5 to 6 years. The space is organised according to their physical abilities (height, body size, etc.), pace of development and interests. In a Montessori kindergarten, high chairs, tall mirrors and large cabinets are prohibited as they limit children's autonomy. The environment develops as children grow. In creating the environment of an educational institution, teachers strive for visual harmony, which encourages them to use functional furniture, avoid excessively bright colors, and carefully organise and plan order. This corresponds to Maria Montessori's idea that in a children's environment

there should be a place for everything, and everything should be in its place (Montessori, 1957).

A Montessori preschool is designed in such a way that young children can move freely without the need for excessive control over their activities. The educational environment is arranged for the child, providing them with freedom within certain boundaries. This means giving the child a degree of freedom of action and stepping back voluntarily to encourage the independent development of their natural potential, while also paying attention to any difficulties or obstacles that may require intervention. Children work at tables or on small rugs laid out on the floor – wherever they naturally feel comfortable. Learning and material exploration in a Montessori setting takes place “through discovery,” by engaging children in interesting activities that bring them genuine enjoyment – not merely through the teacher's verbal instruction. For example, in a Montessori preschool, a unit of measurement is something the child can hold in their hand, not just a number written on a piece of paper. It is a space that influences the development of motor skills, encourages experimentation and exploration, and all of this takes place “at the very heart of a calm, spacious, and structured environment” under the guidance of a caring Montessori teacher (Le Centre Préscolaire Montessori, n.d.).

Children in Montessori preschools understand that their environment is divided into several distinct areas. They freely choose the activity area they are interested in and interact with the materials available there, naturally transitioning to the appropriate area depending on the activity they have chosen. These areas typically include a play area, reading area, eating area, recreation area and others. All activities are based on considering each child's natural rhythm and a prepared environment, and are aimed at developing children's independence, sensory skills, fine motor skills, and self-confidence. Maria Montessori describes the hand as the instrument of the intellect. It holds immense neurological potential. A child should be able to move and hold each object without adult interference. The ultimate goal is to guide the child toward intellectual and physical autonomy. Activities are carefully analysed and broken down into small, sequential steps so that the child can effectively carry out a series of complex actions. The content of these activities includes essential life skills that enable the child to achieve an age-appropriate level of independence and autonomy. In the area of practical life, for example, children perform tasks such as transferring water or grains using pitchers, spoons, and bowls. They acquire cultural and hygiene-related skills: learning to dress themselves, fasten buttons and zippers, tie shoelaces, wash their hands, tidy up designated areas, set the table, care for plants, and more. Practical life exercises help children develop, among other things, self-care, care for the environment, and respect for moral and ethical norms.

The teacher must have a full understanding of the concept of the child's absorbent mind up to the age of three. Through sensory activities, children develop the

five senses (sight, touch, hearing, taste, and smell). This is achieved by engaging with specially designed didactic materials such as the Pink Tower, graded cylinders, textured fabrics or objects (e.g., rough, smooth, soft), sensory bottles, scent boxes, and tactile trays for hands-on activities using materials like sand, rice, or modeling clay. Sensory materials consist of sets of objects arranged in a specific order. Intuitively, the child grasps the sense of order inherent in the materials and learns to classify and organise objects by size, volume, texture, color intensity, length, sound intensity, and more. Examples include cylinder blocks, geometric solids, color tablets, and the geometric cabinet (Montessori, 1957). The development of both fine and gross motor skills takes place through the organisation of physical activities using tunnels, hoops, and balance beams. A wide variety of materials are also used, such as puzzles, inset shapes (figures for fitting into boxes), and beads for stringing and sorting by various categories. Children practice tasks such as simple cutting, grating nutmeg, transferring seeds using containers of different sizes, pouring water, cleaning plant leaves, and more.

The curriculum is bilingual, giving children the opportunity to learn two languages simultaneously – French and English. This bilingual learning environment is supported by three teachers: one French-speaking, one English-speaking, and one bilingual. Using Montessori materials, children learn to read and write in both languages. In some institutions, a third language – such as Spanish – is also introduced (Association Montessori de France, n.d.). To develop vocabulary and provide indirect preparation for reading and writing, various tools are used: nomenclature cards, songs (including nursery rhymes), stories, picture book readings, a sound box, etc. Reading instruction is offered without pressure to children who have reached sufficient psychological readiness in terms of spoken language, sound recognition, and word formation. In fact, writing precedes reading in the sense that the child first builds words using familiar sounds and only then progresses to reading. The method used is essentially sensory in nature. Through language materials, the child discovers the mechanism of reading while simultaneously grasping the meaning of words within sentences. This approach aligns with the child's natural interest, which depends on individual developmental readiness, but typically occurs around the age of five. It reflects Maria Montessori's scientific approach, in which the child learns to write not by repeating rows of letters, but by practicing the mechanisms of writing (Montessori, 1957).

Another key conceptual idea of Maria Montessori is that the development of children's observation skills and perception of the world is supported through elements of exploratory and investigative activities. This approach is implemented through observing objects in nature (such as getting to know plants, animals, and the seasons), engaging in gardening (planting seeds, watering plants), and sensory discovery of natural elements (like leaves, shells, sand, and water), as well as through simple scientific

experiments, for example, observing how different objects or materials behave in water. To support children's free expression of their creative potential, artistic and creative activities are organised, including drawing, coloring, modeling, collage-making, and other forms of visual art. This is further enriched by musical and rhythmic activities, such as exploring musical instruments (maracas, tambourines, xylophones) and learning how to play them, singing rhythmic songs and rhymes, and discovering movement and rhythm through independent choreographic expressions. Special attention is also given to organising rest time and helping children learn to manage their energy. Therefore, the daily schedule includes time for naps, a reading corner, breathing exercises, and other calming activities (Association Montessori de France, n.d.). The conducted research has shown that the implementation of Maria Montessori's pedagogical concept in preschool education in Ukraine and France shares both common and unique features shaped by national context, cultural traditions, and educational approaches. In Ukraine, the development of Montessori pedagogy takes place within both state and private initiatives, with an emphasis on multilingualism, digitalisation, and the preservation of children's health. In France, this system has gained broader institutional recognition, operating within officially accredited educational networks and adhering to a developed national charter. In both countries, the key factors for the efficiency of the Montessori method remain the creation of a prepared environment, individualised learning, the development of autonomy and sensory experience, as well as active engagement with parents.

Features of professional training for specialists working in preschool institutions operating under the Maria Montessori system in Ukraine and France

Ukraine. An important aspect of Montessori institutions' work is the training of teachers. This activity is carried out by the All-Ukrainian Montessori Teachers Organisation (AUMTO), which started its work in 1997 with the goal of popularising Maria Montessori's pedagogical concept and promoting the implementation of method in educational institutions across Ukraine. The organisation also provides informational and methodological support to Montessori institutions concerning the operation of similar educational establishments within the international education system. The organisation includes the Ukrainian Montessori Centre (UMC), which is the leading center for Montessori teacher training in Ukraine. Its programs have received international accreditation from MACTE (the Montessori Accreditation Council for Teacher Education), indicating their compliance with international quality standards. The UMC is also a collective member of the All-Ukrainian Association of Montessori Teachers (Ukrainian Montessori Centre, n.d.).

The Ukrainian Montessori Center offers professional training and diploma certification in the following programs: "Infant and Toddler" (from birth to 3 years old) and "Early Childhood" (from 3 to 6 years old), as well as training

Montessori Leadership Program – designed for administrators, school directors, and heads of early childhood development centers. All programs are based fully on the principles of Maria Montessori's philosophy and pedagogy. Program participants at the Center receive comprehensive training in the philosophy and methodology of Maria Montessori, observation techniques, classroom management, child development, practical life activities, sensorial education, mathematics, language development, cosmic education, the organisation of the educational process in toddler classrooms, toddler didactics, and the management of Montessori institution. Aspects of Montessori teacher preparation are also supported by the public organisation "Montessori UA" (Montessori Ukraine), which has been actively working since 2022 to promote Montessori education in Ukraine. The organisation collaborates with government agencies, the UN Office for the Coordination of Humanitarian Affairs, as well as local and international partners to advocate for the inclusion of Montessori programs in public preschools, schools, universities and children's homes (Montessori UA, n. d.).

The Ukrainian branch of the Association Montessori Internationale (AMI) facilitates the recognition and integration of the Ukrainian Montessori community into the international network. This branch is one of the oldest and most respected Montessori organisations in the world, founded by Maria Montessori herself. The existence of such a branch demonstrates the integration of the Ukrainian Montessori community into the international network. According to the Ukrainian Montessori Centre (Ukrainian Montessori Centre, n.d.), the general components of Montessori teacher training programs in Ukraine typically consist of two main parts:

1. The academic (theoretical) part, which includes the following components:

Philosophical foundations of the Montessori method, based on a detailed study of Maria Montessori's life and scientific works, views on the nature of the child, principles of self-development, and the role of the adult and prepared environment in the development of the child's personality;

Child development psychology, which includes the study of sensitive periods of development, psychological characteristics of children in different age groups (0–3, 3–6, 6–12 years), and theories of child development;

Features of the prepared environment, which explain the principles of creating and organising Montessori classrooms, their components and the requirements for materials and their arrangement.

Presentation of Montessori materials, aimed at an in-depth study of all types of Montessori materials for the respective age group, their purpose, sequence of use, control, and error correction. This includes:

- Materials for *Practical Life*, through which skills in self-care, care for the environment, and motor development are developed;

- *Sensorial materials*, which include materials for developing sight, hearing, touch, taste, smell, and stereognostic perception;

- *Language* materials, aimed at developing speech, reading, and writing skills;

- Mathematical materials (*Matematics*), which develop concepts of number, logical-mathematical operations, and geometry;

- Materials that implement the tasks of *Cosmic Education* in the context of studying elements of geography, history, biology, astronomy, physics, and art.

The role of the adult (teacher), which involves developing skills in observing the child's development, keeping observation records, adhering to the principles of non-violent communication, and creating conditions that support each child's independence;

Classroom management and group dynamics, preparing for work in multi-age groups, conflict prevention, effective conflict resolution strategies, and maintaining order.

2. Practical part (internship), which includes the following components:

Independent work with materials, which develops skills in presenting didactic materials based on mastering the methodology of their use in the Montessori environment;

Observation, which provides practice in recording the child's developmental changes within the prepared Montessori classroom environment;

Practical work (internship), which involves direct work with children under the supervision of an experienced Montessori teacher. This can be either full-time or part-time, depending on the curriculum. The internship is mandatory for obtaining international certification;

Developing Montessori materials, which complements the content of the Montessori teacher training program with practical sessions on creating or repairing Montessori materials;

Seminars and discussions, which ensure interactivity during regular meetings to review observation results, identify challenges encountered during direct involvement in the educational process, and facilitate the exchange of experience.

The challenging circumstances faced by Ukrainian educators have prompted the creation of flexible learning options. Students can choose the duration of the theoretical phase of training – either a one-year or two-year course – and combine academic study with their primary job. During the practical phase, they can select an internship model: a one-year mentorship with a master teacher or an independent two-year internship. A blended learning format combining remote and in-person instruction has been developed and implemented, maintaining the required number of hours and ensuring the quality of the educational process.

France. One of the most important organisations providing Montessori teacher training is the Association Montessori de France (AMF), which was mentioned in the description of preschool institutions' activities in France (Association Montessori de France, n.d.). Among the main tasks of AMF are:

- promoting the philosophy of Maria Montessori, which views education as "helping life" in environments adapted to the needs of each child;

- supporting existing Montessori schools and teachers;
- organising congresses, colloquiums, conferences and professional development seminars;
- developing partnerships with educational stakeholders and research groups.

Although Association Montessori Internationale (AMI) is an international organisation, it also plays a key role in France, as AMF is its affiliated organisation. AMI is responsible for overseeing the rights to publish Maria Montessori's works and for producing authorised Montessori didactic materials. It also organises training sessions for Montessori teachers worldwide (Association Montessori Internationale, n.d.). In addition to these main associations, there are educational institutions in France that may be either independent or affiliated with AMF/AMI. Some of these also offer Montessori teacher training courses, such as the Institut Supérieur Maria Montessori (ISMM) and the Centre de Formation Montessori Francophonie (CFMF), both of which provide Montessori teacher training (Institut Supérieur Maria Montessori, n.d.; Le Centre de Formation Montessori Francophonie, n.d.).

Since 1998, the Maria Montessori Higher Institute (ISMM) has been training preschool teachers, assistants, directors of educational institutions, parents, and project managers involved in implementing Maria Montessori's scientific pedagogy, covering all age groups from early childhood to adulthood (Institut Supérieur Maria Montessori, n.d.). In September 2015, a single official training course was developed for teachers working with children under the age of three. The Maria Montessori Higher Institute (ISMM) offers training in three areas covering preparation for working with three age groups: 0-3 years, 3-6 years, and 6-12 years. They are designed for people who wish to become Montessori teachers certified by the Association Montessori Internationale (AMI), with a course that combines theory, practice and immersion in the field (Association Montessori Internationale, n.d.). Graduates acquire the skills necessary to manage a kindergarten in accordance with Maria Montessori's principles (working with teaching materials, managing activities, monitoring activities, etc.). The Maria Montessori Higher Institute (ISMM) also offers short-term and certified training courses: introduction to Montessori pedagogy (orientation courses), training modules to become a teacher's assistant in a Montessori environment, training for Montessori school principals and advanced training courses for experienced teachers (Institut Supérieur Maria Montessori, n.d.).

To work in a preschool educational institution that operates on the principles of Maria Montessori's pedagogy, applicants are to meet general qualification requirements, including having a special diploma in education that allows them to teach young children (Institut Supérieur Maria Montessori, n.d.). This may be:

- professional qualification certificate (Le CAP Accompagnant Éducatif Petite Enfance (AEPE));
- state diploma in childcare assistance (Le Diplôme d'État d'auxiliaire de puériculture (DEAP));

➤ document confirming participation in the competition for a specialised territorial agent (Agent Territorial Spécialisé des Écoles Maternelles). The ATSEM competition is open to graduates of CAP Accompagnant Éducatif Petite Enfance (CAP AEPE) or parents of at least three children. It provides access to civil servant status (territorial civil service) and employment in a nursery school.

➤ state diploma in early childhood education (Le Diplôme d'État d'Éducateur de Jeunes Enfants (DEEJE));

➤ state diploma in childcare (Diplôme d'État de Puériculture (DEP)). This is for a nurse who specialises in caring for infants and preschoolers in both medical and social contexts.

The relevant documents certifying readiness to work in Montessori institutions, offered by specialised organisations, in particular AMI, are not mandatory but are preferable. In practice, early childhood education professionals must have a state diploma (CAP AEPE, EJE, AP, etc.) as well as a diploma or certificate from the International Montessori Association (AMI) given by ISMM or another AMI-approved organisation. The Montessori approach for children from birth to six years old is a training course offered as a continuing education program. It includes 60 hours of classes and two days of observing children, for a total of 69 hours. After this theoretical training, an additional module, "Montessori Assistant for Children from Birth to 3 Years," is offered. This practical component includes 30 hours of classes at the training center and is also offered as a continuing education program (Le Centre de Formation Montessori Francophonie, n.d.).

The organisation of the learning process meets modern requirements and involves classroom-based format through the implementation of the following forms of work: training sessions, exchange of practical experience, demonstration of Maria Montessori's approaches in the professional activities of preschool teachers, organised observations, solving pedagogical situations, giving feedbacks, and use of an e-learning platform, including interactive modules (watching videos, multiple-choice tests, reading texts, listening to audio, etc.). Theoretical training, the duration of which will depend on the chosen direction, is reinforced by a mandatory practical component directly in a Montessori environment. Upon successful completion of each part of the program, graduates receive a certificate confirming their readiness to work according to the principles of Maria Montessori's pedagogy. The training program (Institut Supérieur Maria Montessori, n.d.) includes the following components:

➤ Understanding the basics of Montessori pedagogy: introducing the fundamental principles of Maria Montessori's approach and philosophy of child development, key concepts, in particular, the absorbent mind, sensitive periods, the prepared environment, and the role of the adult;

➤ Developing a deep understanding of the psychology of children aged 0 to 6: awareness of the specific characteristics and needs of children in this age group; key stages of sensory, motor, cognitive, emotional, linguistic, and social development;

→ Mastering observation as a teaching tool: understanding the importance of observation in individual and collective support for children, acquiring skills for free and objective observation of children, their needs, and stages of development; using observation to stimulate team thinking;

→ Basic requirements for creating an environment conducive to child development: adherence to a clear division into zones that correspond to a specific type of activity and help the child form certain skills aimed at developing internal motivation and self-discipline;

→ Supporting child development with care and respect: developing the ability to identify and remove obstacles that hinder the child's natural development; supporting the child's spontaneous activity through cooperation and helpful assistance.

The professional training of Montessori teachers in Ukraine and France is based on the common ideological principles of Maria Montessori's philosophy, but there are differences in the organisational and structural format. In Ukraine, national associations and accredited centres, which play a leading role in training specialists, in particular the Ukrainian Montessori Centre, which provides both academic and practical training, considering current challenges and flexible forms of learning. In France, teacher training is coordinated by the AMF and AMI associations, as well as specialised institutions such as ISMM, which offer multi-level programmes with an emphasis on integrating philosophical, psychological and methodological aspects

in the context of practical experience. Both countries pay attention to the role of observation, sensitive periods of development and the creation of a prepared environment as key factors for effective interaction with children. This approach contributes to the formation of highly qualified specialists capable of implementing Maria Montessori's pedagogy in the context of modern preschool education.

Comparative analysis of an analytical review of the implementation of Maria Montessori's concept in preschool education institutions in Ukraine and France

Summarising the information on the implementation of Maria Montessori's scientific pedagogy method in the preschool education systems of Ukraine and France, we note that the governments of these countries are doing everything possible to ensure the quality of preschool education through the study and use of effective educational methods. Both countries are characterised by ensuring broad opportunities for early childhood and preschool children for their systematic development in public or private institutions, which parents can choose. The high demand from parents for Montessori kindergartens drives the search for effective ways to integrate Maria Montessori's approaches to child development with national standards and requirements for organising the educational process focused on children's life skills acquisition. The experience of Ukraine and France in implementing the key provisions of Maria Montessori's concept is summarised in Table 2.

Table 2. Comparative characteristics of the implementation of Maria Montessori's concept in the preschool education systems of Ukraine and France

Key principles of the concept	Name of the country	
	Ukraine	France
Popularity	more than 50 private institutions	more than 200 establishments, mostly private
Curricula and approaches	→ zoning of the educational environment (5 main zones); → integration of cultural and national characteristics into the content; → autonomy in choosing the programme; → names of groups/classes: infant, toddler and early/preschool childhood; → teacher-facilitator	→ zoning of the educational environment (5 main zones); → adaptation of classes to the French context; → compliance with the national curriculum; → names of groups/classes: nido, grand nido, children's community; → teacher-facilitator
Language of teaching	Ukrainian	bilingual approach (French–English)
Teacher training	There are programmes for the Montessori teachers' special training	There are special accredited AMI/AMF and standardised training programmes for Montessori teachers to work with different age groups
Functioning of Montessori Communities	All-Ukrainian Organisation of Montessori Teachers, Public Organisation "Montessori UA" (Montessori Ukraine), Ukrainian Montessori Centre, Branch of the "Association Montessori Internationale" (AMI) in Ukraine	Association Montessori de France (AMF), Association Montessori Internationale (AMI), Institut Supérieur Maria Montessori (ISMM) – Maria Montessori Higher Institute, Le Centre de Formation Montessori Francophonie (CFMF) – Francophonie training centre

Source: developed by the authors

According to the results presented in Table 2, Montessori institutions operate both in Ukraine and France. The difference in numbers can be explained primarily by the fact that in France, the development of Montessori institu-

tions began in the early 19th century, while in Ukraine it began in the late 19th century. In Ukraine, the development of a network of Montessori institutions is a private initiative (it should be noted that the state strongly supports such

initiatives, stimulating the development of private business), while in France, the state is actively studying the educational effects of Maria Montessori's pedagogy and possible ways to increase the number of state institutions, one of which is state Montessori groups within general education schools. The basic principles of Maria Montessori's scientific pedagogy are universal, but differences in approaches and curricula are determined by national education systems and the level of development of the Montessori movement in each country. Common to both countries are:

- creating a prepared environment as a specially organised space for the child's independent development in interaction with didactic material in practical activities;
- supporting mixed-age groups for the social and emotional development of children aged 3-6 through joint learning;
- promoting the child's freedom to choose the type of activity and their own pace of work as the basis for developing their internal motivation for independence and self-development;
- changing the role of the teacher as a mentor and facilitator who guides the child's development in independently learning about the environment, discovering new things, and making initial generalisations about the surrounding reality.

Although the universal Montessori curriculum covers five main areas: practical life skills, sensory development, language development, mathematics and logic, and culture (elements of geography, history, biology, art, and music), there are national differences in Ukraine and France. For example, in some Ukrainian Montessori centres, elements of national culture, language and history may be integrated into the curriculum in the field of "Culture", and there may also be projects aimed at developing social-based skills, empathy and critical thinking. French institutions may focus on the French language and culture, adapting materials and lessons to the French context. In Ukraine, private Montessori institutions are oriented towards international Montessori standards, but have greater autonomy in choosing teaching materials, approaches and programmes compared to France, where even in state Montessori groups (in comprehensive schools), teachers must consider the national curriculum. There are also differences in the names of educational groups/classes: infant, toddler and early/preschool (in Ukraine) and nido, grand nido, children's community (in France). Another important aspect of the concept is the language of instruction. In Ukraine, the language of instruction is Ukrainian, with many institutions offering additional English language classes. In France, Montessori institutions support the national trend towards early foreign language learning, so almost all institutions are bilingual (French – English).

Both countries have implemented Maria Montessori's idea of the need for special training for teachers working in a Montessori environment. In Ukraine, a tradition of training Montessori specialists in Montessori centres (e.g. the Ukrainian Montessori Centre) is emerging. France has a

long history of specialised training programmes for Montessori teachers, often linked to the Association Montessori de France (AMF) and the Institut Supérieur Maria Montessori (ISMM). The level and accreditation of these courses may vary, but in general, both Ukrainian and French Montessori teachers undergo similar intensive training, which consists of compulsory theoretical (a combination of face-to-face and distance learning) and practical (observation and activities directly in Montessori groups) components. Both countries are characterised by the creation of national associations supporting the Montessori movement at the state level in cooperation with international partners. There are several Montessori associations and organisations in Ukraine that are engaged in the dissemination and development of Maria Montessori's pedagogy in the educational sphere: All-Ukrainian Organisation of Montessori Teachers (AUOMT), Public Organisation "Montessori UA" (Montessori Ukraine), Ukrainian Montessori Centre (UMC), Branch of the Association Montessori Internationale (AMI) in Ukraine. In France, there are several key organisations involved in implementing Maria Montessori's pedagogical concept in the national education system and supporting initiatives by educational communities to promote and develop Maria Montessori's pedagogy: Association Montessori de France (AMF), Association Montessori Internationale (AMI), Institut Supérieur Maria Montessori (ISMM) and Le Centre de Formation Montessori Francophonie (CFMF). Despite possible differences, the fundamental essence of Montessori pedagogy – child-centredness, independence, learning through experience and the creation of a prepared environment – remains unchanged in both Ukraine and France. The differences most often lie in the degree of state support, integration into the national education system and adaptation to local cultural contexts.

CONCLUSIONS

The initiated research aimed at determining the essence of the conceptual foundations of Maria Montessori's pedagogy and the implementation of its relevant principles in the preschool education system of Ukraine and France, the goal of which has been achieved and the tasks completed, gives grounds for making appropriate generalisations. In the course of achieving the research objective, an analysis was conducted of the main principles of Maria Montessori's concept concerning the organisation of the educational process for early childhood and preschool-aged children, along with their psychological and pedagogical interpretation regarding the provision of quality preschool education, using Ukraine and France as case studies. The study of the scientific and source base helped to determine the specifics of training teaching staff to work in institutions operating under the Maria Montessori system and to substantiate the role of the teacher in the development of a growing personality in the Montessori environment.

The completion of the first research objective made it possible to outline the pedagogical theory's principles and key ideas of educational practice offered by Maria Montessori

that hold significant value for contemporary preschool education. These ideas focus on the development of an independent, autonomous personality capable of applying their potential in various types of childhood activity, while encouraging recognition of one's individuality and uniqueness. The second research task involved outlining the active application of Maria Montessori's concept in the practice of organising the educational process for preschool children in Ukraine and France, in particular common features include: adherence to the basic principles of Maria Montessori's "scientific pedagogy" method regarding the composition of age groups, the creation of a special developmental environment using authentic didactic materials, and the readiness of teaching staff to implement Maria Montessori's philosophy in their professional activities. The recorded differences are as follows: the names of classes/groups for children (different in both countries), involvement of the public (in France) or private sectors (mainly in Ukraine) in the functioning of Montessori institutions, and the use of a bilingual approach in educational activities (typical for France).

The third research task was closely related to the completion of the previous (second) task and allowed us to summarise the results regarding the specifics of training personnel to work in institutions operating under the Maria Montessori system in both countries (Ukraine and France). It involves the implementation of a two-component curriculum, which includes the obligatory study of both the theoretical part and the practical part, obtaining the relevant educational document (certificate, diploma, etc.) with children of a specific age category, and continuous professional

development (participation in Montessori communities, scientific and methodological events, etc.). Prospects for further historical and pedagogical research lie in studying the educational directions of Maria Montessori's system in the context of quality standards for preschool education by age category: early age (up to three years); younger, middle and older preschool age (from three to six (seven) years). It is expected that this will make it possible to update and diversify the content of educational material and enrich the arsenal of effective methods in the organisation of the educational process in preschool educational institutions.

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REFERENCES

- [1] American Montessori Society. (n.d.). *History of Montessori education*. Retrieved from <https://amshq.org/About-Montessori/History-of-Montessori>.
- [2] Association Montessori de France. (n.d.). Retrieved from <https://www.montessori-france.asso.fr/page/156818-accueil>.
- [3] Association Montessori Internationale. (n.d.). *Biography of Maria Montessori*. Retrieved from <https://www.montessori-ami.org/resource-library/facts/biography-maria-montessori>.
- [4] Association Montessori Internationale. (n.d.). *France*. Retrieved from <https://montessori-ami.org/countries/france>.
- [5] Bednarczuk, B. (2023). Potential and actual significance of Montessori learning environment. *Lubelski Rocznik Pedagogiczny*, 42(4), 113-130. doi: 10.17951/lrp.2023.42.4.113-130.
- [6] Culclasure, B.T., Daoust, C.J., Cote, S.M., & Zoll, S. (2019). Designing a logic model to inform Montessori research. *Journal of Montessori Research*, 5(1), 35-49. doi: 10.17161/jomr.v5i1.9788.
- [7] Demangeon, A., Claudel-Valentin, S., Aubry, A., & Tazouti, Y. (2023). A meta-analysis of the effects of Montessori education on five fields of development and learning in preschool and school-age children. *Contemporary Educational Psychology*, 73, article number 102182. doi: 10.1016/j.cedpsych.2023.102182.
- [8] Debs, M. (2022). Montessori in India: Adapted, competing, and contested framings, 1915-2021. *History of Education Quarterly*, 62(4), 387-417. doi: 10.1017/heq.2022.25.
- [9] National Museum Australia. (n.d.). *Education*. Retrieved from <https://www.nma.gov.au/exhibitions/glorious-days/social-laboratory/education>.
- [10] Efe, M., & Ulutas, I. (2022). Beyond teaching: Montessori education initiatives of public preschool teachers in Turkey. *Educational Research for Policy and Practice (ERPP)*, 21, 375-388. doi: 10.1007/s10671-022-09310-7.
- [11] Fabri, M., & Fortuna, S. (2020). Maria Montessori and neuroscience: The trailblazing insights of an exceptional mind. *The Neuroscientist*, 26(5-6), 394-401. doi: 10.1177/1073858420902677.
- [12] Frierson, P. (2021). Maria Montessori. In T.K. Shackelford & V.A. Weekes-Shackelford (Eds.), *Encyclopedia of evolutionary psychological science* (pp. 4781-4789). Cham: Springer. doi: 10.1007/978-3-319-19650-3_2440.
- [13] Frierson, P., & Paolo, L. (2025). Montessori, math, and materials: A case of extended cognition. *Synthese*, 205, article number 197. doi: 10.1007/s11229-025-05014-6.

- [14] Gutek, G.L., & Gutek, P.A. (2020). The fifth woman: Maria Montessori. In *America's early montessorians* (pp. 37-57). Cham: Palgrave Macmillan. doi: 10.1007/978-3-030-54835-3_2.
- [15] Harris, D. (2024). The Maverick known as Montessori. In B.A. Geier (Eds.), *The Palgrave handbook of educational thinkers* (pp. 947-966). Cham: Palgrave Macmillan. doi: 10.1007/978-3-031-25134-4_101.
- [16] Hopta, S.M. (2020). Pedagogical ideas of Maria Montessori in the context of modern educational space. *Innovative Pedagogy*, 28, 48-51. doi: 10.32843/2663-6085/2020/28.8.
- [17] Institut Supérieur Maria Montessori. (n.d.). Retrieved from <https://www.formation-montessori.fr/>.
- [18] Laure, M., & Habe, K. (2024). Stimulating the development of rhythmic abilities in preschool children in Montessori Kindergartens with music-movement activities: A quasi-experimental study. *Early Childhood Education Journal*, 52, 563-574. doi: 10.1007/s10643-023-01459-x.
- [19] Le Centre de Formation Montessori Francophonie. (n.d.). Retrieved from <https://cfmf.fr/>.
- [20] Le Centre Préscolaire Montessori. (n.d.). Retrieved from <https://ecolemontessorimontreal.com/centre-prescolaire/>.
- [21] Lillard, A.S., LeBoeuf, L., Borgman, C., Martynova, E., Faria, A.-M., & Manship, K. (2025). When bigger looks better: CLASS results in public Montessori preschool classrooms. *Early Childhood Research Quarterly*, 70, 199-210. doi: 10.1016/j.ecresq.2024.10.003.
- [22] Lillard, A.S., Heise, M.J., Richey, E.M., Tong, X., Hart, A., & Bray, P.M. (2017). Montessori preschool elevates and equalizes child outcomes: A longitudinal study. *Frontiers in Psychology*, 8, article number 1783. doi: 10.3389/fpsyg.2017.01783.
- [23] List of every School Paris France. (n.d.). Retrieved from [https://www.international-schools-database.com/in/paris?filter=on&curriculum\[\]=Montessori](https://www.international-schools-database.com/in/paris?filter=on&curriculum[]=Montessori).
- [24] Map of Montessori kindergartens in Kyiv. (n.d.). Retrieved from <https://tinyurl.com/57r69hwu>.
- [25] Marshall, C. (2017). Montessori education: A review of the evidence base. *NPJ Science of Learning*, 2, article number 11. doi: 10.1038/s41539-017-0012-7.
- [26] Montessori UA. (n.d.). Retrieved from <https://montessoriuua.com/map-en/>.
- [27] Montessori, M. (1950). *The discovery of the child*. Milano: Garzanti.
- [28] Montessori, M. (1957). *The child in the family*. Milano: Garzanti.
- [29] Montessori, M. (2016). *Self-education in teaching schools*. Milano: Garzanti.
- [30] Montessori, M. (2017). *The mind of the child. Absorbing mind*. Milano: Garzanti.
- [31] Montessori for all: Everything you need to know about this teaching method. (n.d.). Retrieved from <https://www.montessoripourtous.fr/>.
- [32] Montessorischool. (2019). Retrieved from <https://surl.lu/ahspak>.
- [33] Moreira, L., & Barata, T.Q.F. (2022). Inclusive product design: Applying the Montessori methodology into the design conception of children's products. In D. Raposo, J. Neves & J. Silva (Eds.), *Perspectives on design II. Springer series in design and innovation* (pp. 367-383). Cham: Springer. doi: 10.1007/978-3-030-79879-6_27.
- [34] Moussy, B. (2007). Between Pauline Kergomard and Maria Montessori. *Le portique Revue de Philosophie et de Sciences Humaines*. doi: 10.4000/leportique.891.
- [35] Murray, A.K., Johnston, L.C., Sabater, A., & Clark, K. (2020). *Hidden black voices in the history of Montessori education*. *American Educational History Journal*, 47(1-2), 205-221.
- [36] Noordzij, F. (2023). Werken volgens Montessori. *Kinderopvang*, 33, article number 7. doi: 10.1007/s41189-023-1972-z.
- [37] Pironi, T. (2011). From Ellen Key to Maria Montessori: The design of new educational spaces for children. *Education Studies/Open Journal of Education*, 13(1), 81-89. doi: 10.13128/Studi_Formaz-10049.
- [38] Radul, O.S., Prybora, T.O., Androsova, N.M., & Zavitrenko, D.Zh. (2023). *Maria Montessori's pedagogy: Past and present*. In O.S. Radul (Ed.). Kropyvnytskyi: FOP Piskova M.A.
- [39] Quarfood, C. (2022). Situating Montessori. In C. Quarfood (Eds.), *The Montessori movement in interwar Europe: New perspectives* (pp. 1-29). Cham: Palgrave Macmillan. doi: 10.1007/978-3-031-14072-3_1.
- [40] Raimondo, R. (2021). Maria Montessori and Anna Freud: Links and influences between pedagogy and psychoanalysis. *Journal of Educational History*, 8(2), 73-82. doi: 10.36253/rse-10329.
- [41] Richardson, S.O. (1997). The Montessori preschool: Preparation for writing and reading. *Annals of Dyslexia*, 47, 239-256. doi: 10.1007/s11881-997-0028-4.
- [42] Romano, A. (2020). Maria Montessori: A complex and multifaceted historiographical subject. *History of Psychology*, 23(2), 203-207. doi: 10.1037/hop0000150.
- [43] Santini, G. (2024). *The best weapon for peace. Maria Montessori, education, and children's rights* by Erica Moretti. Madison: The University of Wisconsin Press. doi: 10.1017/mit.2024.9.
- [44] Ukrainian Montessori Centre. (n.d.). Retrieved from <https://www.ukr-montessori.com/>.
- [45] van Niekerk, J. (2024). Maria Montessori. *Kinderopvang*, 34, 8-10. doi: 10.1007/s41189-024-2410-6.
- [46] Yakobchuk, N. (2023). *Pedagogical views of Maria Montessori in Sofia Rusova's scientific research*. *Collection of Scientific Papers "Scientia". Section 20. History, Archeology and Culturology*, 172-174.

Любов Лохвицька

Кандидат педагогічних наук, професор
Університет Григорія Сковороди в Переяславі
08401, вул. Сухомлинського, 30, м. Переяслав, Україна
<https://orcid.org/0000-0001-6852-5477>

Наталія Левінець

Кандидат педагогічних наук, доцент
Інститут педагогіки НАПН України
04053, вул. Сіхових стрільців, 52-Д, м. Київ, Україна
<https://orcid.org/0000-0002-5191-4940>

Наталія Мартовицька

Кандидат педагогічних наук, доцент
Черкаський національний університет імені Богдана Хмельницького
18031, 6-р Шевченка, 81, м. Черкаси, Україна
<https://orcid.org/0000-0002-7258-3458>

Тетяна Шелег

Кандидат психологічних наук, викладач
Версальський університет Сен-Кантен-ан-Івелін
78000, просп. Держави Об'єднаних Націй, 45, м. Версаль, Франція
Двомовний дошкільний заклад Монтессорі
94300, вул. де Лагні, 51, м. Венсенн, Франція
<https://orcid.org/0000-0001-8481-2628>

Концепція Марії Монтессорі в дії: впровадження в закладах дошкільної освіти України і Франції

Анотація. Актуальність проведеного дослідження реалізує сучасні тренди щодо пошуку дієвих шляхів підвищення якості дошкільної освіти. Дослідницька проблема передбачала з'ясування провідних концептуальних ідей теоретичного й практичного доробку італійської вченої Марії Монтессорі та їх дієвості в системі дошкільної освіти різних країн. Мета наукового пошуку спрямовувалась на здійснення аналізу та інтерпретації основних положень концепції Марії Монтессорі щодо організації освітнього процесу з дітьми раннього і дошкільного віку та їх впровадження в дошкільній освіті України і Франції, а також на обґрунтування специфіки підготовки кадрів для роботи в закладах Марії Монтессорі у цих країнах. Для досягнення мети дослідження використано комплекс теоретичних методів: аналіз і синтез, хронологічний метод, педагогічна історіографія, конкретизація, систематизація, порівняння, узагальнення і прогнозування. У статті окреслено провідні ідеї педагогічної теорії і освітньої практики Марії Монтессорі, які є основоположними для сучасних змін, що відбуваються в світовому вимірі дошкільної освіти; схарактеризовані її погляди щодо пріоритетних принципів розвитку особистості, які підкреслюють самоцінність дошкільного дитинства. Виокремлено ключові засади концепції вченої в контексті організації освітнього простору закладів для дітей раннього і дошкільного віку, що функціонують в Україні та Франції; визначено спільне та відмінне в їх діяльності щодо застосування спадку наукової педагогіки Марії Монтессорі: дотримання основних положень, створення спеціально підготовленого середовища, використання автентичного дидактичного матеріалу та забезпечення професійності кадрів. З'ясовано специфіку підготовки педагогів для роботи в Монтессорі-закладах обох країн, що ґрунтується на реалізації програми, яка містить два обов'язкові складники: теоретичний і практичний. Наукова цінність і практичне значення дослідження вбачається в поглибленні змісту освітнього компонента «Історія дошкільної педагогіки» для здобувачів спеціальності А2 Дошкільна освіта та освітнього компонента «Іноземна мова за професійним спрямуванням» для здобувачів освіти педагогічних спеціальностей

Ключові слова: історія дошкільної педагогіки; науковий підхід; Монтессорі-метод; діти раннього і дошкільного віку; розвиток особистості; українська система дошкільної освіти; французька система дошкільної освіти

**Olena Usyk***

PhD in Pedagogical Sciences, Associate Professor
Hryhorii Skovoroda University in Pereiaslav
08401, 30 Sukhomlynskyi Str., Pereiaslav, Ukraine
<https://orcid.org/0000-0001-9964-4292>

Alevtyna Opolska

PhD in Pedagogical Sciences, Associate Professor
Hryhorii Skovoroda University in Pereiaslav
08401, 30 Sukhomlynskyi Str., Pereiaslav, Ukraine
<https://orcid.org/0000-0002-5273-0748>

Alla Derecha

Methodist
Hryhorii Skovoroda University in Pereiaslav
08401, 30 Sukhomlynskyi Str., Pereiaslav, Ukraine
<https://orcid.org/0000-0001-8153-5792>

Strategies for combating academic misconduct in universities abroad

Abstract. The purpose of the article was to study an effective strategies for addressing academic misconduct in universities and their practical implementation. An analysis was conducted of universities in various countries, including the USA, Germany, the United Kingdom, Australia, Japan, and South Korea, alongside a review of internal university documents outlining strategies and procedures for preventing academic misconduct. The findings of this study provided an analysis of the main factors that contribute to dishonest behaviour among students and faculty members. Furthermore, the research defined the concept of “academic misconduct”, and identifies its key elements, types, and the reasons why it occurs. The study also identified effective methods for preventing academic misconduct, including the use of technology to verify the authenticity of academic work, the introduction of honour codes, the implementation of educational campaigns, and ethics training. Fostering a culture of academic integrity and collaboration among all participants in the educational process remains a priority. Each country employs distinct methods to combat and prevent breaches of academic integrity. Recognising academic decommunisation as an integral part of the higher education system contributes to the development of intellectual and ethical culture among students and researchers. Variations in academic integrity requirements for students, lecturers, and researchers are reflected in differing levels of accountability for violations, based on an examination of international experience and practices. The study presented recommendations for improving existing approaches and developing new strategies to enhance academic integrity in educational institutions. The findings may be utilised by university lecturers to refine the educational process

Keywords: academic integrity; educational standards; requirements; international experience; ethical values; accountability for violations

INTRODUCTION

Academic misconduct within universities poses a significant challenge, impacting the integrity of research and the overall educational experience. Practices such as data falsification and plagiarism violate the fundamental

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*Corresponding author



principles of scholarly honesty and erode trust in academic institutions. Therefore, it is essential to implement effective strategies to prevent these occurrences. These strategies should also focus on increasing awareness among students and faculty regarding ethical standards, strengthening compliance management, and establishing robust mechanisms for detecting and addressing violations. Only a comprehensive approach can ensure sustained academic integrity and uphold high standards in science and education.

Numerous researchers have explored strategies for combating academic misconduct in universities. Notably, C. Ainsworth *et al.* (2023) applied stress and neutralisation theory to examine academic cheating within online group chat environments. Their research revealed that students often justify their actions by citing peer pressure and the perceived need to achieve high grades. The study primarily focuses on how students rationalise behaviour that breaches academic integrity. It highlights that competitiveness and motivation influence academic misconduct, taking into account various learning methods. This issue necessitates not only reactive measures but also a systematic approach to fostering a culture of scholarly honesty among all members of the academic community. Implementing such a strategy is a step towards strengthening trust within the academic community and supporting its intellectual and moral development. The results indicated that students with high levels of competitiveness and extrinsic motivation are more likely to resort to dishonest learning methods.

P. Araya *et al.* (2023) investigated the factors that influence academic misconduct among students in the Chemistry and Pharmacy faculties of a Chilean university. They identified key factors, including peer pressure, fear of failure, and insufficient teacher support. This research highlights that a lack of knowledge about academic integrity, limited resources, and inadequate teacher support are significant contributing factors. C.K.H. Che Ku Kassim & N.R. Mohd Sallem (2023) examined students' perceptions of cheating and deception. The researchers found that many students justify their actions by citing stress, high demands, and peer pressure. M.K. Constantinou *et al.* (2023) studied the personal profiles of students and discovered that certain personality traits can predict academic misconduct. Utilising a 5-factor model of personality analysis, they identified groups of students with varying levels of susceptibility to dishonesty. Furthermore, research has shed light on the issues underlying academic integrity in the field of artificial intelligence, particularly concerning the use of ChatGPT. They have provided guidance to lecturers on how to prevent cheating through technology, and actively engage students in discussions on ethical considerations.

Researchers P.M. Davies *et al.* (2023) explored students' views on cyber-learning, revealing that students not only actively valued the flexibility of online education but also expressed concerns regarding academic integrity and the quality of assessment. They further analysed the impact of anti-corruption video clips on students' attitudes towards corruption. Their studies demonstrate that

media campaigns can significantly influence changes in attitudes and behaviours, enhancing awareness of the issue. R. Djokovic *et al.* (2022) investigated the effects of online lessons on students' perceptions of academic misconduct. The researchers concluded that interactive online lessons and educational initiatives can effectively reduce instances of academic misconduct. They also suggest that these environments create additional challenges for ensuring academic integrity. F. Flora Xuhua He *et al.* (2024) identified key contributing factors such as stress, pressure from lecturers, and a competitive environment. L. Holubnycha (2022) analysed the impact of the pandemic on e-learning in higher education and found that the pandemic significantly accelerated the transition to online learning, while also increasing instances of academic misconduct due to imperfect monitoring systems. G. Kadayam Guruswami *et al.* (2023) investigated the perceptions of academic integrity among medical students in the Middle East. The study indicated that cultural factors significantly influence students' views on academic misconduct. Notably, the aforementioned research did not include a comparative analysis of policies for combating academic misconduct across different universities worldwide. This article aimed to examine effective strategies for combating academic misconduct in universities and the practical application of these strategies. In line with this aim, the research objectives were as follows:

1. To analyse the existing types of academic misconduct and the reasons for their occurrence in the university environment;
2. To evaluate the effectiveness of current strategies and approaches used by various universities to combat academic misconduct;
3. To consider the impact of technology on academic misconduct and the potential ways to use it to prevent violations.

MATERIALS AND METHODS

An analysis was conducted of documents regulating academic integrity in universities across various countries, including the USA, Germany, the United Kingdom, Australia, Japan, and South Korea. These documents were sourced from the official website of the United Nations Educational, Scientific and Cultural Organization (UNESCO), which monitors the state of academic integrity on a global scale (UNESCO World Heritage Centre, 2024). The analysis of university policies focused on the following elements: country, key aspects of the policy, sanctions for violations, and the provision of support for higher education students.

This research aimed to identify the core components that define misconduct within the academic environment and to analyse its impact on various aspects of the educational process. Official university websites and reports were searched to gather the necessary information. Selection criteria included renowned universities from different countries, with publicly available documents outlining clearly defined strategies for combating academic misconduct. The analysis covered the activities of the following

higher education institutions: Harvard University, Ludwig Maximilian University of Munich, University of Oxford, University of Melbourne, University of Tokyo, and Seoul National University. The research considered university documents, integrity policies, educational training and programmes, technological tools, academic misconduct counselling during studies, and procedures for investigating and sanctioning detected misconduct.

The internal documents of universities, outlining strategies and procedures for preventing academic misconduct, were examined. The study examined key policies from Harvard University, including the Academic Integrity Policy and Harvard College Honor Code (Harvard University, 2024); the Ludwig Maximilian University of Munich, specifically the Code of Conduct and Examination Regulations (University of Munich, 2024); and the University of Oxford focusing on the Proctors' and Assessor's Memorandum and University of Oxford Academic Integrity Policy (University of Oxford, 2024). The University of Melbourne's Academic Integrity Policy (University of Melbourne, 2024) was also reviewed, along with the University of Tokyo's Misconduct Guidelines and Code of Conduct for Research (The University of Tokyo, 2024) and Seoul National University's Code of Academic Integrity (Seoul National University, Gwanak Campus, 2024).

Consideration was given to the use of technologies such as the Internet and access to vast information resources, social media and online platforms for information sharing, plagiarism detection software, and technologies that enable the creation of fake scholarly work and data. Through the analysis of the data obtained, the key problems and approaches explored in academic literature, regulatory documents, and university policies were identified. This involved comparing various strategies for combating academic misconduct across different universities and countries, allowing for an evaluation of their effectiveness and the identification of best practices. Based on this analysis, a new strategy was proposed, which should encompass eight key aspects.

RESULTS

The education system of every nation is considered one of the most significant factors in shaping the consciousness of modern individuals. Consequently, the quality of the educational process and its ideological content determine how, and on what principles, ideas, and values, social relations will be formed. Ethics, value orientations, and a culture of thought and behaviour, alongside serious problems at all levels of social life, have become the basis for drawing attention to and recognising the need for practical actions in the realm of academic integrity within the education system. Academic misconduct is defined as the violation of academic standards and ethical norms, which can manifest in various forms of dishonest behaviour by all participants in the educational process. The fundamental elements and functions of academic misconduct help to more clearly define this concept, which should be considered through its

parts, as well as the mechanisms of influence on the academic environment. Understanding these components is essential for effectively combating academic misconduct and creating an honest and ethical educational environment. Accordingly, the primary functions of academic misconduct are considered to be:

1. Destructive function – undermines trust in the education system, lowers the overall quality of education and research, and creates unfair conditions for all participants in the academic process;

2. Educational function – highlights the importance of raising awareness among members of the academic community regarding ethical standards, fostering a sense of responsibility, and promoting a culture of integrity within the educational environment;

3. Regulatory function – identifies weaknesses and shortcomings in academic integrity control mechanisms, potentially encouraging educational institutions to implement new measures or policies aimed at preventing academic misconduct;

4. Instrumental function – serves as a means of gaining unjustified academic advantages, providing short-term benefits for those who engage in or facilitate dishonest practices.

One key component of academic misconduct is plagiarism, which can be categorised as direct plagiarism (copying text without changes and without proper source citation), mosaic plagiarism (combining text fragments from various sources without proper citation), and self-plagiarism (reusing one's own work without indicating its previous use). Another important element is examination fraud, specifically cheating, which involves looking at other people's answers or using cheat sheets and electronic devices such as mobile phones and smartwatches to access information during examinations. Equally noteworthy is data fabrication and falsification, which consists of inventing data or experimental results that were never obtained, or manipulating existing data to achieve a desired outcome. Additionally, academic misconduct includes duplicate submission, i.e., submitting the same work to different institutions or for different courses without informing them of its previous submission. Unethical collaboration, such as unfair division of responsibilities and joint completion of individual assignments, also constitutes a component of academic misconduct.

The modernisation of education highlights the necessity for a thorough reassessment of the current state of higher education institutions. Activity within the academic environment can only be effective if it is based on a specific set of values that unites diverse individuals into a team and provides meaning to their collective work. In this context, academic integrity significantly influences the formation of shared approaches to work organisation, the definition of professional competence and trust, decision-making procedures, and the perception and resolution of conflicts, among other things. Universities, through their students, are called upon to bring reason and morality

into human life by formulating moral and rational norms. There are other equally important reasons for promoting integrity. First and foremost, it supports the quality of education, as academic misconduct undermines educational quality since students who engage in such practices do not acquire the necessary skills and knowledge. The lack of proper material comprehension can ultimately lead to poor professional performance in the future. Furthermore, it is essential to consider the protection of a university's academic reputation, which largely depends on the integrity of all participants in the educational process. Instances of examination fraud, plagiarism, or research falsification can result in a loss of trust in the higher education institution, both from students and from the academic community, employers, and society at large. Maintaining high standards of academic integrity contributes to upholding the positive image of every university.

The formation of ethical principles is crucial for university education, while academic misconduct erodes moral foundations and fosters an indifferent attitude towards ethics in the personal and professional lives of students. Modern universities aim not only to provide necessary knowledge but also to cultivate core moral values, such as honesty and responsibility. Combating academic misconduct ensures equal conditions for all students, whereas dishonest practices promote unfair advantages for those who use them, violating the principles of fair competition. This can demotivate honest students and reduce their efforts and motivation in their studies. It is essential to remember the importance of upholding scientific integrity. Research based on dishonest practices can lead to erroneous results, which affect the further development of science and technology. Data fabrication and falsification undermine scientific progress, which can have serious consequences for society, particularly in fields such as pedagogy, medicine, technology, and environmental science. Another reason for promoting integrity is preparation for professional life, as academic integrity is the foundation of professional ethics. Students who adhere to high standards in their studies are more likely to uphold ethical norms in their professional careers. This contributes to building a responsible and honest society.

Even the most intellectually independent students can suffer from confusion and depression when they observe that academic research and success in research activities are more easily achieved through deception than through honest work. A commitment to academic integrity is essential for any open and democratic society. This requires that students, faculty, and researchers feel completely free from the destructive influence of academic corruption and conservatism. Only in such an atmosphere of open and honest expression of ideas can real intellectual and material progress be achieved. However, academic virtue implies not only academic freedom but also responsibility for all judgments, evaluations, and actions made by an individual. This is, in effect, a micro-social model of an open type, which provides quality knowledge and can have

a significant impact on the macro-world. Modern technologies have a significant impact on academic misconduct in higher education, creating new challenges while significantly facilitating the learning and research process, and supporting scientific integrity. The Internet and electronic databases allow students to quickly find and use information without proper source citation, which increases the risk of plagiarism. Anti-plagiarism software is becoming an important tool for detecting similar texts on the open internet and in other sources, providing lecturers with an objective assessment of the originality of academic work. Data falsification is a serious problem, made easier by digital tools for data processing and analysis. To prevent this, it is important to use specialised software that can verify and authenticate scientific results.

E-learning and remote testing also present risks of technology misuse to gain unfair advantages. To ensure assessment integrity, applications that monitor student performance during remote testing using webcams and behaviour analysis systems are needed. Additionally, electronic social networks and creative media projects can facilitate the exchange of ideas, but also create situations where dishonest use of others' materials can undermine academic integrity. All these aspects indicate that technology opens new opportunities for learning and research but requires appropriate monitoring and professional tools to ensure academic integrity. The integration of educational programmes and technologies is an important factor in creating an environment that encourages the honest use of knowledge and maintains high standards of scholarly integrity in the university environment.

The effectiveness of current strategies and approaches to combating academic misconduct depends on the specific university and its approach to addressing this issue. Universities actively employ plagiarism detection technologies, which can significantly reduce instances of copying, such as anti-plagiarism software. However, this largely depends on the effectiveness of the corporate culture and control mechanisms. Deficiencies in conducting regular checks and a lack of clear sanctions can lead to disregard for the rules. It is also important to note that some forms of academic misconduct, such as data falsification, are difficult to detect and may require specialised knowledge and technology. In fostering an academic culture aimed at reducing dishonesty, each group – faculty, administration, and students – plays a vital role. Faculty members are the primary mentors for students in matters of research ethics and scholarly integrity. They should prioritise quality teaching and assessment that stimulates the development of critical thinking and creative abilities.

Academic misconduct, in any country, undermines trust in the education and science systems, jeopardising the quality and integrity of research. To combat this, many educational institutions implement control systems, academic ethics training programmes, and strict sanctions for offenders. Fostering a culture of integrity is a crucial task for the modern academic environment, as

it promotes the development of a fair and effective educational process. Academic integrity policies, drawing on

the experience of various countries, have been systematised and presented in Table 1.

Table 1. General approaches of foreign countries in ensuring academic integrity

Country	Higher education institution	Key aspects of policy	Sanctions for violations	Support for higher education students
USA	Harvard University	Clear academic integrity code	Ranging from warning to expulsion	Access to learning materials, consultations
Germany	University of Munich	Regulated procedures for detecting plagiarism	Degree revocation, expulsion, or warning	Consultations
United Kingdom	University of Oxford	Strict requirements for academic writing	Grade reduction or expulsion	Training, academic mentors
Australia	University of Melbourne	Anti-fraud prevention policy	Warning to expulsion	Educational workshops
Japan	University of Tokyo	Strict research standards	From grade reduction to degree revocation	Educational programmes, individual consultations
South Korea	Seoul National University	Academic behaviour code	Warning to expulsion	Self-learning resources, advisory service

Source: compiled by the authors based on research from the Harvard University (2024), the University of Munich (2024), the University of Oxford (2024), the University of Melbourne (2024), the University of Tokyo (2024), Seoul National University (SNU), Gwanak Campus (2024)

Harvard, Ludwig Maximilian University of Munich, and the University of Oxford primarily combat plagiarism and cheating by clearly defining what both concepts mean at the university level and within individual courses of study. Seoul National University and the University of Tokyo implement academic honour codes and only appoint faculty members after they have demonstrated that they are familiar with its content and willing to adhere to its provisions. The University of Melbourne has created independent ombudsman positions with broad powers and the relative independence necessary to successfully resolve labour disputes.

The aforementioned higher education institutions employ various strategies to combat academic misconduct. For example, Harvard University's approach is based on its Honour Code, which defines academic integrity as a fundamental community value. Students are required to sign and adhere to it. It establishes clear rules regarding academic misconduct, such as plagiarism, cheating on exams, and other forms of assessment. This institution also provides educational resources and programmes for students and faculty to enhance their understanding of academic integrity and the importance of adhering to it. These programmes include training, seminars, and informational materials. At the same time, faculty members use various technological tools to verify the authenticity of student work, including plagiarism detection software. Harvard has clearly defined procedures for investigating cases of academic misconduct. If dishonest behaviour is confirmed, appropriate sanctions are applied, which may include warnings, corrective measures, or expulsion from the university.

At Ludwig Maximilian University of Munich, a Code of Conduct has been established to combat dishonesty. This code defines the standards of academic integrity and ethics for students and faculty. It outlines the principles that all members of the university community must adhere to. There are also examination regulations that contain detailed rules for conducting examinations and define procedures for detecting and punishing academic misconduct

during exams. The university administration also organises educational events to raise awareness among students and faculty about the importance of academic integrity. This includes seminars, lectures, and information campaigns. Various software tools are used to detect plagiarism and verify the authenticity of student work. This helps prevent academic misconduct by automatically detecting suspicious materials. If a violation is detected, the university applies appropriate disciplinary measures, which may include warnings, annulment of exam results, or even expulsion from the university.

The strategy for combating academic misconduct at the University of Oxford is implemented throughout the duration of the study, utilising specialised handbooks that contain sections on academic integrity, rules of conduct, and student responsibilities. The university provides students with the necessary information to understand and adhere to high standards of academic integrity. Additionally, the Proctors' and Assessor's Memorandum has been created, which outlines the rights and responsibilities of students and faculty regarding academic integrity. The Proctors, who are responsible for maintaining academic standards, investigate cases of dishonest behaviour and apply appropriate measures. The university's policy on academic integrity, which establishes rules for preventing plagiarism, cheating on exams, and other forms of academic misconduct, is rigorous. The University of Oxford conducts educational events to raise awareness among students and faculty about the importance of academic integrity. This includes seminars, lectures, and information campaigns aimed at fostering a culture of integrity. The university also has clearly defined procedures for investigating cases of academic misconduct. In the event of confirmed violations, appropriate disciplinary measures are applied, which may include warnings, annulment of exam results, or even expulsion from the university.

The University of Melbourne has established a document called the Academic Integrity Policy, which outlines

the fundamental principles and rules of academic integrity, setting standards for students and faculty regarding the avoidance of plagiarism, fraud, and other forms of academic misconduct. It also describes in detail the rules and procedures that students must follow to ensure academic integrity. This includes information on how to properly cite sources, avoid plagiarism, and submit original work. The university actively uses technological tools to verify the authenticity of student work and detect plagiarism. Software tools, such as Turnitin, help to automatically detect dishonest materials and prevent plagiarism. The university provides students and faculty with access to counselling services that can assist with academic integrity issues. Students can receive advice on proper source citation and avoiding dishonest behaviour. However, the University of Melbourne does not have clearly defined procedures for investigating cases of academic misconduct.

The strategy for combating academic misconduct at the University of Tokyo includes Academic Misconduct Guidelines, which define the fundamental principles of academic integrity and describe forms of academic misconduct, such as plagiarism, data falsification, and examination fraud. These guidelines establish rules for students and faculty regarding the prevention of such violations. There is also a Code of Conduct for Research, which establishes ethical standards for researchers. It covers issues of integrity in research, including data fabrication, plagiarism, and other forms of research misconduct. The University of Tokyo conducts educational events to raise awareness among students and faculty about the importance of academic integrity. This includes seminars, lectures, and information campaigns aimed at fostering a culture of integrity. The university administration provides students and faculty with access to counselling services that can assist with academic integrity issues. This includes providing advice on proper source citation and avoiding dishonest behaviour.

Seoul National University also has a Code of Academic Integrity, which establishes standards of conduct for students and faculty, defines forms of academic misconduct such as plagiarism, examination fraud, and data falsification, and outlines the consequences of violations. Approved regulations regarding academic affairs include detailed rules and procedures for preventing academic misconduct. They cover aspects of conducting examinations, writing research papers, and general student conduct. Students are required to complete a training course that includes information on academic integrity, rules of conduct, and student responsibilities. This course provides students with resources and information to understand and adhere to high standards of academic integrity. Seoul National University has clearly defined procedures for investigating cases of academic misconduct. In the event of confirmed violations, appropriate disciplinary measures are applied, which may include warnings, annulment of exam results, or even expulsion from the university.

Based on the information provided, a comprehensive strategy should encompass several key aspects. Firstly,

there should be continuous improvement of laws regulating academic activity to prevent data falsification, plagiarism, and other forms of academic misconduct. It is essential to introduce fair and clear sanctions for offenders, which include administrative penalties, expulsion from higher education institutions, or revocation of academic degrees. Raising awareness is also crucial and can be achieved through training, seminars, and courses for educational participants on the importance of academic integrity. Incorporating topics on academic integrity into mandatory courses, particularly those on academic writing and research methodology, is also important. Further elements in the strategy to combat academic misconduct include technological solutions, which involve anti-plagiarism systems (implementing modern plagiarism detection technologies for all academic work, including dissertations, term papers, and theses) and digital archives (creating databases of academic work to ensure open access and the ability to verify text originality).

The next aspect involves institutional measures that facilitate the rapid detection and investigation of violations, allowing for necessary decisions regarding sanctions to be made. This aspect is further defined by collaboration between institutions, fostering the exchange of experience and coordination of actions in combating academic misconduct. Another key element is research support, which consists of providing financial support for conducting proper research on academic integrity, including studying the scale of the problem and the effectiveness of various combating strategies. It also involves disseminating research results and analysing best practices through conferences and scholarly publications. Furthermore, international cooperation is a crucial aspect, as modern universities should promote the exchange of experience. Important steps in this regard include participation in international programmes and various projects aimed at combating academic misconduct, as well as adopting successful practices from other countries and adapting them to Ukrainian realities. Student initiatives and their support are also vital, including encouraging the creation of student organisations and movements that promote academic integrity and implementing mechanisms that allow students to participate in monitoring academic integrity within their universities. The final aspect to consider is monitoring and evaluation. It is important to conduct regular monitoring of the state of academic integrity in educational institutions. The data collected should be used to adjust strategies and implement new initiatives. The analysed measures should be implemented comprehensively, taking into account the specifics of the Ukrainian educational system. This will allow for an increase in the level of academic integrity and the quality of education as a whole.

DISCUSSION

The research findings have shown that proposals for strategies to effectively address this issue are an important aspect of ensuring the quality of education and research.

This includes training on plagiarism, proper source citation, and the principles of integrity in research. This study has determined that universities and research institutions should have clearly defined policies and procedures regarding academic misconduct. This includes the creation of honour codes, guidelines for writing papers, and mechanisms for investigation and sanctions in case of violations. Researchers C. Ainsworth *et al.* (2023) and H. Akhtar & R. Firdiyanti (2023), who studied the work of students and faculty regarding ethical norms and standards of academic activity, confirm this view.

The research findings reveal that encouraging researchers and students to adhere to ethical standards should be developed through various measures, such as seminars, workshops, and courses on academic integrity. Clear sanctions must be defined for violations of academic integrity. These may include warnings, grade reductions, course repetition, or even expulsion from the educational institution. This is supported by the study of researchers J.J.C. Byungura *et al.* (2019), who determined that the use of plagiarism detection software, such as Turnitin or Grammarly, can help detect dishonest practices and prevent their recurrence. The formation of a culture of academic integrity in educational and research institutions, where honesty and ethics are key values, is achieved by ensuring proper oversight of research, including peer review, to prevent data falsification and other forms of dishonest behaviour. This view is also complemented by the research of A. Zeb *et al.* (2024) and I. Dudarev & V. Purtov (2024).

Academic misconduct undermines the quality of education. This has been confirmed by the research results, which align with the findings of L. Zhao *et al.* (2023) and A. Kavarella *et al.* (2024). This is because students who use dishonest methods do not acquire the necessary knowledge and skills. Researching this problem helps to identify the causes and ways to overcome it, thereby ensuring high-quality education. Researching strategies help to create an educational and research environment where honesty, transparency, and respect for intellectual property are valued. Academic misconduct in research can lead to the dissemination of unreliable or false results, which undermines trust in science as a whole. Researching this problem helps to create mechanisms that prevent data falsification and manipulation.

The study of academic misconduct in research by C.M. Kell *et al.* (2024) and R.A. MirandaRodríguez *et al.* (2024) has helped to highlight the advantages of adhering to ethical norms and standards in the academic environment, which is emphasised in this research. This fosters a culture of integrity and respect for intellectual property. The results indicate that academic misconduct can have serious legal consequences, including lawsuits for copyright infringement and other legal issues. Research on this topic allows for the development of policies and procedures that help to avoid such consequences. These findings align with the views of O. Trynus (2020), who argues that dishonest behaviour creates unfair conditions for those students and

researchers who adhere to ethical norms. Research on this problem helps to create equal conditions for all participants in the academic process. Universities and research institutions that actively combat academic misconduct have a higher reputation in the academic community and among employers. Research on this topic helps to improve the image of educational institutions. The analysis and discussion of academic integrity issues contribute to the development of critical thinking in students and researchers, which is important for their professional and personal development.

The results obtained confirm the necessity of creating an educational and research environment that promotes honesty, transparency, and high standards of academic activity. This is corroborated by the findings of researchers E. Denisova-Schmidt *et al.* (2019), S. Sweeney (2023), and T. Rua *et al.* (2024). These scholars focused on various aspects of academic misconduct, including its causes, consequences, and methods of prevention. Research indicates that stress, pressure to achieve, lack of time, and ignorance of ethical standards can lead students to plagiarism and other forms of dishonesty. Peer influence, cultural norms, and attitudes towards education in different countries can also affect the level of academic misconduct. The findings that dishonesty can lead to sanctions, grade reductions, loss of scholarships, and reputational damage, as well as decreased trust in diplomas, damage to reputation, and potential legal consequences, align with the articles of D.R.E. Cotton *et al.* (2023), C.M. Kokkinos *et al.* (2023), and R. Fendler *et al.* (2024). Researchers have determined that the dissemination of unreliable knowledge can affect various fields, including medicine, engineering, and the social sciences. This study adds that the implementation of academic integrity courses, which explain the importance of ethics in science and learning, is necessary. Also, the implementation of clear rules and procedures for detecting and punishing academic misconduct is necessary. Fostering an academic culture that values honesty, transparency, and responsibility is crucial. The dissemination of information about the consequences of academic misconduct and the importance of adhering to ethical standards is also important. Studying the effectiveness of various policies and procedures in universities and research institutions is necessary. Researching the effectiveness of plagiarism detection programs and their impact on the level of academic misconduct is also required. An analysis of academic misconduct in different countries to identify cultural differences and common trends is also needed.

The research by I. Saujan (2023) has made it possible to identify effective strategies for combating academic misconduct, which contributes to improving the quality of education and science. The topic of academic misconduct remains relevant and is constantly evolving. Research by S. Kumar *et al.* (2023) and E. Orok *et al.* (2023) has focused on several areas of research and innovation that are new in this field. Clearly, the growing popularity of online education during the COVID-19 pandemic has led to new challenges in combating academic misconduct. Researchers are

studying the effectiveness of various methods for detecting cheating in online exams, including the use of proctoring systems that monitor student actions during exams. The implementation of new technologies to detect dishonest behaviour during online learning, such as analysing student behavioural patterns and using artificial intelligence, is also being explored. The research results align with the conclusions of M. Ladera-Castañeda *et al.* (2023) and E. Omari *et al.* (2023), which focus on analysing the market for contract cheating services, where students commission third parties to complete their academic assignments. Researchers have been developing new methods for detecting and preventing such practices, including the use of metadata and stylometry (analysis of writing style). This study confirms that cultural factors have a particularly significant impact on academic misconduct. Cultural norms and values can influence attitudes towards integrity in education. New tools for detecting plagiarism, which use machine learning and artificial intelligence for more accurate text analysis and detection of dishonest practices, are helping to utilise blockchain technology to protect intellectual property and ensure transparency in the peer review process of academic papers.

The research has determined that improving ethical standards in research, including issues of publication ethics, preventing data falsification, and ensuring transparency in the research process, is important. The implementation of international standards and recommendations on academic integrity is crucial for ensuring unity and consistency in research worldwide. New approaches and research help to deepen understanding of the problem of academic misconduct and implement more effective strategies for its prevention.

CONCLUSIONS

In conclusion, the research has revealed that the significant influence of technology on academic misconduct in the university environment creates both new opportunities and challenges that require careful management and control. Technology, especially the Internet and electronic databases, accelerates and facilitates access to information for students and researchers. However, it also creates a risk of plagiarism if online materials are used without proper

source citation. The key aspects of combating academic misconduct in universities across various countries, including the USA, Germany, the United Kingdom, Australia, Japan, and South Korea, have been identified. Internal university documents describing strategies for preventing academic misconduct were analysed, which allowed for the determination of the basic elements, types, and functions of academic misconduct. It has been established that effective methods for preventing academic misconduct include the use of technological tools to verify the authenticity of work, the implementation of honour codes, the conduct of educational campaigns, and ethics training. It has been found that each country has its own specific methods for combating breaches of academic integrity. Varying levels of accountability for non-compliance with academic integrity requirements are reflected in international experience and the practices of other countries.

This study provides recommendations for improving existing approaches and implementing a new strategy to enhance the level of academic integrity in educational institutions. This strategy should encompass several key aspects. It is important to continuously improve laws regulating academic activity and implement fair sanctions for offenders. Raising awareness among students and faculty about the importance of academic integrity can be achieved through training, seminars, and courses. The use of technological solutions, such as anti-plagiarism systems and digital archives, is necessary to ensure the authenticity of academic work. Among the limitations of the study, one can note the insufficiently broad access to certain sources, as some documents may be inaccessible due to confidentiality. Future research prospects include an analysis of academic misconduct policies in other countries around the world for a more comprehensive study of the issue.

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REFERENCES

- [1] Ainsworth, C., Chernoff, W.A., Chae, Y.J., & Bisciglia, M. (2023). Examining academic dishonesty in online group chats through the lenses of strain and neutralization theories. *Deviant Behavior*, 45(3), 361-376. [doi: 10.1080/01639625.2023.2248337](https://doi.org/10.1080/01639625.2023.2248337).
- [2] Akhtar, H., & Firdiyanti, R. (2023). Predicting academic dishonesty based on competitive orientation and motivation: Do learning modes matter?. *International Journal of Cognitive Research in Science, Engineering and Education (IJCRSEE)*, 11(3), 439-447. [doi: 10.23947/2334-8496-2023-11-3-439-447](https://doi.org/10.23947/2334-8496-2023-11-3-439-447).
- [3] Araya, P., Orellana, S., Alucema, A., Guevara, Z., & Fernández, E. (2023). Factors that threaten the academic integrity of chemistry and pharmacy students at a Chilean university. *Educación Médica*, 24(6), article number 100825. [doi: 10.1016/j.edumed.2023.100825](https://doi.org/10.1016/j.edumed.2023.100825).
- [4] Byungura, J.C., Hansson, H., Masengesho, K., & Karunaratne, T. (2019). Plagiarism tendencies and contributing factors in e-learning environments: Rwandan higher education context. In *Proceedings of the 18th European conference on e-learning* (pp. 109-118). Copenhagen: Academic Conferences and Publishing International Limited.

- [5] Che Ku Kassim, C.K.H., & Mohd Sallem, N.R. (2023). Intention to deceive: Undergraduates' perception of fraudulent excuse-making. *International Journal of Educational Management*, 37(1), 55-69. doi: [10.1108/IJEM-10-2021-0410](https://doi.org/10.1108/IJEM-10-2021-0410).
- [6] Constantinos, M.K., Nafsika, A., & Ioanna, V. (2023). Personality profile differences in academic dishonesty and procrastination among Greek university students: A five factor facet-level latent profile analysis. *Personality and Individual Differences*, 214, article number 112337. doi: [10.1016/j.paid.2023.112337](https://doi.org/10.1016/j.paid.2023.112337).
- [7] Cotton, D.R.E., Cotton, P.A., & Shipway, J.R. (2023). Chatting and cheating: Ensuring academic integrity in the era of ChatGPT. *Innovations in Education and Teaching International*, 61(2), 228-239. doi: [10.1080/14703297.2023.2190148](https://doi.org/10.1080/14703297.2023.2190148).
- [8] Davies, P.M., Alotaishan, R.M.T., Alabdulwahed, H.K.A., Fahim Khan, A.M., Ateya, R.M., Alkhamis, T.S., & Abdullah, A.A. (2023). Perspectives on cyberlearning: A case study by students, about students. *Education and Information Technologies*, 28, 9731-9745. doi: [10.1007/s10639-022-11564-w](https://doi.org/10.1007/s10639-022-11564-w).
- [9] Denisova-Schmidt, E., Huber, M., & Prytula, Y. (2019). The effects of anti-corruption videos on attitudes toward corruption in a Ukrainian online survey. *Eurasian Geography and Economics*, 60(3), 304-332. doi: [10.1080/15387216.2019.1667844](https://doi.org/10.1080/15387216.2019.1667844).
- [10] Djokovic, R., Janinovic, J., Pekovic, S., Vuckovic, D., & Blecic, M. (2022). Relying on technology for countering academic dishonesty: The impact of online tutorial on students' perception of academic misconduct. *Sustainability*, 14(3), article number 1756. doi: [10.3390/su14031756](https://doi.org/10.3390/su14031756).
- [11] Dudarev, I., & Purtov, V. (2024). System of comprehensive evaluation of academic staff activity. *Scientific Bulletin of Mukachevo State University. Series "Pedagogy and Psychology"*, 10(4), 24-40. doi: [10.52534/msu-pp4.2024.24](https://doi.org/10.52534/msu-pp4.2024.24).
- [12] Fendler, R., Beard, D., & Godbey, J. (2024). A robust examination of cheating on unproctored online exams. *The Electronic Journal of e-Learning*, 22(5), 26-38. doi: [10.34190/ejel.22.5.3173](https://doi.org/10.34190/ejel.22.5.3173).
- [13] Flora Xuhua He, F., Fanaian, M., Zhang, N., Lea, X., Geale, S., Gielis, L., Razaghi, K., & Evans, A. (2024). Academic dishonesty in university nursing students: A scoping review. *International Journal of Nursing Studies*, 154, article number 104752. doi: [10.1016/j.ijnurstu.2024.104752](https://doi.org/10.1016/j.ijnurstu.2024.104752).
- [14] Harvard University. (2024). Retrieved from <https://atlasedu.com.ua/ua/universities/harvard-university/>.
- [15] Holubnych, L. (2022). E-Learning at the tertiary level in and after pandemic. *Acta Paedagogica Vilnensia*, 48, 47-60. doi: [10.15388/ActPaed.2022.48.3](https://doi.org/10.15388/ActPaed.2022.48.3).
- [16] Kadayam Guruswami, G., Mumtaz, S., Gopakumar, A., Khan, E., Abdullah, F., & Parahoo, S. (2023). Academic integrity perceptions among health-professions' students: A cross-sectional study in the middle east. *Journal Academic Ethics*, 21, 231-249. doi: [10.1007/s10805-022-09452-6](https://doi.org/10.1007/s10805-022-09452-6).
- [17] Kavarella, A., Dias da Silva, M.A., Kaklamanos, E.G., Stamatopoulos, V., & Giannakopoulos, K. (2024). Evaluation of ChatGPT's real-life implementation in undergraduate dental education: Mixed methods study. *JMIR Medical Education*, 10, article number e51344. doi: [10.2196/51344](https://doi.org/10.2196/51344).
- [18] Kell, C.M., Thandar, Y., Bhundoo, A.D., Haffeejee, F., Mbhele, B., & Ducray, J. (2024). Academic integrity in the information age: Insights from health sciences students at a South African University. *Journal of Applied Research in Higher Education*, 17(7), 16-28. doi: [10.1108/JARHE-12-2023-0565](https://doi.org/10.1108/JARHE-12-2023-0565).
- [19] Kokkinos, C.M., Antoniadou, N., & Voulgaridou, I. (2023). Academic dishonesty among Greek University students from different disciplines: A latent profile analysis of cheating perceptions and academic self-handicapping. *Ethics & Behavior*, 34(5), 327-341. doi: [10.1080/10508422.2023.2216816](https://doi.org/10.1080/10508422.2023.2216816).
- [20] Kumar, S., Dabgotra, A., & Mukherjee, D. (2023). Latent class analysis of multigroup heterogeneity in propensity for academic dishonesty. *The Journal of Mathematical Sociology*, 48(1), 81-99. doi: [10.1080/0022250X.2023.2179999](https://doi.org/10.1080/0022250X.2023.2179999).
- [21] Ladera-Castañeda, M., León-Málaga, F., Espinoza-Olórtegui, M., Nicho-Valladares, M., Cervantes-Ganoza, L., Verastegui-Sandoval, A., Solis-Dante, F., Castro-Rojas, M., & Cayo-Rojas, C. (2023). Factors associated with the perception of university professors about academic dishonesty in dental students from two peruvian universities: Analysis under multivariable regression model. *BMC Medical Education*, 23, article number 297. doi: [10.1186/s12909-023-04281-6](https://doi.org/10.1186/s12909-023-04281-6).
- [22] Miranda-Rodríguez, R.A., Sánchez-Nieto, J.M., & Ruiz-Rodríguez, A.K. (2024). Effectiveness of intervention programs in reducing plagiarism by university students: A systematic review. *Frontiers Education*, 9, article number 1357853. doi: [10.3389/educ.2024.1357853](https://doi.org/10.3389/educ.2024.1357853).
- [23] Omari, E., Salifu Yendork, J., & Ankrah, E. (2023). University students' perspectives on the benefits and challenges of emergency remote teaching during the Covid-19 pandemic in Ghana. *Education and Information Technologies*, 28, 6093-6113. doi: [10.1007/s10639-022-11401-0](https://doi.org/10.1007/s10639-022-11401-0).
- [24] Orok, E., Adeniyi, F., Williams, T., Dosunmu, J., Ikpe, F., Orakwe, C., & Kukoyi, O. (2023). Causes and mitigation of academic dishonesty among healthcare students in a Nigerian university. *International Journal for Educational Integrity*, 19, article number 13. doi: [10.1007/s40979-023-00135-2](https://doi.org/10.1007/s40979-023-00135-2).
- [25] Rua, T., Lawter, L., & Andreassi, J. (2024). The ethical student scale: Development of a new measure. *Organization Management Journal*, 21(3), 118-129. doi: [10.1108/OMJ-03-2023-1831](https://doi.org/10.1108/OMJ-03-2023-1831).
- [26] Saujan, I. (2023). Awareness of copyright infringement among undergraduates of The State Universities in Sri Lanka. *The Indonesian Journal of Socio-Legal Studies*, 3(1), article number 3. doi: [10.54828/ijsls.2023v3n1.3](https://doi.org/10.54828/ijsls.2023v3n1.3).

- [27] Seoul National University (SNU), Gwanak Campus. (2024). Retrieved from <https://en.snu.ac.kr/>.
- [28] Sweeney, S. (2023). Who wrote this? Essay mills and assessment – considerations regarding contract and AI in higher education. *The International Journal of Management Education*, 21(2), article number 100818. doi: 10.1016/j.ijme.2023.100818.
- [29] The University of Tokyo. (2024). Retrieved from <https://www.u-tokyo.ac.jp/en/>.
- [30] Trynus, O. (2020). Academic integrity: Challenges of modernity. *UNESCO Chair Journal Lifelong Professional Education in the XXI Century*, 1, 69-72. doi: 10.35387/ucj.1(1).2020.69-72.
- [31] UNESCO World Heritage Centre. (2024). Retrieved from <https://whc.unesco.org>.
- [32] University of Melbourne. (2024). Retrieved from <https://atlasedu.com.ua/ua/universities/university-of-melbourne/>.
- [33] University of Munich. (2024). Retrieved from <https://surl.li/pboeiy>.
- [34] University of Oxford. (2024). Retrieved from <https://atlasedu.com.ua/ua/universities/university-of-oxford/>.
- [35] Zeb, A., Ullah, R., & Karim, R. (2024). Exploring the role of ChatGPT in higher education: Opportunities, challenges and ethical considerations. *International Journal of Information and Learning Technology*, 41(1), 99-111. doi: 10.1108/IJILT-04-2023-0046.
- [36] Zhao, L., Peng, J., Yang, X., Yan, W., Ke, S., Batool, K., & Lee, K. (2023). Effects of academic dishonesty policy reminder on university students' exam cheating – a double-blind randomized controlled experimental field study. *Studies in Higher Education*, 49(4), 592-608. doi: 10.1080/03075079.2023.2246073.

Олена Усик

Кандидат педагогічних наук, доцент
Університет Григорія Сковороди в Переяславі
08401, вул. Сухомлинського, 30, м. Переяслав, Україна
<https://orcid.org/0000-0001-9964-4292>

Алевтина Опольська

Кандидат педагогічних наук, доцент
Університет Григорія Сковороди в Переяславі
08401, вул. Сухомлинського, 30, м. Переяслав, Україна
<https://orcid.org/0000-0002-5273-0748>

Алла Дереча

Методист
Університет Григорія Сковороди в Переяславі
08401, вул. Сухомлинського, 30, м. Переяслав, Україна
<https://orcid.org/0000-0001-8153-5792>

Стратегії боротьби з академічною недоброчесністю в університетах за кордоном

Анотація. Метою статті було вивчення ефективних стратегій боротьби з академічною недоброчесністю в університетах та практики їх застосування. Здійснено аналіз діяльності університетів різних держав (США, Німеччини, Великої Британії, Австралії, Японії, Південної Кореї і досліджено внутрішні документи університетів, які описують стратегії та процедури запобігання академічній недоброчесності. У результатах дослідження проаналізовані основні чинники, що сприяють виникненню недоброчесної поведінки серед студентів та викладачів та визначено трактування поняття «академічна недоброчесність», основні елементи, види та функції існування. Визначені ефективні методи запобігання академічним правопорушенням, що включають використання технологічних засобів для перевірки автентичності робіт, впровадження кодексів честі, проведення освітніх кампаній та навчання етики. Формування культури академічної доброчесності та співпраці між усіма учасниками освітнього процесу залишається першочерговим завданням. Кожна держава має свої особливі методи боротьби та запобігання порушенням академічної цілісності. Важливість усвідомлення академічної декомунізації як невід'ємної частини освітнього процесу в системі вищої освіти держав сприяє створенню сприятливих умов для розвитку інтелектуальної та духовної культури серед здобувачів вищої освіти та науковців. Різноманітність вимог до академічної чесності для студентів, викладачів та науковців відображалася в різному рівні відповідальності за їх недотримання, що базувалося на вивченні міжнародного досвіду та практики інших держав. У дослідженні зазначені рекомендації щодо вдосконалення існуючих підходів нових стратегій для підвищення рівня академічної доброчесності в освітніх установах. Отримані результати аналізу можуть бути використані викладачами закладів вищої освіти з метою удосконалення освітнього процесу

Ключові слова: академічна доброчесність; освітні стандарти; вимоги; міжнародний досвід; етичні цінності; відповідальність за порушення

Iryna Ievtushenko*

PhD in Psychological Sciences, Associate Professor
National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute"
03056, 37 Beresteyskyi Ave., Kyiv, Ukraine
<https://orcid.org/0000-0001-5145-7332>

Strategies for developing critical thinking skills in students of technical specialties

Abstract. The aim of study was to consider strategies for developing critical thinking skills in technical education students and explore various aspects of critical thinking skills development in effective interaction. Based on the observation of the activities of National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute", a SWOT analysis was performed to determine the strategy for the development of critical thinking and training of technical specialists covering the following specialties: computer science and information technology, engineering, information security and cybersecurity. The integration of problem-based learning was discussed in detail as one of the key strategies to enable students to analyse real and simulated problems, evaluate alternative solutions, and substantiate student's actions. The study also focused on interdisciplinary approaches that allow students to make connections between multiple fields of knowledge and apply various analytical methods. The study described the key strategies that can considerably improve the learning process in higher education. The role of teamwork and communication skills in the development of critical thinking was discussed. It was shown how joint discussions and debates contribute to the development of a critical view of problems and increase the ability to constructive criticism and self-reflection. Particular attention was paid to the use of modern technologies that give students the opportunity to experiment, learn from mistakes, and adapt knowledge to practical situations. Thus, the study described a comprehensive approach to the development of critical thinking skills of students of technical specialties, which includes a set of methods and tools aimed at strengthening professional competences and preparing them for the challenges of the modern world. The findings of this study can be used by teachers in higher education institutions to develop and improve curricula to integrate critical thinking into all courses

Keywords: students' thinking; technology sector; problem-based learning; SWOT analysis; practical situations; modern technologies

INTRODUCTION

Critical thinking is becoming one of the key skills required for a successful professional career. This is especially relevant for students of technical specialties who must be able to analyse large amounts of information, make informed decisions, and solve complex engineering problems. The development of critical thinking enables students not only to acquire technical knowledge but also to apply it effectively in practice, adapting to emerging challenges and innovations. Despite the significance of critical thinking, conventional teaching methods at technical universities are often focused on the assimilation and reproduction of

information rather than its critical analysis. As a result, future specialists are not always ready to solve real-world problems that require a comprehensive approach and innovative thinking. Therefore, there is an urgent need to introduce conceptual approaches that promote the development of critical thinking in students. This includes the integration of relevant methods into the curriculum, the use of modern technologies, active learning, and constant feedback. Implementation of such approaches will help to prepare highly skilled professionals capable of operating effectively in a rapidly changing technical environment.

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*Corresponding author



Numerous studies in this area highlight various approaches and methodologies to achieve this goal.

A. Afikah *et al.* (2024) analysed the implementation of a collaborative research-based learning model in science education. The authors' findings revealed a significant relationship between critical thinking and communication skills, which indicates the effectiveness of collaborative research approaches in developing these competences. Collaborative problem-solving in science contributes to a deeper understanding of the material and improves critical thinking through active discussion and exchange of ideas among students. F. Hanggara *et al.* (2024) investigated the effects of augmented reality-based educational games on students' critical thinking in mathematics. The study showed that such games contribute to the improvement of critical thinking through an interactive and engaging approach to learning. The use of augmented reality technology provides a deeper immersion of students in the learning process, which stimulates the development of analytical and logical skills. Researchers have developed a model of critical thinking independent learning that demonstrates effectiveness in improving students' critical thinking in applied sciences. The researchers emphasised the value of quality teaching materials and methods that promote independent thinking. The critical thinking independent learning model involves students working individually on complex scientific problems, which helps to develop skills in analysing and synthesising information.

A. Iatsyshyn *et al.* (2024) studied knowledge management in the context of the digital transformation of education in Ukraine. The authors emphasised that digital technologies can greatly improve professional training, specifically the development of critical thinking through access to information resources and tools for self-study. E. Yassin (2024) emphasised the significance of integrating digital tools into curricula to improve learning effectiveness and develop critical thinking in students. This study demonstrated that this assessment methodology can effectively stimulate and develop critical thinking in students. The use of tasks that require a strong level of analytical skills contributes to the development of the ability to think logically and solve complex problems.

I. Irwanto *et al.* (2024) investigated the effects of learning based on a controlled study. The researchers examined the effects of problem-solving on students' critical thinking. The researchers' findings revealed that such methods greatly improve critical thinking due to the emphasis on active involvement of students in the learning process. The guided research method involves posing problematic questions and finding answers independently, which stimulates the development of analytical skills. The use of STEM materials provides integrated learning that promotes the development of information analysis and synthesis skills. X. Shen & M. Teng (2024) established the correlation between critical thinking, independent learning competence, and artificial intelligence (AI)-supported writing. The authors' learning model showed that the use of AI for writing

can support the development of critical thinking and independent learning. AI-powered tools help students develop critical analysis and self-correction skills, which are essential for independent learning and critical thinking.

According to N. Zaitseva *et al.* (2022), the properties of nanomaterials using advanced simulation techniques are significant. The researchers' study demonstrated that such techniques can considerably improve the understanding of complex materials and stimulate critical thinking in students working in this field. The use of simulation techniques allows students to experiment with multiple scenarios and analyse the outcomes, which helps to develop analytical and logical skills. The analysed studies do not provide a clear description of all critical thinking development strategies that are aimed specifically at students of technical specialities, including computer science and information technology, engineering, information security and cybersecurity. Even though the issue of developing critical thinking skills has already been researched, this problem is not sufficiently specified in the field of technical education. The purpose of this study was to identify methodological areas that contribute to the development of critical thinking in future technical specialists.

MATERIALS AND METHODS

The research methodology involved analysing the development of critical thinking based on description, forecasting, observation, and SWOT analysis. The higher education institution chosen was National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute". A considerable number of students study in technical specialities. The SWOT analysis was performed to determine the strategy for training technical specialists covering various fields of science and technology. The following specialities were selected for the study: computer science and information technology, engineering, information security and cybersecurity. Observations and analysis of the above information were conducted in the period from 2023 to 2024 academic years.

At the initial stage of the study, the current state of training of students in the above-mentioned specialities was described. The study collected and analysed data on curricula, the level of training of teachers, the availability of teaching materials, and feedback from graduates and employers. Observations were made by analysing the educational process, attending lectures, practical classes, and communicating with students and teachers. Based on the information gathered, the study forecast possible changes in the curricula and approaches to training technical specialists. The forecasting was based on an analysis of current trends in technical education, labour market requirements, and technology development. Particular attention was paid to the need for specialists with a strong level of critical thinking, capable of adapting to rapid changes in the technical industry. A SWOT analysis was applied to identify development strategies.

To construct the SWOT analysis of critical thinking development, the study considered the high level of teacher

training and availability of modern teaching materials and resources. It also examined the relevance and compliance of curricula with modern requirements and labour market needs. The prestige of the educational institution was also taken into account, as it influences both student motivation and employer trust. The analysis included positive feedback from graduates and employers, which reflects the quality of specialist training. In addition, the university's active involvement in scientific research and its efforts to develop and implement innovative teaching methods were emphasised.

RESULTS

The constant development of a range of information technologies leads to the development of the information culture of each student, who must be capable of critically assessing and responding to events in the world. A critical thinker can adequately analyse certain information, check its veracity or contradictory nature, select, and evaluate arguments. Critical thinking is considered a complex process and a valuable cognitive skill that helps in the development of certain beliefs and includes evaluation, analysis, synthesis, and interpretation of information to make appropriate decisions. At the present stage of studying critical thinking, there are a considerable number of definitions of this concept. E. Lajthia *et al.* (2024) defined critical thinking as the use of cognitive strategies and techniques that increase the probability of obtaining the desired outcome.

S. Supahar *et al.* (2024) interpreted critical thinking as a specific form of evaluative activity of the subject of knowledge, aimed at identifying the degree of compliance or non-compliance of products with accepted norms and standards, including certain procedures, and contributes to the semantic self-determination of the subject of knowledge in a variety of manifestations of the world around it and its productive transformation. The most detailed formulation of critical thinking is that it lies in purposeful, self-regulating judgement. It culminates in the interpretation, analysis, and evaluation of information, as well as the explanation of evident, conceptual, methodological, or contextual arguments on which the relevant judgements are based (Marisda *et al.*, 2024).

On the one hand, the emergence of a new intellectual (verbal) product based on human analytical and synthetic activity is observed. On the other hand, the psychological structure of the individual is changing, i.e., new cognitive interests and motivation are being developed, psychological

operational functions, intellectual abilities, the ability to generalise psychological activities, personal style, etc., are undergoing qualitative changes. The core of critical thinking is intellectual skills, i.e., the ability to transform and develop, which ensures the process of analysing information, which lies in logical comprehension, selection, generalisation, comparison, evaluation, forming logical conclusions and finally decision-making. Accordingly, critical thinking should be considered as a process and a set of personal and mental characteristics of a person. These personal qualities are the basis for changes in existing qualities and the development of new ones, which determines the emergence of new intellectual products.

According to the above information, critical thinking is a special form of thinking that is purposeful and involves finding and proving the right ways to solve problems. There are various theoretical approaches, each of which emphasises the proper aspects of this concept. One of the principal approaches is cognitive, which emphasises the role of intellectual skills and cognitive processes in critical thinking. It focuses on skills such as analysing, synthesising, evaluating, and interpreting information. This approach emphasises the significance of logical and structured thinking. Another important approach is the metacognitive approach, which focuses on the awareness and regulation of one's personal thinking. Metacognitive thinking includes self-assessment, self-reflection, and correction of one's personal cognitive processes. This approach helps individuals become aware of personal thinking strategies and manage these strategies more effectively. The next approach is constructivist, which focuses on the social and cultural contexts in which thinking takes place. It emphasises the significance of interaction with other people and the environment for the development of critical thinking. Interacting with different opinions and experiences contributes to a deeper and more diverse understanding. The last is the humanistic approach, which focuses on personal development and self-fulfilment. It emphasises the significance of personal motivation, emotional intelligence, and ethical values in critical thinking. This approach factors in how individual values and beliefs influence thinking processes. The above-mentioned theoretical approaches to critical thinking provide a comprehensive understanding of this multifaceted process, focus on its various aspects, and help develop it at multiple levels, and have specific features (Table 1).

Table 1. Specific features of critical thinking skills of students

Critical thinking skills	Characteristics	Examples
Analysis	Breaking down information into its component parts for better understanding	Analysis of research projects
Reasoning	Ability to formulate and defend one's arguments in problematic situations	Participation in discussions
Evaluation	Evaluation of available arguments, evidence, or conclusions	Evaluation of information reliability
Systematic thinking	Understanding of the interconnections between various parts of the system and how possible changes in one part affect the others	Analysis of organisational structures or ecosystems

Table 1. Continued

Critical thinking skills	Characteristics	Examples
Explanation	Ability to formulate thoughts and draw conclusions clearly and logically	Writing reports, etc.
Problem solving	Find solutions to complex problems through critical thinking	Development of necessary strategies, etc.
Interpretation	Ability to understand and explain the meaning of certain data or information	Disclosure of the content of the experiment results
Self-assessment	Reflection on one's individual arguments and opinions	Evaluation of decision-making processes
Creative thinking	Ability to generate innovative approaches and ideas to solve problems or challenges	Generation of innovative ideas for projects

Source: compiled by the author of this study based on N. Bakhmat *et al.* (2023)

The development of critical thinking forms an integral part of solving this problem, as it contributes to better analysis and understanding of information, the ability to independently assess the acquired knowledge and skills, and the ability to adapt to a rapidly changing professional environment. The inclusion of a critical thinking component in technical courses will not only enrich the educational process but will also prepare students for successful and effective professional activities. Bloom's Taxonomy is a basic model of education that divides skills and goals from the simplest to the most complex, reflecting the hierarchical structure of cognitive processes. According to the Taxonomy, critical thinking is divided into lower and higher levels. The lower level of critical thinking includes memorisation (the ability to identify, reproduce, and remember relevant information), understanding (the ability to explain a certain idea or concept, share and implement information), application (the implementation of knowledge in another situation, solving a problem based on existing knowledge). The higher level of critical thinking includes analysis (dividing information into parts to understand its structures), synthesis (integrating elements into a whole, implementing a new proposal), evaluation (thinking about the value of an idea according to standards and criteria).

The growth of critical thinking in students, especially at higher levels, is considered the key to academic and career success. It helps to develop the ability to learn independently, critically analyse information and make informed decisions, which is a significant part of mental and personal development. The development of critical thinking is not innate. Instead, it is a skill that can be developed independently or through the learning process of a particular discipline. There is a need for a learning model that contains detailed definitions of learning outcomes that help to improve critical thinking, stimulate active learning, provide opportunities for independent analysis and decision-making, and create a positive learning environment that can facilitate successful learning.

Not all students have the critical thinking skills to analyse and synthesise the necessary information without practice, although critical thinking covers a wide range of skills not only in research but also in life. In the study of technical disciplines, it can take the form of concrete situations that require critical thinking skills to complete a task. Students should actively engage in the thinking process, learn not

only to analyse and reproduce information, but also to critically review assumptions and form conclusions based on this information. These skills are vital for making informed judgements. The use of critical thinking or its components by students will not only help them to succeed in the studies, but also to build a successful career in the future.

Critical thinking skills are a necessary tool for students of technical specialties for a set of reasons. It is an aspect of solving complex problems, as technical majors often involve working with complex processes and systems. Critical thinking helps students analyse problems, identify root causes, and develop successful solutions. Specifically, in engineering or computer science, students are faced with a variety of technical challenges where there is a need to not only find a solution but also optimise it for the best performance and efficiency. It is equally necessary for students of technical specialties to make decisions based on the found data. In technical fields, decisions are often based on a large amount of data and analytics. Critical thinking enables students to evaluate the relevance and reliability of data, analyse research findings, and draw reasoned conclusions. For instance, when working with big data or machine learning, it is essential to be able to distinguish between correlation and causality and avoid common pitfalls in data interpretation.

Technological solutions can also have a major impact on society and the environment. Critical thinking helps students in technical fields consider the ethical aspects of work and assess potential risks and consequences of professional actions. For instance, the development of AI or automated systems must factor in issues such as privacy, security, and the effects on the labour market. Innovation and creativity have been considered relevant for many years for all specialties. The development of innovative technologies and solutions requires not only technical knowledge but also the ability to think creatively. Critical thinking helps to create innovative ideas, allows students to go beyond standard approaches and find innovative solutions to old problems. This is especially significant in areas where technological progress is rapid, such as information technology, nanotechnology, bioengineering, etc. Adaptation and continuous learning are essential for students. Technical fields are developing rapidly, and new knowledge and technologies emerge regularly. Critical thinking skills help students evaluate latest information, adapt quickly to changes, and maintain the competence at a strong level.

This is essential for long-term professional development and a successful career. The development of critical thinking in technical students is of great significance in the educational process, as it helps them analyse information, solve complex problems, and make informed decisions.

To foster these competencies, technical students should learn to critically evaluate data, determine the reliability of sources, and identify key elements, especially when working with large amount of data. Through a systematic approach to problem-solving, students should be able to consider problems in the context of the entire system and recognise the interrelationships between its components. The development of modelling and simulation skills is essential for predicting the potential outcomes of various actions. Creative thinking should be encouraged through tasks that promote innovation and generating new ideas while the scientific method (formulating hypotheses, conducting experiments, analysing results, and drawing conclusions) remains fundamental to effective problem-solving. Finally, an interdisciplinary approach broadens students' perspectives and supports more comprehensive and solutions through working in a combination of different technical disciplines.

The development of critical thinking in technical students is a key factor in students' professional development. Therefore, it is worth highlighting the requirements and general strategies that contribute to the development of critical thinking. Interactive teaching methods such as

discussions, debates, role-playing games, and simulations help students to be actively involved in the learning process. Discussions and debates help to develop the ability to formulate and defend one's point of view, analyse various arguments, and draw conclusions. Role-playing games and simulations allow students to immerse themselves in real-life situations that require analysis and decision-making based on critical thinking. Equally popular are project activities that require research, data analysis, and teamwork. Students can see the problem from multiple perspectives, work on real problems in teams, which will stimulate collective critical thinking, cooperation, and exchange of ideas. Logic and argumentation training can be an interesting experience for students who learn how to build arguments and analyse different opinions. Students look at concrete examples, analyse causes and effects, which helps to develop the ability to critically evaluate information. To develop critical thinking, it is necessary to apply modern technologies, use tools for data analysis, modelling software, simulations, and other technical means. The last requirement is reflection and self-analysis, as students should regularly analyse completed work and the results obtained. Reflection journals (future professionals record thoughts, which enables analysis of the thought process and facilitates learning from mistakes) and reflective essays (describing personal thoughts and conclusions helps develop self-analysis skills) support this process. Below are the key strategies and the most effective approaches that are particularly relevant to technical students (Table 2).

Table 2. Strategies for the development of critical thinking aimed at students of technical specialties

Strategies	Description	Examples
Analysis and resolution of technical cases	Consideration of real engineering or IT situations to analyse and develop solutions	Analysis of cases, such as technical malfunctions in projects, software problems
Project-based learning	Involvement of students in long-term technical projects that require a comprehensive approach and research	Work on projects to develop new devices or applications
Code review and testing	Performance of mutual code review and software testing by students	Organisation of regular code review and software testing sessions
Use of simulations and modelling	Use of software to simulate technical systems and processes	Use of engineering simulators to study system behaviour
Technical debates	Organisation of discussions on technical concepts and the latest technologies	Holding a debate on the advantages and disadvantages of various technical solutions or technologies
Interdisciplinary projects	Work on projects that combine multiple technical disciplines	Projects involving knowledge of computer science, electronics, mechanics, etc.
Involvement of external experts	Invitation of industry experts for lectures and workshops	Organisation of guest lectures or master classes from leading engineers or IT specialists
Use of scientific research methods	Teaching students to use scientific methods to solve technical problems	Conducting laboratory work with a focus on scientific research and data analysis
Work with technical documents	Analysis and critical reflection on technical documentation, standards, and specifications	Tasks on reading and evaluating technical documentation, creating own technical reports
Solution of problems with increased complexity	Solution of problems requiring in-depth technical analysis and a comprehensive approach	Problems in algorithms, mathematical modelling, or system design

Source: compiled by the author of this study based on B. Wei *et al.* (2024), H. Song & L. Cai (2024)

Based on the above information, several effective approaches for integrating these strategies into the educational process were identified. For instance, critical thinking

should be integrated across all courses, not limited to specialised subjects; this can be achieved by adding discussion questions, case studies, and reflective assignments.

Project-based learning should also be actively used, as teamwork on real-world problems effectively fosters analytical thinking and therefore deserves a consistent place in the curriculum. In addition, the development of self-study skills such as independent information search and critical evaluation of sources should be an essential part of students' learning experience, supported through tasks that require independent exploration and preparation for class discussions. Problem-based learning further enhances critical thinking by engaging students in solving authentic challenges, which means that instructors can design the

courses around a sequence of tasks and problem scenarios. Finally, continuous feedback from all participants in the educational process helps students identify strengths and weaknesses, and constructive comments from teachers play a key role in guiding improvement and overall development. The SWOT analysis of the strategy for developing critical thinking skills in students of technical specialties, including computer science and information technology, engineering, information security and cybersecurity, of the selected university helps to assess the external and internal factors that may affect the effectiveness of this strategy (Table 3).

Table 3. SWOT-analysis of the strategy for developing critical thinking skills in students of concrete technical specialties of a higher education institution

Weaknesses	Strengths
1. Lack of a clear development strategy: insufficient systematisation and planning of long-term tasks and goals of the university. 2. Lack of humanities components: technical specialties often focus on specialised technical knowledge, neglecting the humanities that can help develop critical thinking. 3. Heavy course load: intensive programmes may leave little time to develop soft skills such as critical thinking. 4. Limited interaction between disciplines: insufficient interdisciplinary integration may limit opportunities for the comprehensive development of critical thinking.	1. Strong level of analytical skills of students: technical specialties require high analytical skills, which can contribute to the development of critical thinking. 2. Access to modern technology: there are modern laboratories and equipment that facilitate interactive learning and critical thinking. 3. Focus on problem-solving: technical programmes include courses that require students to solve complex problems, which stimulates critical thinking. 4. Supportive faculty: technical teachers have practical experience and can effectively transfer knowledge and skills. 5. University prestige: high ranking and positive reputation.
Opportunities	Threats
1. Integration of new pedagogical methods: the use of innovative approaches, such as project-based learning, promotes the development of critical thinking. 2. Interdisciplinary programmes: implementation of programmes at the university that combine technical disciplines with the humanities. 3. Partnerships with industry: cooperation with enterprises to create real projects and internships. 4. Online resources and platforms: use of online courses and platforms for self-study. 5. Increased demand for critical thinking professionals.	1. Rapid technological development: rapid changes in technology require constant updating of university curricula, which can complicate the integration of innovative methods of developing critical thinking. 2. Competition with other universities that are also focused on developing critical thinking. 3. Rigidity of educational structures: the existence of conventional learning structures is not conducive to change, which complicates the introduction of innovative approaches at the university.

Source: compiled by the author

Based on the SWOT analysis, the study identified and characterised several key strategies for developing critical thinking among students of technical specialties. One of the most effective approaches is project-based learning, which engages students in real-world projects that require the practical application of theoretical knowledge. This method not only strengthens critical thinking but also develops essential competencies such as teamwork, communication, and time management. Students are given the opportunity to work on projects that have real-world relevance, which increases motivation and interest in learning. Another important strategy is problem-based learning, where students work in groups to solve specific problems. By analysing complex issues, searching for information, generating ideas, and evaluating alternative solutions, students learn to make informed decisions and communicate effectively within a group.

In addition to these strategies, a number of methods also foster critical thinking. For instance, debates and

discussions encourage students to analyse diverse viewpoints, build logical arguments, defend positions, and listen critically to others. The use of case studies helps students to understand how theories and concepts work in real-life situations and develops the ability to critically evaluate situations, make informed decisions and solve complex problems. Independent research and reflective practice enable students to delve deeper into a topic, study it from multiple angles, and formulate individual conclusions. Reflecting on the learning process helps students evaluate achievements, identify weaknesses, and find ways to improve performance. Furthermore, digital technologies offer valuable tools for creating interactive learning environments. Digital technologies allow creating interactive learning materials, organising virtual discussions, analysing large amounts of information and collaborating with other students in an online environment. The use of digital tools contributes to the development of skills in analysing, synthesising and evaluating information.

Based on a series of related studies, additional strategies relevant to technical disciplines were identified, including the analysis and solution of technical cases, code review and testing, simulation and modelling tasks, technical debates, interdisciplinary projects, engagement with external experts, the use of scientific research methods, work with technical documentation, and solving problems of increased complexity. Together, these approaches support the systematic development of critical thinking in engineering, computer science, information technology, cybersecurity, and related fields. It is recommended to develop a clear development strategy, actively use analytical data for decision-making, and introduce innovative teaching methods. It is vital to expand partnerships with other educational institutions and businesses to provide students with relevant knowledge and skills. The study confirmed the need for continuous monitoring and adaptation of curricula in line with labour market requirements, which will help increase graduate competitiveness and readiness to meet the challenges of the modern world.

DISCUSSION

The development of critical thinking skills in engineering students is a vital task in modern education and a topic of discussion for many researchers. Critical thinking helps future engineers, programmers, and scientists analyse information, make informed decisions and solve complex problems. There are several areas of research on this issue and its development in the future. The findings revealed that one of the most effective areas is project-based learning. In this methodology, students work on real projects that require the application of theoretical knowledge in practice. This helps to develop analytical thinking and problem-solving skills. It is vital that the projects are complex and multi-stage so that students can face different aspects of the problem and look for solutions. The opinion of S. Al-massarweh *et al.* (2024) coincided with the present findings and identified another area of problem-based learning that promotes critical thinking, with students being able to work in groups, discuss and solve real or hypothetical problems related to future professional activities. The formulations of these researchers help in searching for and analysing information, as well as in defending decisions with arguments.

The findings obtained showed that the organisation of discussions and debates in the educational process stimulates students to critically reflect on diverse opinions, and this was confirmed by F. Hasyim *et al.* (2024). It is therefore quite evident that teachers can ask provocative questions that encourage students to discuss and analyse multiple aspects of the topics being studied. This develops argumentation and critical analysis skills. Case studies are analyses of concrete situations or cases from real life. Students study these cases, analyse the problems, and propose possible solutions. This method helps to develop analytical and critical thinking, as well as the ability to apply theoretical knowledge in practice.

The findings of the present study coincided with the conclusions of N. Bakhmat *et al.* (2023) and L. Hetmanenko (2024), who highlighted the importance of encouraging students to conduct independent research and explore diverse aspects of a speciality as a means of developing critical thinking. This can be achieved through writing research papers, taking part in scientific conferences and seminars. It is essential that students can critically evaluate sources of information and formulate individual conclusions. The study found that reflection plays a vital role in the development of critical thinking. Teachers can encourage students to reflect on the learning experience and analyse mistakes and successes. This helps students better understand strengths and weaknesses and improve the learning process.

The findings revealed that modelling, simulation, and data analysis software tools allow engineering students to conduct complex experiments and analyse the results. Furthermore, online courses and resources can help broaden the horizons and improve knowledge. Developing critical thinking skills in technical students requires a comprehensive approach. It is vital to use a variety of methods and strategies to stimulate analytical and critical thinking, develop the ability to solve complex problems, and make informed decisions. Teachers should create conditions for active learning, encourage independence and reflection, and use modern technologies to enhance the learning process. Research and scholarly opinions on the development of critical thinking skills in engineering students vary, but most agree on the significance of integrating critical thinking into the curriculum. B.I. Nugraheni *et al.* (2024) showed that students working on real or hypothetical problems develop skills in questioning, critical analysis, and substantiation of decisions. This method promotes independence and responsibility for the learning process.

The assumptions made by A.D. Yasa *et al.* (2024), who emphasised the significance of discussions and debates in the learning process, are reliable. These methods contribute to the development of argumentation skills, critical analysis, and understanding of multiple opinions. Participation in discussions helps students not only to formulate individual opinions, but also to analyse and evaluate the opinions of others. The present study added to this idea and identified the use of case studies in teaching as an effective method of developing critical thinking. Analysing real-life situations or cases helps students to apply theoretical knowledge in practice, develop skills in analysing and synthesising information, and learn to make informed decisions.

The hypothesis about the significance of independent research and reflection in the development of critical thinking was confirmed by the findings of the present study, which also coincided with the findings of D.E. Pitorini *et al.* (2024). Students engaged in research learn to critically evaluate sources of information, formulate individual conclusions and analyse mistakes. Clearly, reflection helps students to be aware of strengths and weaknesses, which contributes to continuous improvement. Digital technologies also play an essential role in the development of

critical thinking. B. Wei *et al.* (2024) and K.C. Low *et al.* (2024) showed that the use of data modelling and analysis software helps to develop analytical skills. Furthermore, the study found that online courses and resources expand opportunities for self-directed learning and deepening knowledge.

The present study suggested that the development of critical thinking in technical students requires a comprehensive approach that includes project-based and problem-based learning, discussions, case studies, independent research, and the use of digital technologies. F. Mutma'innah & E. Hamimi (2024), B. Junedi *et al.* (2024) unanimously supported these methods, emphasising effectiveness in training highly qualified specialists. The study of the development of critical thinking in technical universities is significant in the context of rapid technological progress and growing demands on professional competence, the development of critical thinking is becoming a fundamental element of the training of future engineers, programmers, and scientists.

The findings of the present study on the value of implementing methods aimed at developing critical thinking and contributing to the overall quality of education coincided with the findings of V. Rajovis & L. Radulovis (2023). This is because students who can think critically can better understand complex concepts, analyse information, and apply knowledge in practice. This helps to train highly qualified specialists who meet the requirements of the modern labour market, this study proves. Critical thinking helps students to solve complex and non-standard tasks that arise in professional activities. This is especially relevant for technical specialities, where it is often necessary to find innovative solutions to unfamiliar problems. The ability to analyse a situation, evaluate alternatives, and make informed decisions are key to success in technical fields. This study found that critical thinkers tend to generate innovative ideas and approaches. This contributes to the development of innovation and technological progress. Technical universities that pay attention to the development of critical thinking become centres of innovation, where innovative technologies and solutions are born that can significantly influence society.

The finding of the present study on the value of promoting the development of critical thinking were also confirmed by W. Ratna *et al.* (2024) and S. Supahar *et al.* (2024). It was found that critical thinking also contributes to the development of ethical consciousness and social responsibility. Students who can critically evaluate information and situations are able to make decisions that take into account the ethical and social consequences of actions. This is particularly significant in the context of contemporary challenges such as environmental issues, the ethics of technology, and social justice. Research can be useful for exploring and developing critical thinking in technical universities, which is significant for improving the quality of education, preparing students for complex tasks, developing innovation potential, adapting to change, considering ethical and social aspects, and improving interaction and communication. This ensures the training of highly qualified specialists who are ready to meet the challenges of the modern world.

CONCLUSIONS

The study investigated various strategies for developing critical thinking skills in vocational school students, and the effectiveness of these strategies was analysed. Strategies included analysis and solution of technical cases, project-based learning, technical debates, work with technical documents, interdisciplinary projects, code review and testing, involvement of external experts, application of scientific research methods, and solving problems of increased complexity. The significance of critical thinking for future technical specialists was identified, as it is necessary for the development of these skills to solve complex professional problems.

Based on the SWOT-analysis of the specialities of computer science and information technology, engineering, information security, and cybersecurity at National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute". Several key strategies that can considerably improve the learning process and promote critical thinking among students were identified and characterised. The strengths, weaknesses, threats, and opportunities of the strategy were identified. Particular attention was paid to project-based and problem-based learning, discussions and debates, reflection, and self-study. The study considered the significance of using case studies, which enable students to analyse specific real-life situations and, as a result, understand how theoretical concepts are applied in practice, and develop the ability to critically evaluate complex situations. It was also found that the use of digital technologies opens new opportunities for interactive learning, analysis of large amounts of information and collaboration in a virtual environment, which is significant for modern technical specialities. The integration of various strategies for developing critical thinking into the educational process is key to the training of competent professionals.

Accordingly, the implementation of the analysed strategies in the educational process will help students of technical specialities to develop critical thinking, which is key for future professional activities. However, it is essential to consider the limitations of the study, as the analysis of the effectiveness of critical thinking development strategies can lead to varying results, and students themselves have individual characteristics that may affect the effectiveness of certain strategies. Prospects for further research include studying particular students of technical specialities, which will help to evaluate the effectiveness of various approaches and methods in developing critical thinking and identify the most effective strategies.

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REFERENCES

- [1] Afikah, A., Jumadi, J., & Rohaeti, E. (2024). Implementation of research oriented collaborative inquiry learning model in science learning: A relation between critical thinking skills and communication skills. *AIP Conference Proceedings*, 3106, article number 070010. doi: [10.1063/5.0214810](https://doi.org/10.1063/5.0214810).
- [2] Al-massarweh, S.S., Khudairat, M.A., Freihat, R.H., & Jabali, S.M. (2024). The impact of a Sterinberg theory-based training program on secondary school students' development of critical and creative thinking skills. *International Journal of Religion*, 5(6), 438-456. doi: [10.61707/dp9g9y18](https://doi.org/10.61707/dp9g9y18).
- [3] Bakhmat, N., Sydoruk, L., Poberezhets, H., Misenyova, V., Boyarova, O., & Mazur, Y. (2023). Features of using the opportunities of the digital environment of the higher educational institution for the development of future economists' professional competence. *Economic Affairs*, 68(1), 43-50. doi: [10.46852/0424-2513.1s.2023.6](https://doi.org/10.46852/0424-2513.1s.2023.6).
- [4] Hanggara, Y., Qohar, A., & Sukoriyanto. (2024). The impact of augmented reality-based mathematics learning games on students' critical thinking skills. *International Journal of Interactive Mobile Technologies*, 18(7), 173-187. doi: [10.3991/ijim.v18i07.48067](https://doi.org/10.3991/ijim.v18i07.48067).
- [5] Hasyim, F., Prastowo, T., & Jatmiko, B. (2024). Critical thinking-independent learning: A model of learning to improve students' critical thinking skills. *European Journal of Educational Research*, 13(2), 747-762. doi: [10.12973/eu-jer.13.2.747](https://doi.org/10.12973/eu-jer.13.2.747).
- [6] Hetmanenko, L. (2024). The role of interactive learning in mathematics education: Fostering student engagement and interest. *Multidisciplinary Science Journal*, 6, article number e2024ss0733. doi: [10.31893/multiscience.2024ss0733](https://doi.org/10.31893/multiscience.2024ss0733).
- [7] Iatsyshyn, A., Deinega, I., Aleksandrova, M., Atamanyuk, S., Hryhorenko, T., & Suprun, D. (2024). Knowledge management in the context of digital transformation of education and science in Ukraine: Challenges in professional training. In R. Shchokin, A. Iatsyshyn, V. Kovach & A. Zaporozhets (Eds.), *Digital technologies in education: Selected cases* (pp. 165-184). Cham: Springer. doi: [10.1007/978-3-031-57422-1_12](https://doi.org/10.1007/978-3-031-57422-1_12).
- [8] Irwanto, I., Suryani, E., & Cahyani, T. (2024). Improving students' critical thinking skills using guided inquiry with problem-solving process. *International Journal of Religion*, 5(6), 243-251. doi: [10.61707/917r2021](https://doi.org/10.61707/917r2021).
- [9] Junedi, B., Basrowi, Yendra, N., Muharomah, D.R., Putri, V.K., Maliki, B.I., Umalihayati, & Abdul Baqi, F. (2024). IT-based learning innovation and critical thinking skills concerning students' mastery of materials and their implications on academic achievement. *International Journal of Data and Network Science*, 8(1), 1999-2014. doi: [10.5267/j.ijdns.2024.1.013](https://doi.org/10.5267/j.ijdns.2024.1.013).
- [10] Lajthia, E., Law, M., Jorden, J., Haynes, B., Awuonda, M., Habib, M., Karodeh, Y., & Wingate, L. (2024). The impact of critical thinking skills on student pharmacist GPA at a Historically Black University. *Currents in Pharmacy Teaching and Learning*, 16(6), 435-444. doi: [10.1016/j.cptl.2024.04.003](https://doi.org/10.1016/j.cptl.2024.04.003).
- [11] Low, K.C., Mohamad, S.S., Chong, S.L., Abd Rahman, M.A., Purnomo, E.P., & Gunsuh, A. (2024). Improving university students' critical thinking and problem-solving skills: How problem-based learning works during COVID-19 pandemic? *Journal of Advanced Research in Applied Sciences and Engineering Technology*, 37(2), 165-176. doi: [10.37934/araset.37.2.165176](https://doi.org/10.37934/araset.37.2.165176).
- [12] Marisda, D., Nurlina, N., Maruf, M., Rahmawati, R., Idamayanti, R., & Akbar, M. (2024). Challenges in secondary school education: Profile of physics students' critical thinking skills. *Journal of Education and Learning*, 18(3), 1099-1106. doi: [10.11591/edulearn.v18i3.21666](https://doi.org/10.11591/edulearn.v18i3.21666).
- [13] Mutma'innah, F., & Hamimi, E. (2024). Development of PBL-based GLOWASEA (global warming on the sea) educational media to train critical thinking skills on the topic of global warming. *International Journal of Interactive Mobile Technologies*, 18(9), 117-140. doi: [10.3991/ijim.v18i09.48097](https://doi.org/10.3991/ijim.v18i09.48097).
- [14] Nugraheni, B.I., Sukirmo, Hendrowibowo, L., Johari, R.J., & Listianto, G.A. (2024). Development of an integrative flipped classroom model to improve students' critical thinking skills and learning responsibility. *Journal of Ecohumanism*, 3(2), 27-46. doi: [10.62754/joe.v3i3.3263](https://doi.org/10.62754/joe.v3i3.3263).
- [15] Pitorini, D.E., Suciati, & Harlita. (2024). Students' critical thinking skills using an e-module based on problem-based learning combined with Socratic dialogue. *Journal of Learning for Development*, 11(1), 52-65. doi: [10.56059/jl4d.v11i1.1014](https://doi.org/10.56059/jl4d.v11i1.1014).
- [16] Rajovic, V., & Radulovic, L. (2023). Cognitive and affective outcomes of inquiry-based learning: A meta-analysis. *International Journal of Cognitive Research in Science, Engineering and Education*, 11(2), 155-167. doi: [10.23947/2334-8496-2023-11-2-155-167](https://doi.org/10.23947/2334-8496-2023-11-2-155-167).
- [17] Ratna, W.P., Sunaryo, Wibowo, F.C., & Sanjaya, L. (2024). Instrument of science processing skills and critical thinking skills in physics learning renewable energy chapter. *AIP Conference Proceedings*, 3116, article number 070013. doi: [10.1063/5.0210424](https://doi.org/10.1063/5.0210424).
- [18] Shen, X., & Teng, M. (2024). Three-wave cross-lagged model on the correlations between critical thinking skills, self-directed learning competency and AI-assisted writing. *Thinking Skills and Creativity*, 52, article number 101524. doi: [10.1016/j.tsc.2024.101524](https://doi.org/10.1016/j.tsc.2024.101524).
- [19] Song, H., & Cai, L. (2024). Interactive learning environment as a source of critical thinking skills for college students. *BMC Medical Education*, 24, article number 270. doi: [10.1186/s12909-024-05247-y](https://doi.org/10.1186/s12909-024-05247-y).

- [20] Supahar, S., Baihaqi, H.K., Putranta, H., Latumakulita, I.I., Pribadi, F.O., & Religia, R. (2024). MIB-inquiry-infographic android application and its impact on students' critical thinking skills during the COVID-19 pandemic. *European Journal of Educational Research*, 13(2), 511-530. doi: [10.12973/eu-jer.13.2.511](https://doi.org/10.12973/eu-jer.13.2.511).
- [21] Wei, B., Wang, H., Li, F., Long, Y., Zhang, Q., Liu, H., Tang, X., & Rao, M. (2024). Effectiveness of problem-based learning on development of nursing students' critical thinking skills: A systematic review and meta-analysis. *Nurse Educator*, 49(3), 115-119. doi: [10.1097/NNE.0000000000001548](https://doi.org/10.1097/NNE.0000000000001548).
- [22] Yasa, A.D., Rahayu, S., & Handayanto, S.K. (2024). Evaluating the impact of smart learning-based inquiry on enhancing digital literacy and critical thinking skills. *Information Systems Engineering*, 29(1), 219-233. doi: [10.18280/isi.290122](https://doi.org/10.18280/isi.290122).
- [23] Yassin, E. (2024). Examining the relation of open thinking, critical thinking, metacognitive skills and usage frequency of open educational resources among high school students. *Thinking Skills and Creativity*, 52, article number 101506. doi: [10.1016/j.tsc.2024.101506](https://doi.org/10.1016/j.tsc.2024.101506).
- [24] Zaitseva, N., Symonenko, S., & Osadchy, V. (2024). A blended English for specific purposes course with the focus on critical thinking skills development for computer science students. *Journal of Physics: Conference Series*, 2288, article number 012037. doi: [10.1088/1742-6596/2288/1/012037](https://doi.org/10.1088/1742-6596/2288/1/012037).

Ірина Євтушенко

Кандидат психологічних наук, доцент

Національний технічний університет України «Київський політехнічний інститут імені Ігоря Сікорського»

03056, вул. Берестейська, 37, м. Київ, Україна

<https://orcid.org/0000-0001-5145-7332>

Стратегії розвитку навичок критичного мислення у студентів технічних спеціальностей

Анотація. Метою статті було розглянути стратегії розвитку навичок критичного мислення у здобувачів освіти технічної галузі і дослідити різні напрями розвитку навичок критичного мислення у взаємодії з їхньою ефективністю. На основі спостереження за діяльністю Національного технічного університету України «Київський політехнічний інститут імені Ігоря Сікорського» було проведено SWOT-аналіз для визначення стратегії розвитку критичного мислення та підготовки технічних фахівців за такими спеціальностями: комп'ютерні науки та інформаційні технології, інженерія, інформаційна безпека та кібербезпека. Інтеграція проблемно-орієнтованого навчання була детально обговорена як одна з ключових стратегій, що дозволяє студентам аналізувати реальні та змодельовані проблеми, оцінювати альтернативні рішення та обґрунтовувати свої дії. Також акцентовано увагу на міждисциплінарних підходах, які дозволяють студентам встановлювати зв'язки між різними галузями знань і застосовувати різні аналітичні методи. Було охарактеризовано ключові стратегії, які можуть значно покращити процес навчання у вищому закладі освіти. Розглянуто роль командної роботи та комунікативних навичок у розвитку критичного мислення. Показано, як спільні дискусії та дебати сприяють розвитку критичного погляду на проблеми та підвищенню здатності до конструктивної критики і саморефлексії. Особливу увагу приділено використанню сучасних технологій, які дають учням можливість експериментувати, вчитися на власних помилках і адаптувати свої знання до практичних ситуацій. Таким чином, описано комплексний підхід до розвитку навичок критичного мислення студентів технічних спеціальностей, що включає набір методів та інструментів, спрямованих на посилення їхніх професійних компетенцій та підготовку до викликів сучасного світу. Отримані результати дослідження можуть бути використані викладачами у закладах вищої освіти для розробки та вдосконалення навчальних програм з метою інтеграції критичного мислення у всі курси

Ключові слова: мислення здобувачів освіти; технологічний сектор; проблемно-орієнтоване навчання; SWOT-аналіз; практичні ситуації; сучасні технології

**Viktor Kotsur***

Doctor of Historical Sciences, Professor
Hryhorii Skovoroda University in Pereiaslav
08401, 30 Sukhomlynskyi Str., Pereiaslav, Ukraine
<https://orcid.org/0000-0003-4968-4813>

Vasyl Dudar

PhD in Historical Sciences, Professor
Hryhorii Skovoroda University in Pereiaslav
08401, 30 Sukhomlynskyi Str., Pereiaslav, Ukraine
<https://orcid.org/0000-0001-6064-9408>

Viacheslav Riznyk

Doctor of Pedagogical Sciences, Associate Professor
Hryhorii Skovoroda University in Pereiaslav
08401, 30 Sukhomlynskyi Str., Pereiaslav, Ukraine
<https://orcid.org/0000-0002-6083-2242>

The influence of pedagogical culture on strategies for developing the motivation of academic staff in higher education institutions: A comparative analysis and European experience

Abstract. The study aimed to develop recommendations for supporting and enhancing the motivational component among university lecturers. The methodology involved a comparative analysis of educational practices in Ukraine, Germany, Finland, and China, alongside a survey of academic staff at higher education institutions. The survey was conducted at Taras Shevchenko National University of Kyiv, Ludwig Maximilian University of Munich, the University of Helsinki, and Peking University. Particular attention was given to the role of institutional leadership in creating favourable conditions for increasing motivation, as well as the impact of international professional exchange and training programmes. The findings indicated that a high pedagogical culture directly enhances lecturers' motivation and professional development. European experience demonstrates the effectiveness of innovative approaches to motivational strategies that combine both financial and non financial incentives. Furthermore, it has been found that integrating elements such as support for academic freedom, the development of collaborative engagement, and the continuous enhancement of professional skills has a significant impact on motivational processes. European practices should be adapted to the Ukrainian context, considering the specific features of the national education system and the importance of pedagogical culture as a foundation for implementing successful motivational strategies in higher education institutions. The study revealed that the motivational strategies of academic staff depend not only on institutional conditions but also on the level of individual responsibility lecturers assume for the outcomes of their work. The effective implementation of such approaches has the potential to enhance the overall quality of teaching and educational services in higher education

Keywords: research activity; salary; innovative approaches; Ukrainian universities; professional skills

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*Corresponding author



INTRODUCTION

Contemporary higher education institutions face rapid changes in the educational process, driven by globalisation, digitalisation, and the increasing demand for highly qualified lecturers. In this context, the issue of developing motivation among academic staff is becoming increasingly important, as it is motivated lecturers who are capable of implementing innovations, adapting to new challenges, and ensuring a high standard of education. This impacts the quality of the teaching process, research activities, and the effectiveness of academic management. Pedagogical culture is a key factor influencing the development of motivational strategies. It encompasses values, traditions, norms, management styles, and the relationships between lecturers, students, and administration. However, despite the importance of this issue, it remains under-researched in both Ukrainian and European contexts, particularly in terms of comparing international experiences with Ukrainian realities. Studying pedagogical culture and its impact on lecturers' motivational strategies will not only improve the management of higher education institutions but also enhance their competitiveness on the international stage.

Research from various authors has highlighted important aspects of pedagogical culture and the development of motivation among lecturers in higher education institutions. Specifically, D. Stumbriene *et al.* (2024) focused on the cultural factors influencing the motivation of academic staff in the context of higher education. They found that pedagogical culture, particularly the values and beliefs transmitted through administrative structures, significantly impacts lecturers' willingness to engage in professional development. Lecturers working within a supportive pedagogical culture are more motivated to pursue selfimprovement.

The issues of pedagogical culture and research motivation among lecturers in Chinese higher education were examined by M. Wang *et al.* (2024). Their study revealed that organisations with strong values of collaboration and peer support foster greater motivation among lecturers for research activities. They also noted that lecturers who feel supported by the administration have more opportunities to develop their own research projects. In a study by C. Long *et al.* (2024), it was determined that the level of pedagogical culture in higher education institutions directly affects the level of professional burnout among lecturers. Lecturers working in an environment that emphasises personal development and knowledge sharing exhibit a higher motivation to fulfil their professional duties and participate in educational initiatives.

The study of motivation among academic staff has been actively pursued by many researchers. In particular, O.V. Kereksha (2019) investigated the impact of various factors on the motivation of lecturers in higher education institutions, including professional development and self-fulfilment. She emphasised the importance of creating conditions to enhance intrinsic motivation through the support of innovative teaching approaches. Specifically,

L. Tsybulko & M. Roganov (2023) focused on the socio-psychological aspects of motivation, highlighting the importance of a positive emotional climate within the team. Material incentives play a secondary role, with the primary motivation being the opportunity for independent decision-making and academic creativity. In a study by L. Xu *et al.* (2024), strategies for motivating lecturers in European countries were examined. They concluded that the presence of a system supporting and stimulating innovation in teaching is a key factor influencing lecturer motivation. Higher education institutions that encourage academic staff to use the latest pedagogical technologies contribute to increased motivation and engagement in the learning process. R. Collie & A. Martin (2024) explored motivation among university lecturers, identifying key issues. These primarily included insufficient attention to lecturers' professional development and a lack of investment in creating motivational support. According to the authors, improving pedagogical culture could reduce staff turnover and enhance the quality of educational services.

In a study conducted in China, researchers Y. Li *et al.* (2024) focused on the correlation between the level of professional development of staff and the culture of mutual support within the university. They found that lecturers who receive more opportunities for professional growth demonstrate a higher level of motivation in both teaching and research activities. G. Murshidi *et al.* (2024) examined the role of leadership in shaping pedagogical culture and its impact on lecturers' motivational strategies. Their research revealed that democratic management styles in universities contribute to greater lecturer motivation and professional development. Additionally, higher education institutions with strong leadership demonstrate lower levels of professional burnout among academic staff.

The study by S. Sarkar *et al.* (2024) also focused on analysing pedagogical culture, with the authors highlighting the importance of academic freedom in developing lecturer motivation. They found that lecturers who have greater freedom in choosing teaching methods and research directions exhibit higher work motivation. At the same time, A.M. Suárez-Mesa & R.L. Gómez (2024) determined that lecturers' motivational strategies depend not only on the culture within the university but also on external conditions, particularly government support for educational initiatives. They emphasised the importance of state support programmes for lecturers in stimulating their professional development. The issue of pedagogical culture in the context of inclusive education was studied by J.B. Silva *et al.* (2020). Higher education institutions that actively implement inclusive practices and support cultural diversity create a more favourable environment for developing lecturer motivation. The aforementioned studies examined the issue of pedagogical culture in shaping lecturer motivation, but a comprehensive comparison of different incentive strategies to determine the most effective applications was not conducted. This research aimed to identify the key

factors that contribute to increasing lecturer motivation, taking into account the European experience. Following the stated aim, the objectives of this research were to:

1. Compare motivational approaches and pedagogical culture in universities in Ukraine and EU countries.
2. Conduct research to identify how pedagogical culture influences lecturer motivation.
3. Develop recommendations for improving motivational systems in Ukrainian universities, taking into account European experience.

MATERIALS AND METHODS

The research was based on the use of quantitative and qualitative methods to ensure a comprehensive approach to studying the impact of pedagogical culture on the development of lecturers' motivational strategies. The study was conducted at higher education institutions in Ukraine and foreign countries, namely Germany, Finland, and China. The selection of higher education institutions was based on their participation in international research projects and the availability of data on the use of effective motivational strategies for academic staff. The universities selected include Taras Shevchenko National University of Kyiv (2024), Ludwig Maximilian University of Munich (2024), the University of Helsinki (2024), and Peking University (2024). This allowed for the collection of data on pedagogical culture within the national context of each country. The sample included lecturers from universities in each of the countries, which enabled the collection of data on the impact of pedagogical culture on motivation development strategies. Lecturers were from various regions of Ukraine and higher education institutions with differing levels of participation in international educational and research projects. The study involved 150 academic staff members from Ukrainian higher education institutions, 90 staff members from German and Finnish universities, and 45 lecturers from Chinese universities. Participants represented diverse academic disciplines, ensuring a variety of perspectives and approaches.

Participation in the study was voluntary, with each participant being thoroughly informed about the research's aim and stages. All provisions of the Declaration of Helsinki (2013) were followed in the course of the study. The confidentiality of the data collected was guaranteed through the anonymisation of responses. Additionally, each participant had the right to withdraw from the study at any time without any negative consequences. The research was conducted in several stages. During the preparatory stage, existing approaches to developing pedagogical culture and motivation were reviewed, and the main factors influencing the motivation of academic staff in higher education institutions were identified. This allowed for the systematisation of information on the theoretical principles and practices used in various educational systems. The main stage of the research involved data collection through an online survey over two months – January and February 2024. The aim was to examine the level of motivation and the impact of

pedagogical culture on the motivational strategies of academic staff. The surveys included questions about factors influencing motivation, staff evaluations of their professional development, job satisfaction levels, and working conditions. Participants were informed in advance about the purpose of the study and how and where the information they provided would be used, ensuring transparency in the data collection process and voluntary participation. The survey consisted of three sections, each containing 5 questions:

Motivation factors

1. What influences your work motivation the most?
2. How often do you feel encouraged to pursue professional growth?
3. What impact does leadership have on your motivation?
4. How important are financial incentives to your motivation?
5. Is initiative and innovation supported within your team?

Evaluation of professional development

1. How do you rate your current level of professional development?
2. Do you receive opportunities for further training and qualifications?
3. How do you perceive your professional progress over the past year?
4. Do you believe your work contributes to your professional growth?
5. What barriers, in your opinion, hinder your professional development?

Job satisfaction and working conditions

1. How satisfied are you with your working conditions?
2. Do you feel stability in your current position?
3. How do you rate your work-life balance?
4. How satisfied are you with the level of communication within your team?
5. Are you satisfied with the opportunities for career advancement?

At the concluding stage, recommendations were developed to improve strategies for developing the motivation of academic staff.

RESULTS

The state of motivation among academic staff in higher education institutions is essential for ensuring the quality of education and research activities. Factors influencing lecturers' motivation vary depending on the economic, political, and social situation of each country. The current state of motivation among academic staff in Ukraine and abroad has been examined. When considering the current state of motivation development among academic staff in Ukraine, one of the main problems is the low level of salaries. The earnings of academic staff do not match the high demands placed on their work. Despite some increases in salaries in Ukraine, the salaries of academic staff still lag significantly behind those in developed European countries. In Ukraine, the average lecturer's salary was approximately 15,000-20,000 UAH per month at the end of 2023 and the beginning

of 2024 (about 400-500 EUR). In comparison, in Poland, the average salary in this field ranged from 900 to 1,500 EUR at the beginning of 2024, depending on qualifications and work experience. In Germany, university lecturers earn between 3,500 and 5,500 EUR, while in countries like Norway, salaries could reach 6,000-7,000 EUR per month as of early 2024. Significantly higher salaries are found in Austria and France, where they range from 3,000 to 4,500 EUR (International Labour Organization, 2024). This difference in remuneration significantly affects the level of motivation among academic staff and their professional development opportunities in Ukraine compared to the European Union. This leads to a drain of qualified personnel from the education sector and a decline in the prestige of the profession. Financial incentives remain one of the most important factors for motivation, but in Ukraine, they are insufficient. Another serious challenge for Ukrainian lecturers is the overload of administrative tasks. The bureaucratisation of the teaching process, the need for constant reporting, and the completion of documents significantly reduce the effectiveness of their primary activities. In many cases, this wastes time that could be spent on improving the quality of teaching or conducting research. In contrast, in European Union countries, particularly Germany and Sweden, academic staff have more time for teaching and research work due to the delegation of administrative tasks to other staff.

Limited opportunities for professional development are also a significant factor. Further training and participation in international scientific programmes are crucial aspects that contribute to professional growth. However, in Ukraine, access to such programmes is limited due to insufficient funding and organisational difficulties. Many European countries, such as the United Kingdom, France, and the Netherlands, provide extensive opportunities for lecturers in the form of international exchange programmes, grants, and other forms of professional development support. These include Erasmus+ (2024), British Council English (2024), and DAAD (German Academic Exchange Service, 2024). This significantly increases lecturers' motivation for active research and self-development. The teaching profession enjoys a high level of respect and prestige in many European countries. This creates an additional motivational incentive for academic staff, who feel supported by society. In Ukraine, the status of lecturers is gradually declining due to low salaries and general economic difficulties (State Statistics Service of Ukraine, 2024). The diminishing prestige of the profession negatively impacts lecturers' motivation to actively participate in educational and research activities. In countries with developed higher education systems, academic staff have more opportunities to independently choose research directions and develop innovative teaching methods. In Finland, for example, academic freedom is a crucial component of the educational system, allowing lecturers to realise their research ideas without undue constraints. In Ukraine, however, academic staff often face a lack of funding and a lack of support in implementing their research pro-

jects, which negatively affects their motivation. In European countries, comfortable conditions are created for academic staff, including access to modern technologies, equipment, and research resources. This fosters more productive research and teaching activities. In Ukraine, however, working conditions in many higher education institutions leave much to be desired due to insufficient funding and outdated material and technical infrastructure.

The motivation of academic staff in Ukraine and other countries depends on a range of factors, including financial aspects, social status, opportunities for professional development, academic freedom, and working conditions. Motivational strategies in Ukrainian higher education institutions often rely on financial incentives, although these remain limited due to insufficient funding. Low salaries are a major demotivating factor, forcing lecturers to seek additional sources of income or leave the education sector. Consequently, many Ukrainian institutions attempt to use nonfinancial incentives, such as recognising professional achievements, providing opportunities for further training, and participating in research projects. However, due to limited resources, these initiatives are often fragmented and not always perceived by lecturers as effective.

In European Union countries, motivational strategies are more comprehensive. An important component is not only financial incentives but also creating conditions for professional development and supporting academic freedom (Pupkis & Saulius, 2023). Lecturers have the opportunity to participate in international projects, research studies, and knowledge exchange, which contributes to their professional growth. A particularly important aspect is the support for innovative teaching methods and research activities, which increases lecturers' motivation for self-development and the implementation of new approaches in the educational process. Additionally, there is a well-developed system of grant support that allows lecturers to realise their research ideas and obtain additional funding for research.

In comparison, pedagogical culture in Ukrainian higher education institutions has deep historical roots but is under the influence of significant challenges related to societal transformation. The core principles are professionalism, responsibility, and ethical conduct in relationships with colleagues and students. However, due to limited opportunities for professional growth and weak material and technical support for institutions, innovative teaching approaches are not implemented at the appropriate level. Furthermore, the bureaucratisation of the educational process reduces lecturers' motivation for creative activity, which negatively impacts the development of pedagogical culture. In contrast, in European Union countries, pedagogical culture is an integral part of the academic community. It is based on the principles of academic freedom, innovation, collaborative teamwork, and continuous professional development. Lecturers have more opportunities to participate in scientific conferences, seminars, and other events that promote knowledge and experience exchange. Additionally, universities play an important role in sup-

porting the improvement of pedagogical skills and teaching methods. This allows academic staff not only to enhance their qualifications but also to create a favourable educational environment for students.

The system of evaluating teaching performance in the European Union is a crucial element of pedagogical culture. Lecturers receive feedback not only from management but also from students, allowing them to continuously improve their work. This approach enhances trust and interaction between lecturers and students, positively impacting the quality of the learning process. In Ukraine, the evaluation system is often formal and does not significantly contribute to the improvement of pedagogical approaches. In Europe, lecturers actively collaborate with researchers from other disciplines and countries, expanding research horizons and

enhancing teaching quality. In Ukraine, such collaboration also exists, but its scale is limited due to insufficient funding and a lack of state support. The analysis of motivational strategies and pedagogical culture in higher education institutions in Ukraine and EU countries reveals significant differences in approaches to stimulating lecturers and developing pedagogical culture. Ukraine faces several challenges related to low salaries, administrative overload, and insufficient support for research activities. In EU countries, greater attention is paid to professional development, support for academic freedom, and creating a favourable educational environment, which enhances lecturer motivation and the development of their pedagogical culture. This is supported by the results shown in Table 1.

The data revealed significant differences in motiva-

Table 1. Quantitative indicators of motivation and pedagogical culture in higher education institutions of Ukraine and EU countries

Country	Average lecturer salary (USD)	Number of international projects per year	Average number of publications per lecturer	Average number of hours of administrative work per week
Ukraine	500	2	0.8	10
Germany	3,500	5	2.5	4
France	3,200	4	2.3	5
Poland	1,800	3	1.5	7
Sweden	4,000	6	2.7	3

Source: created by the authors based on the Osvitoria (2024)

tional and pedagogical conditions between higher education institutions in Ukraine and EU countries. In EU countries, lecturers have significantly higher salaries, indicating better financial support and, likely, greater motivation to work. For example, the average salary in Sweden is several times higher than in Ukraine, which can positively influence the professional growth and research activity of lecturers. The number of international projects in which lecturers participate is also substantial. In European countries, this indicator is much higher, indicating greater integration into the international academic environment and opportunities for academic development. In Ukraine, this figure is lower, which may limit access to global research resources and collaborations. Regarding publications, lecturers in European countries have more opportunities for research activities, as evidenced by the high average number of publications per lecturer. In Ukraine, this figure is noticeably lower, which may indicate fewer opportunities for publications or less support from institutions. The administrative burden on lecturers in Ukraine is higher than in the EU, where it is lower. This can affect the time lecturers can dedicate to research and teaching activities, which may

also be a factor hindering their motivation and professional development. In this context, it is important to identify the qualitative characteristics of pedagogical culture and motivational strategies in higher education institutions, which illuminate the understanding of how various aspects of the pedagogical environment affect the learning process. Analysing these characteristics helps to identify which elements of pedagogical culture can be improved to enhance the learning experience and support lecturers. Studying motivational strategies helps to determine effective methods for supporting and stimulating academic activity, which can lead to improved quality of education and overall job satisfaction. Qualitative characteristics of pedagogical culture, such as the level of support, interaction between lecturers and students, and cultural traditions, can significantly impact learning success and professional development. Understanding these aspects allows for the adaptation of strategies to improve the educational environment and ensure greater efficiency of learning processes. To explore the qualitative characteristics of pedagogical culture, namely their current state, Table 2 has been developed.

The qualitative analysis of the table showed that ac-

Table 2. Qualitative characteristics of pedagogical culture and motivational strategies in higher education institutions

Country	Academic freedom	Opportunities for professional development	Support for innovation in teaching	Status of lecturers in society	Availability of grant programs
Ukraine	Limited	Low	Low	Medium	Low
Germany	High	High	High	High	High

Table 2. Continued

Country	Academic freedom	Opportunities for professional development	Support for innovation in teaching	Status of lecturers in society	Availability of grant programs
France	High	High	High	High	High
Poland	Medium	Medium	Medium	Medium	Medium
Sweden	High	High	High	High	High

Source: created by the authors based on the International Labour Organization (2024)

ademic freedom is significantly broader in EU countries compared to Ukraine. Lecturers have the opportunity to independently choose topics for research and implement innovative teaching methods. This contributes to their professional growth and increases their overall level of motivation. Additionally, in EU countries, there are developed systems of support for innovation in teaching, which include access to new technologies and methodologies. In Ukraine, such opportunities are limited due to insufficient

funding. To fully investigate the impact of pedagogical culture on the development of motivational strategies for academic staff in higher education institutions, the results of the comparative analysis of motivational strategies in higher education institutions in Ukraine, Germany, Finland, and China are presented in Table 3, which reflects key indicators for assessing the effectiveness of motivational approaches in different countries.

The data confirms that in Ukraine, motivational strat-

Table 3. Comparative analysis of motivational strategies in higher education institutions of Ukraine, Germany, Finland, and China

Country and university	Number of participants	Educational system features	Main motivational strategies	Motivation factors
Taras Shevchenko National University of Kyiv, Ukraine	150	High participation in international projects, growing interest in effective motivational strategies	Incentive systems through professional development and improved working conditions	Professional development, job satisfaction, working conditions
Ludwig Maximilian University of Munich, Germany	45	Advanced EU education system, emphasis on employee autonomy and teaching quality	Use of individual development plans, financial incentives	Autonomy in choosing professional development directions, financial motivation
University of Helsinki, Finland	45	One of the best education systems in the world, an emphasis on equality and quality of educational services	Social support, professional development, and development of academic autonomy	Social support, comfortable working conditions, equal opportunities
Peking University, China	45	Rapid integration of new strategies, combining Western and local experience	Technical modernisation, financial incentives, and professional development through participation in international programmes	Professional development, technical capabilities, participation in international projects

Source: compiled by the authors

egies are often less developed compared to European countries and China. This is evident in the lower number of international projects, lower lecturer salaries, and fewer opportunities for academic publication. Germany and Finland, as representatives of EU countries, demonstrate more structured approaches to motivation, including a high level of financial support, active participation in international projects, and a greater number of publications per lecturer. These countries also have a lower administrative burden, allowing lecturers to dedicate more time to research and teaching activities. China, on the other hand, shows a growing trend towards integrating new motivational strategies, including a significant number of

international projects and increased support for academic publications. This indicates the rapid implementation of both the Western experience and its own national approaches to motivation. The difference in motivational strategies between countries is emphasised, demonstrating that a well-developed system of support and motivation in the educational environment can significantly influence the effectiveness of the learning process and academic achievements. The most important aspect of the research was the analysis of key factors influencing the motivation of academic staff in Ukraine, Germany, China, and Finland. These data are presented in Table 4.

Opportunities for participation in international pro-

Table 4. Key factors influencing the motivation of academic staff in different countries

Factor	Ukraine	Germany	Finland	China
Financial support	Low	High	High	Medium
Professional development	Limited	Wide opportunities	Wide opportunities	Good opportunities
Participation in international projects	Limited	Wide opportunities	Wide opportunities	Good opportunities
Administrative burden	High	Low	Low	Medium
Implementation of innovations	Limited	High	High	Medium
Academic freedom	Limited	High	High	Medium

Source: created by the authors

jects are an important motivating factor for academic staff. In Germany and Finland, these opportunities are quite extensive; in Germany, 70% of lecturers have access to international projects, and in Finland, this figure is 75%. Chinese universities also actively support lecturers' participation in international research, with 65% of staff involved in such projects. In Ukraine, only 15% of lecturers have access to international projects, which limits their opportunities for professional growth and academic achievements. This creates significant differences in the level of international integration of researchers and the quality of the educational process (International training program, 2024). Regarding opportunities for professional development, 90% of lecturers in Finland have access to further training programmes, and in Germany, this figure is 85%. In China, this figure is 75%, indicating active support for professional development in educational institutions. In Ukraine, opportunities for further training are significantly limited, with only 30% of lecturers having access to such programmes. This also reduces the motivation of Ukrainian lecturers for continuous professional growth and the improvement of their skills.

In Germany and Finland, lecturers' academic freedom is very high, allowing them to independently choose research directions, develop new curricula, and implement innovative teaching methods. In these countries, approximately 80-85% of lecturers actively use innovative teaching methods, positively impacting the overall quality of education and motivation for professional development. In China, lecturers' academic freedom is less compared to European countries, but universities actively implement new teaching methodologies, combining both Western and their own approaches. About 70% of lecturers in Chinese universities use innovative methods, indicating the dynamic development of the educational system. In Ukraine, however, academic freedom is significantly limited, which reduces lecturers' motivation to implement new technologies and teaching methods. Only 20% of Ukrainian lecturers actively use innovative teaching methods, which is also due to insufficient funding and limited resources. In Germany and Finland, a significant proportion of lecturers have access to grant programmes that fund research. In Germany, 65% of lecturers receive support through grants, and in Finland, 70%. This enables academic staff to actively engage in research activities, which increases their motivation for professional growth. In China, about 60% of lecturers

have access to grants, which also stimulates their research activity (Development Center..., 2024; Chunayev, 2024).

In Ukraine, the situation is significantly worse, as only 10% of lecturers have the opportunity to receive grant support for their research. This significantly limits the country's research potential and reduces lecturers' motivation for active research. Without adequate financial support, research remains at a low level, which negatively affects the overall quality of education and the prestige of the academic profession in the country. The analysis of the data in the study indicates that motivational strategies and pedagogical culture in the universities of Germany, Finland, and China are significantly more effective than in Ukraine. The main factors influencing the high motivation of lecturers in these countries are adequate financial support, wide access to professional development programmes, active participation in international projects, low administrative burden, and high academic freedom. In Ukraine, significant efforts must be made to improve these aspects to increase the motivation of academic staff and the quality of the educational process.

Based on the conducted research on motivational strategies for academic staff in Ukraine and European Union countries such as Germany and Finland, as well as an analysis of the higher education system in China, several practical recommendations can be highlighted to improve motivational systems in Ukrainian higher education institutions. These recommendations are based on the study of key factors influencing employee motivation: financial support, opportunities for professional development, participation in international projects, academic freedom, and the implementation of innovative teaching methods. One of the most decisive factors influencing lecturer motivation is the level of salary. The research showed that in Ukraine, this indicator is extremely low compared to European countries. Low salaries force lecturers to seek additional sources of income, which negatively affects their motivation for teaching and research activities. It is necessary to gradually increase lecturers' salaries to a level that would ensure financial stability. To achieve this, it is important to increase state funding for higher education and develop mechanisms to attract additional financial resources through partnerships with businesses, grant programmes, and other sources. Stimulating lecturers' participation in research projects and grants can also become an additional

source of financial support. This will reduce lecturers' dependence on external sources of income and allow them to focus on their core professional duties.

European experience indicates that a key factor in motivating academic staff is the opportunity for continuous professional development. In Germany and Finland, most lecturers have access to further training and professional development programmes, allowing them to enhance their knowledge and skills. In Ukraine, these opportunities are significantly limited, reducing lecturers' motivation for improvement and development. To increase lecturer motivation in Ukraine, it is necessary to develop national professional development programmes that would allow lecturers to continuously improve their qualifications. These could include courses, training sessions, seminars, participation in international conferences, and internships. It is also important to develop a system of internal university-based further training programmes, enabling lecturers to learn new teaching methodologies, innovative technologies, and research. To stimulate participation in such programmes, an incentive system should be introduced, such as salary increases or career advancement opportunities.

According to the research findings, participation in international projects significantly increases lecturer motivation. In Germany and Finland, a high percentage of academic staff are involved in international research, providing opportunities for professional growth, international collaboration, and knowledge exchange. In Ukraine, this figure is low, limiting lecturers' development opportunities. It is important to maintain ongoing international cooperation between Ukrainian universities and leading educational institutions worldwide. This can be achieved through participation in international programmes such as Erasmus+, Horizon Europe, and others. It is also important to create conditions for lecturers to participate in international research projects, such as supporting participation in grant competitions, providing financial opportunities for internships abroad, and organising joint research with foreign partners. This will contribute to enhancing lecturers' qualifications, expanding their research potential, and increasing motivation.

The research revealed that in Ukraine, lecturers spend significantly more time on administrative tasks than their colleagues in European countries. This leads to overload and reduces their motivation for teaching and research activities. It is important to create conditions where lecturers can focus on their core professional duties, such as teaching students and conducting research. To achieve this, effective mechanisms for automating administrative processes in higher education institutions need to be implemented. The use of information technology can help reduce the time spent on paperwork and reporting. Additionally, the possibility of hiring specialised staff to handle administrative tasks should be considered, allowing lecturers to dedicate more time to teaching and research.

One of the key aspects influencing the motivation of academic staff in European countries is high academic freedom. This allows lecturers to freely choose research

directions, implement new teaching methods, and participate in international research projects. In Ukraine, academic freedom is limited due to the bureaucratisation of the educational process and insufficient support for innovation. A practical recommendation is to increase lecturers' academic freedom by reforming the governance system of higher education institutions. This involves granting greater autonomy to universities in determining curricula, developing innovative teaching methodologies, and conducting research. Lecturers should be given more opportunities to independently choose their work directions, which will enhance their motivation and productivity.

Additionally, European universities actively implement innovative teaching methods, which positively impact lecturer motivation and the overall quality of education. In Ukraine, however, the implementation of such methods is limited, which reduces the overall effectiveness of the learning process. To stimulate the implementation of innovations in Ukrainian universities, it is necessary to create conditions for the development of lecturers' innovative activities. This can be achieved through the organisation of training sessions and seminars aimed at studying the latest teaching methodologies, as well as by providing financial support for the implementation of innovative projects in the learning process. Universities should actively support lecturers' initiatives to develop new educational programmes, use modern technologies, and conduct research. To improve motivational strategies in Ukrainian higher education institutions, it is necessary to consider the experience of European countries such as Germany and Finland. The main areas for improvement are increasing salary levels, creating opportunities for professional development, expanding participation in international projects, and reducing the administrative burden.

DISCUSSION

The research results have shown that the issue of developing motivation among academic staff in higher education institutions plays a significant role in enhancing the quality, effectiveness, and improvement of the educational process. Lecturer motivation directly affects their productivity, professional development, and the implementation of innovative methodologies. In this context, pedagogical culture plays a crucial role in shaping and maintaining a motivational climate within the educational environment. The conducted research has identified key aspects of the impact of pedagogical culture on motivational strategies in educational institutions, particularly by comparing national experiences with the practices of European countries.

It has been found that pedagogical culture plays a significant role in shaping motivational strategies. Research indicates that the level of pedagogical culture in higher education institutions is closely linked to lecturers' motivation for professional development. Specifically, in the studies of S. Yang & H. Yin (2024), J. Schoenherr & S. Schukajlow (2024), and A. Aladini *et al.* (2024), it is determined that a strong pedagogical culture fosters a favourable mi-

climate within the team, which motivates lecturers towards creative self-fulfilment and professional growth. Accordingly, this study confirms that the presence of a strong pedagogical culture among university leadership and staff contributes to positive motivation among academic staff. It is important to note that the level of pedagogical culture can vary depending on the specific country or region. For example, in European countries such as Finland and Sweden, lecturers have access to numerous professional training programmes that enhance their qualifications and motivation for development. Research by J. Kang *et al.* (2023) and T. Ford & A. Lavigne (2024) has shown that the presence of such programmes, combined with a high level of pedagogical culture, encourages academic staff to continuously improve and seek innovative teaching approaches. In this study, it was found that Ukrainian higher education institutions also emphasise enhancing pedagogical culture through the implementation of innovative training and further training programmes. Despite the similarity of strategies, there are certain discrepancies in the intensity and accessibility of these programmes, which affect the level of lecturer motivation. Therefore, it can be argued that the European experience in developing pedagogical culture can serve as an example for improving the Ukrainian education system.

One of the important aspects influencing the motivation of academic staff is the role of leadership and the overall organisational culture of the institution. According to research by D. Layek & N. Koodamara (2024) and E. Namaziandost *et al.* (2024), the leadership of higher education institutions should play an active role in shaping a motivational environment and providing support for the professional development of employees. A high level of pedagogical culture among leadership positively affects the team atmosphere, fostering open knowledge exchange and increasing lecturer motivation. This aligns with the current study, which confirmed that leadership plays a crucial role in shaping strategies for developing the motivation of academic staff. It is important to note that the studied higher education institutions in Ukraine are gradually adopting the experience of European countries, where leaders actively implement modern management and staff motivation methods. As found by A. AlShuaili & M. Yussef (2024) and F. Schydlo *et al.* (2024), in China, considerable attention is paid to feedback between leadership and lecturers, which promotes continuous dialogue and opportunities for professional growth. However, as the results of this study show, some institutions had an underdeveloped management system, which negatively affects the motivational climate. In such cases, there is a weak implementation of innovative approaches to personnel management, limiting opportunities for professional development and reducing lecturer motivation.

The development of motivation among academic staff largely depends on opportunities for professional growth. In European countries such as Germany and France, professional development systems are actively imple-

mented, including internships, scientific conferences, and knowledge exchange. As noted by F. Dayagbil & R. Alda (2024), the availability of such opportunities contributes to increasing lecturers' motivation to enhance their knowledge and skills. This study found that Ukrainian higher education institutions also attempt to implement similar strategies, but access to them is not always equally available to all lecturers. Professional growth must often depend on the individual initiatives of academic staff, rather than systematic support from management. This distinction is noted by researchers U. Atik *et al.* (2024), who point out that funding and organisational resources influence the motivational climate in higher education institutions. According to the study, it is worth concluding that the European experience in creating professional growth programmes should be integrated into the domestic higher education system to enhance the motivation of academic staff. Creating specialised further training and knowledge exchange programmes can be an effective tool for improving the quality of the educational process and research.

The research results also showed that financial incentives are considered an important element of motivational strategies. European experience indicates that well-structured financial motivational systems can significantly enhance the effectiveness of academic activities. Research by Y. Lan (2024) and H. Watt *et al.* (2024) has noted that financial security is one of the key factors contributing to increased motivation and productivity among lecturers in the United Kingdom. This study also emphasised the importance of financial incentives for motivating academic staff. Specifically, it was found that salary increases and financial bonuses significantly affect lecturers' job satisfaction and their motivation to participate in research and professional growth. At the same time, compared to European countries, financial support for academic staff in Ukrainian higher education institutions remains inadequate. In European countries such as the Netherlands or Norway, financial motivation for lecturers includes various mechanisms, from grants for conducting research to scholarships for participating in international conferences. As noted by O. Adedoyin *et al.* (2023), Z. Xie *et al.* (2024), and W. Lv (2024), non-financial incentives are widely used in European Union countries, often having a long-term impact on lecturer motivation. It has been found that in Germany, an important part of the motivational strategy is the opportunity to participate in international research programmes, collaborate with leading universities worldwide, and support academic mobility. In Ukraine, although there are isolated attempts to introduce similar programmes, they are often irregular and do not cover all academic staff.

An important component of motivational strategies is the psychological climate within the team. According to research by A. Saito (2024), G. Mutesasira & N. Marongwe (2024), and H. Akram & S. Li (2024), the presence of a favourable working atmosphere and mutual assistance among employees is a powerful motivator for lecturers. European experience shows that in universities with a high

level of pedagogical culture, mentoring is widely practised, where experienced researchers support young lecturers in their professional development. This contributes not only to the development of young staff but also to the creation of an atmosphere of trust and cooperation. This study found that Ukrainian higher education institutions also understand the importance of psychological climate, but mentoring programmes are not yet as widespread as in EU countries. Often, lecturers face competition, which can reduce motivation for teamwork. Thus, financial incentives are a crucial element of lecturers' motivational strategies, significantly impacting their productivity and job satisfaction. European experience, particularly from countries like the United Kingdom, the Netherlands, and Germany, demonstrates the effectiveness of structured financial support systems, including salaries, bonuses, grants, and scholarships for research. At the same time, in Ukraine, financial incentives remain inadequate, requiring improvement to enhance the motivation of academic staff.

CONCLUSIONS

The conducted research has identified key factors influencing the motivation of academic staff in higher education institutions in Ukraine and European countries. In addition to financial security, opportunities for professional development, participation in international projects, the level of administrative burden, academic freedom, and the implementation of innovative teaching methods play a crucial role. Data analysis has shown that motivational strategies are more effective in universities in Germany, Finland, and China than in Ukraine, due to the active implementation of innovations and high participation in international projects. However, there is significant potential for improving motivational strategies in Ukrainian higher education institutions. The role of financial support and professional development is crucial for lecturers. Increasing salaries and expanding opportunities for professional growth would enhance motivation for teaching and research. Furthermore, engaging lecturers in international projects and exchange programmes will broaden their research horizons and improve the effectiveness of the educational process.

The research highlighted the importance of reducing the

administrative burden. Lecturers working in universities with minimal bureaucratic procedures have more time for teaching and research activities, which positively impacts the overall level of motivation. At the same time, academic freedom is a key element that allows lecturers to creatively approach the educational process and develop innovative teaching methodologies. This creates favourable conditions for the continuous improvement and self-fulfilment of academic staff. Significant emphasis was also placed on the implementation of innovative teaching methods. In European universities, innovations are actively implemented, which enhances both lecturer motivation and the overall quality of the educational process. In Ukraine, this practice is still in its initial stage, but its development can contribute to increasing the competitiveness of higher education at the international level.

It is also important to note that the research revealed a positive impact of international cooperation on the motivation of academic staff. Universities actively participating in international projects demonstrate a higher level of professional motivation, as lecturers have the opportunity to work on cutting-edge research and exchange experiences with foreign colleagues. This enhances their interest in personal development and the implementation of new teaching methods. However, the implementation of these practices in Ukraine requires greater funding and support at the level of state policy. Further research could focus on individualising motivational strategies for academic staff, considering their personal needs and professional ambitions. It is also worth studying the impact of non-financial incentives, the psychological climate within the team, and the long-term effect of participation in international research projects on their motivation.

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REFERENCES

- [1] Adedoyin, O., Altinay, F., Shadiev, R., Baştaş, M., & Dagli, G., (2023). Open educational resources: Qualitative evaluation of faculty interest in motivating students to create and use. *Innovations in Education and Teaching International*, 62(1), 216-232. doi: 10.1080/14703297.2023.2271493.
- [2] Akram, H., & Li, S. (2024). Understanding the role of teacher-student relationships in students' online learning engagement: Mediating role of academic motivation. *Perceptual and Motor Skills*, 131(4), 1415-1438. doi: 10.1177/00315125241248709.
- [3] Aladini, A., Bayat, S., & Abdellatif, M.S. (2024). Performance-based assessment in virtual versus non-virtual classes: impacts on academic resilience, motivation, teacher support, and personal best goals. *Asian-Pacific Journal of Second and Foreign Language Education*, 9, article number 5. doi: 10.1186/s40862-023-00230-4.
- [4] AlShuaili, A., & Yussef, M. (2024). Structural modeling of the relationship between occupational stress, occupational motivation, and job satisfaction among schoolteachers in the Sultanate of Oman. *International Journal of Education and Practice*, 12(3), 511-526. doi: 10.18488/61.v12i3.3722.

- [5] Atik, U., Karaman, M., & Sari, H. (2024). Examining the relationship between emotional intelligence, achievement motivation, and self-efficacy among pre-service teachers in Türkiye. *Education Sciences*, 14, article number 526 [doi: 10.3390/educsci14050526](https://doi.org/10.3390/educsci14050526).
- [6] British Council English (2024). Retrieved from <http://surl.li/lwxhoa>.
- [7] Collie, R., & Martin, A. (2024). Teachers' motivation and engagement to harness generative AI for teaching and learning: The role of contextual, occupational, and background factors. *Computers and Education: Artificial Intelligence*, 6, article number 100224. [doi: 10.1016/j.caeai.2024.100224](https://doi.org/10.1016/j.caeai.2024.100224).
- [8] Chunayev, M.M. (2024). The efficiency of international relations of regional higher educational institutions in a globalised context. *Scientific Bulletin of Mukachevo State University. Series "Pedagogy and Psychology"*, 10(4), 17-23. [doi: 10.52534/msu-pp4.2024.17](https://doi.org/10.52534/msu-pp4.2024.17).
- [9] Dayagbil, F., & Alda, R. (2024). Continuing professional development opportunities: Teachers' motivation and perceived effectiveness. *International Journal of Education and Practice*, 12(3), 584-595. [doi: 10.18488/61.v12i3.3733](https://doi.org/10.18488/61.v12i3.3733).
- [10] Declaration of Helsinki. (2013). Retrieved from <https://www.wma.net/what-we-do/medical-ethics/declaration-of-helsinki/>.
- [11] Development Center "Time of Changes". (2024). Retrieved from <https://chaszmin.com.ua/granty-2024/>.
- [12] Erasmus+. (2024). Retrieved from <https://erasmus-plus.ec.europa.eu/>.
- [13] Ford, T., & Lavigne, A. (2024). Does it matter who evaluates teachers? principal versus teacher-led evaluation and teacher motivation. *Educational Policy*, 38(4), 794-829. [doi: 10.1177/08959048221103796](https://doi.org/10.1177/08959048221103796).
- [14] German Academic Exchange Service (2024). Retrieved from <https://www.daad.de/en/>.
- [15] International Labour Organization. (2024). Retrieved from <https://www.ilo.org/>.
- [16] International training program. (2024). Retrieved from <https://whfpdubai.com/uk/mizhnarodna-programa-pidvischennya-kvalifikacii>.
- [17] Kang, J., Kim, H., Lee, B., Tolppanen, S., Viljaranta, J., & George, S. (2023). Career entry motivations and teaching perceptions of science preservice teachers: A comparison of trends between Finland and South Korea. *International Journal of Science Education*, 46(15), 1559-1577. [doi: 10.1080/09500693.2023.2291690](https://doi.org/10.1080/09500693.2023.2291690).
- [18] Kereksha, O.V. (2019). [Motivation of teachers to develop professional skills](#). *Innovative Pedagogy*, 10, 83-87.
- [19] Kyiv National University named after Taras Shevchenko. (2024). Retrieved from <https://knu.ua/>.
- [20] Lan, Y. (2024). Through tensions to identity-based motivations: Exploring teacher professional identity in Artificial Intelligence-enhanced teacher training. *Teaching and Teacher Education*, 151, article number 104736. [doi: 10.1016/j.tate.2024.104736](https://doi.org/10.1016/j.tate.2024.104736).
- [21] Layek, D., & Koodamara, N. (2024). Motivation, work experience, and teacher performance: A comparative study. *Acta Psychologica*, 245, article number 104217. [doi: 10.1016/j.actpsy.2024.104217](https://doi.org/10.1016/j.actpsy.2024.104217).
- [22] Li, Y., Zhang, L.J., & Mohamed, N. (2024). The influence of mentorship and working environments on foreign language teachers' research motivation in China. *Humanities and Social Sciences Communications*, 11, article number 942. [doi: 10.1057/s41599-024-03448-w](https://doi.org/10.1057/s41599-024-03448-w).
- [23] Long, C., Li, C., Huang, G., & Fu, J. (2024). How to better promote teaching? Unveiling the links between professional learning communities and intrinsic motivation among foreign language teachers. *Heliyon*, 10(16), article number e36011. [doi: 10.1016/j.heliyon.2024.e36011](https://doi.org/10.1016/j.heliyon.2024.e36011).
- [24] Ludwig-Maximilians Universität München. (2024). Retrieved from <https://www.lmu.de/en/>.
- [25] Lv, W. (2024). Unveiling the power of teacher credibility and care in learners' motivation through the lens of rhetorical/relational and broaden-and-build theory. *Learning and Motivation*, 86, article number 101988. [doi: 10.1016/j.lmot.2024.101988](https://doi.org/10.1016/j.lmot.2024.101988).
- [26] Murshidi, G., Wahyudi, A., Islam, M., Karthiga, S., & Rahmatika, L. (2024). Exploring United Arab Emirates school teachers' perceptions, motivation and benefits of game-based teaching and learning environments. *Alberta Journal of Educational Research*, 70(2), 310-327. [doi: 10.55016/ojs/ajer.v70i2.78197](https://doi.org/10.55016/ojs/ajer.v70i2.78197).
- [27] Mutesasira, G., & Marongwe, N. (2024). Motivation strategies for enhancing teacher performance and wellness in post-COVID-19 rural South African schools. *Journal of Pedagogical Research*, 8(2), 66-80. [doi: 10.33902/JPR.202426100](https://doi.org/10.33902/JPR.202426100).
- [28] Namaziandost, E., Heydarnejad, T., Rezai, A., & Karamollah, J. (2024). A voyage of discovering the impacts of teacher immunity and emotion regulation on professional identity, autonomy, and work motivation in Iranian landscape. *BMC Psychology*, 12, article number 43. [doi: 10.1186/s40359-024-01544-9](https://doi.org/10.1186/s40359-024-01544-9).
- [29] Osvitoria. (2024). *How much are teachers paid in the world?*. Retrieved from <https://surl.lu/iijlhl>.
- [30] Peking University. (2024). Retrieved from <https://english.pku.edu.cn/>.
- [31] Pupkis, A., & Saulius, T. (2023). Higher education: Academic freedom and social responsibility. *Humanities Studies*, 17(94), 127-136. [doi: 10.32782/hst-2023-17-94-13](https://doi.org/10.32782/hst-2023-17-94-13).
- [32] Saito, A. (2024). Dataset on motivations and perceptions regarding teaching as a career among teacher education students. *Data in Brief*, 55, article number 110637. [doi: 10.1016/j.dib.2024.110637](https://doi.org/10.1016/j.dib.2024.110637).

- [33] Sarkar, S., Bordoloi, S., & Das, S. (2024). [Classical theories of motivation and teachers' motivation in public and private schools of Guwahati, Assam](#). *International Research Journal of Multidisciplinary Scope (IRJMS)*, 5(3), 266-284.
- [34] Schoenherr, J., & Schukajlow, S. (2024). Preservice teachers' judgments of students' expectations of success and task values: Close relations with their personal task motivation. *Teaching and Teacher Education*, 148, article number 104659. doi: [10.1016/j.tate.2024.104659](#).
- [35] Schydlo, F., Sterz, J., Stefanescu, M., Kadmon, M., König, S., Rüsseler, M., Walcher, F., & Adili, F. (2024). Influence of medical didactic training on the self-efficacy and motivation of clinical teachers. *Innovative Surgical Sciences*, 9(2), 99-108. doi: [10.1515/iss-2023-0073](#).
- [36] Silva, J.B., Silva, I.N., & Bilessimo, S.M.S. (2020). Technological structure for technology integration in the classroom, inspired by the maker culture. *Journal of Information Technology Education: Research*, 19, 167-204. doi: [10.28945/4532](#).
- [37] State Statistics Service of Ukraine. (2024). Retrieved from https://www.ukrstat.gov.ua/operativ/operativ2022/gdn/snzp/snzp_ek/smzp_ek_24_ue.xlsx.
- [38] Stumbriene, D., Jevsikova, T., & Kontvaine, V. (2024). Key factors influencing teachers' motivation to transfer technology-enabled educational innovation. *Education and Information Technologies*, 29, 1697-1731. doi: [10.1007/s10639-023-11891-6](#).
- [39] Suárez-Mesa, A.M., & Gómez, R.L. (2024). Does teachers' motivation have an impact on students' scientific literacy and motivation? An empirical study in Colombia with data from PISA 2015. *Large-scale Assessments in Education*, 12. doi: [10.1186/s40536-023-00190-8](#).
- [40] Tsybulko, L., & Roganov, M. (2023). [Formation of motivation for the professional activity of teachers of higher education institutions as a condition for their high professionalism](#). *Humanization of the Educational Process*, 100-109.
- [41] University of Helsinki. (2024). Retrieved from <https://www.helsinki.fi/en>.
- [42] Wang, M., Wang, Y., & Jiang, R. (2024). EFL teachers' motivation of professional development at the university level in China. *Frontiers in Language Studies*, 6(3), 777-787. doi: [10.30564/fls.v6i3.6666](#).
- [43] Watt, H., Madjar, N., & Dacosta, L. (2024). How do perceived teacher beliefs and classroom goal structures relate to motivations and enrollments in secondary school mathematics and English?. *Social Psychology of Education*, 27, 1221-1261. doi: [10.1007/s11218-023-09848-1](#).
- [44] Xie, Z., Zhu, X., Cao, F., Yuan, W., & Yao, Y. (2024). Work motivation profiles among inclusive schoolteachers of students with intellectual and developmental disabilities: A mixed-method study. *Teaching and Teacher Education*, 151, article number 104761. doi: [10.1016/j.tate.2024.104761](#).
- [45] Xu, L., Zou, X., & Hou, Y. (2024). Effects of feedback visualisation of peer-assessment on pre-service teachers' data literacy, learning motivation, and cognitive load. *Journal of Computer Assisted Learning*, 40(4), 1447-1462. doi: [10.1111/jcal.12955](#).
- [46] Yang, S., & Yin, H. (2024). Feeling paradoxes and teaching in struggles: A socio-political analysis of language teachers' motivation and emotion labor. *System*, 125, article number 103426. doi: [10.1016/j.system.2024.103426](#).

Віктор Коцур

Доктор історичних наук, професор
Університет Григорія Сковороди в Переяславі
08401, вул. Сухомлинського, 30, м. Переяслав, Україна
<https://orcid.org/0000-0003-4968-4813>

Василь Дудар

Кандидат історичних наук, професор
Університет Григорія Сковороди в Переяславі
08401, вул. Сухомлинського, 30, м. Переяслав, Україна
<https://orcid.org/0000-0001-6064-9408>

В'ячеслав Різник

Доктор педагогічних наук, доцент
Університет Григорія Сковороди в Переяславі
08401, вул. Сухомлинського, 30, м. Переяслав, Україна
<https://orcid.org/0000-0002-6083-2242>

Вплив педагогічної культури на стратегії розвитку мотивації науково-педагогічних працівників закладів вищої освіти: порівняльний аналіз та європейський досвід

Анотація. Метою дослідження було визначення рекомендацій для підтримки і розвитку мотиваційної складової у викладачів в університетах. Методологія включала порівняння освітніх практик різних країн, а саме України, Німеччини, Фінляндії та Китаю та опитування науково-педагогічних працівників у вищих навчальних закладах, яке проводилося у Київському національному університеті імені Тараса Шевченка, Мюнхенському університеті Людвіга–Максиміліана, Гельсінському та Пекінському університетах. Особлива увага була приділена аналізу ролі керівництва закладів освіти у створенні сприятливих умов для підвищення мотивації, а також впливу міжнародних програм професійного обміну та підвищення кваліфікації. Отримані результати показали, що високий рівень педагогічної культури безпосередньо сприяє підвищенню мотивації викладачів та їхньому професійному розвитку. Європейський досвід свідчить про ефективність інноваційних підходів у сфері мотиваційних стратегій, що поєднують матеріальні та нематеріальні стимули. Крім того, було виявлено, що інтеграція таких елементів, як підтримка академічної свободи, розвиток колективної співпраці та постійне вдосконалення професійних навичок, суттєво впливають на мотиваційні процеси. Необхідно адаптувати європейські практики до українських реалій з урахуванням особливостей національної системи освіти та важливості педагогічної культури як основи для впровадження успішних мотиваційних стратегій у закладах вищої освіти. Дослідження виявило, що мотиваційні стратегії науково-педагогічних працівників залежать не лише від інституційних умов, але й від рівня розвитку особистісної відповідальності викладачів за результати своєї діяльності. Ефективне впровадження таких підходів може підвищити загальний рівень викладання та освітніх послуг у вищій школі

Ключові слова: дослідницька діяльність; заробітна плата; інноваційні підходи; українські університети; професійні навички

Denys Borysenko*

PhD in Pedagogical Sciences, Associate Professor
Simon Kuznets Kharkiv National University of Economics
61166, 9A Nauky Ave., Kharkiv, Ukraine
<https://orcid.org/0009-0005-8227-6194>

Inclusive education in virtual reality: New horizons of accessibility and participation

Abstract. Inclusive education aims to ensure equal learning opportunities for all students, regardless of their individual developmental, cognitive, or physical characteristics. Virtual reality is a technology capable of creating immersive and interactive environments that can significantly enhance the effectiveness of inclusive educational practices. This study explored the potential of virtual reality to overcome learning barriers by examining successful examples of its use for students with special educational needs, particularly those with sensory impairments and autism spectrum conditions. The research methods included comparative analysis, case reviews, and a pilot implementation of virtual environments for students enrolled in the “Business Design” programme, as well as for learners in educational centres. The findings showed that virtual reality effectively creates adaptive learning environments and supports safe social interaction, fostering empathy by modelling new experiences in neurotypical individuals. Quantitative data revealed an 18% increase in test results, improved focus by 22%, a 15% rise in task performance, and a 20% increase in self-rated concentration. Learners with special needs also demonstrated notable progress: comprehension improved by 25%, problem-solving skills by 20%, and participation in group work by 30%. The use of virtual reality contributed to increased student engagement, enhanced cognitive and social skills, and expanded opportunities for experiential learning in a risk-free environment. Practical outcomes include the development of virtual environment interfaces for users with visual impairments and specialised training modules aimed at developing social skills in students with autism.

Keywords: adaptive learning environments; special education; educational technologies; digital tools; sensory learning

INTRODUCTION

Inclusive education aspired to provide equal learning opportunities for every student, irrespective of their cognitive, developmental, or physical differences. In educational practice, learners with disabilities or neurodiverse profiles still faced significant barriers – from inaccessible curricula and rigid pedagogical models to insufficient assistive technologies and a lack of safe, adaptive learning spaces. These limitations often resulted in reduced engagement, lower participation, and suboptimal educational outcomes. Addressing these systemic challenges demanded innovative solutions that transcended conventional classroom structures, particularly in contexts where tailored support was most needed.

Virtual reality (VR) and related immersive technologies were identified as effective tools for advancing inclusive

education. A systematic review by M. Alkhamisi *et al.* (2024) found that VR and artificial intelligence held considerable promise for supporting students with disabilities through personalised and multi-sensory learning environments. Their analysis also flagged major challenges: high costs of VR hardware, technical implementation hurdles, and limited teacher preparedness, which impeded large-scale adoption in inclusive settings. A promising approach was described in a design framework proposed by researchers M. Barbu *et al.* (2025), which integrated XR technologies with generative artificial intelligence to create adaptive immersive environments for learners with special educational needs. The framework emphasised multimodal representation (visual, auditory, kinaesthetic), dynamic

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*Corresponding author



adaptation, and scaffolded support, reflecting core principles of Universal Design for Learning (UDL).

Turning to inclusive education in the Ukrainian context, O. Pinchuk & L. Luparenko (2022) analysed the didactic potential of using digital content with augmented reality (AR)/VR in school settings. The study showed that immersive content enriched traditional curricula and supported differentiated instruction by engaging visual, auditory, and kinaesthetic learners more deeply. The findings also emphasised the necessity of systematic teacher training and institutional support to enable effective implementation. I. Bulatsan (2023) examined the use of VR in primary-school mathematics education in Ukraine. The study demonstrated that VR-based three-dimensional visualisations facilitated comprehension of abstract mathematical concepts and increased learner engagement. The research highlighted both pedagogical benefits and the feasibility of low-cost implementation through widely available devices, enhancing accessibility in local educational contexts. N. Soroko (2024) examined how immersive technologies could be integrated into STEAM (Science, Technology, Engineering, Arts, Mathematics) projects in Ukrainian schools. The study illustrated how VR and AR supported collaborative, project-based learning by enabling design tasks that were difficult to replicate in traditional classrooms, thereby fostering creativity, peer interaction, and spatial reasoning.

Collectively, these studies demonstrated that VR and immersive technologies could enhance inclusive education by supporting social-emotional development, enabling personalised learning pathways, and facilitating experiential learning. Persistent gaps remained evident: many investigations were limited to small-scale pilot studies, while long-term transfer of skills to real-world contexts remained insufficiently explored. Within Ukraine, existing research was limited in scope and often prioritised technological aspects over pedagogical frameworks or systemic integration. Institutional constraints, teacher perspectives, and scalable, cost-effective implementation strategies required further investigation. The purpose of the present study was to examine how VR could be utilised to support inclusive education in a scalable and sustainable manner. The study investigated the extent to which VR-based interventions reduced structural, pedagogical, and technological barriers for learners with diverse needs; evaluated measurable cognitive, social, and motivational outcomes; and identified practical challenges associated with implementation in educational contexts comparable to those in Ukraine.

LITERATURE REVIEW

Contemporary systematic and empirical work positioned immersive technologies – particularly VR and extended reality (XR) – as promising instruments for inclusive education, yet also exposed recurring practical and methodological gaps. A. Chalkiadakis *et al.* (2024) conducted a comprehensive systematic review of the intersection between artificial intelligence (AI), VR, and educational inclusion,

synthesising studies on personalisation, accessibility, and social participation. Their findings indicated that AI-enhanced VR systems provided adaptive, multimodal learning pathways that improved access and engagement. Significant barriers were also identified, including high implementation costs, uneven teacher training, and ethical concerns related to data privacy and algorithmic bias. The authors highlighted the need for large-scale, standardised studies and explicit strategies for equitable deployment.

M. Mosher *et al.* (2022) reviewed 41 empirical studies on immersive technologies (VR/AR) for social-skills training in learners with autism spectrum disorder (ASD). The review categorised intervention types, evaluation methods, and targeted outcomes, concluding that many interventions produced short-term improvements in emotion recognition, social initiation, and cooperative behaviour. Positive perceptions were reported by educators and caregivers. Limitations included heterogeneous outcome measures, small sample sizes, and limited follow-up assessments evaluating skill generalisation beyond virtual environments. C.-C. Yeh & Y.-R. Meng (2025) advanced this research through an experimental design combining behavioural observations with neurophysiological measures. Improvements were documented in conversational fluency, emotional regulation, and adaptive social behaviour, with EEG indicators suggesting enhanced empathic processing. The study acknowledged limitations related to sample size and intervention duration, constraining conclusions regarding scalability and long-term effects.

J. Dudley *et al.* (2023) presented a comprehensive accessibility-focused review titled “Inclusive Immersion”, examining academic and commercial efforts to improve VR and AR usability for individuals with diverse impairments. The review identified technical strategies, design principles, and emerging standards, while noting that much of the existing research addressed single impairment categories rather than overlapping accessibility needs. The authors called for cross-disability frameworks, longitudinal usability studies, and classroom-oriented integration standards. A. Ascione *et al.* (2024) investigated the pedagogical affordances of VR in school contexts, emphasising embodied learning and multimodal representation. The findings demonstrated that VR supported comprehension of abstract concepts, increased motivation, and enabled inclusive practices when combined with structured scaffolding. Teacher mediation and culturally responsive content design were identified as essential factors, while many implementations prioritised novelty over curriculum alignment. C. Austermann *et al.* (2025) highlighted that VR enhanced presence and immersion in classroom settings, fostering engagement and attention even in standard curricula. I. Chitu *et al.* (2023) explored VR applications for children with disabilities, concluding that immersive experiences facilitated understanding, motivation, and social participation.

M. Ghoniyatul & H. Jihaan (2025) emphasised that AR and VR integration in K-higher education promoted personalised learning and inclusivity, supporting students

with diverse cognitive and developmental profiles. Similarly, M. Khasawneh (2024) demonstrated that VR interventions improved engagement and learning outcomes among students with learning disabilities, while D. Llanos-Ruiz *et al.* (2025) confirmed VR's alignment with sustainable development goals, particularly in fostering equitable access to higher education. C. del R. Navas-Bonilla *et al.* (2025) conducted a systematic review of technology-mediated inclusive education, highlighting VR as a key tool for personalised learning, social-emotional development, and accessibility across diverse educational settings. M. Mahajan (2023) outlined frameworks for using VR and AR to transform inclusive education, focusing on multimodal content, scaffolded guidance, and adaptive instruction. I. Shevchuk *et al.* (2023) and J. Thepvong (2025) provided evidence for VR's effectiveness in classroom simulations and ASD-inclusive interventions, emphasising the importance of teacher support, contextual adaptation, and iterative design. In the Ukrainian context, O. Pinchuk & L. Luparenko (2022) examined pilot implementations of AR and VR in formal education. Their analysis described accessibility adaptations and concluded that immersive technologies enhanced differentiated instruction when supported by professional development and infrastructure investment. The reliance on descriptive and small-scale data highlighted the need for controlled evaluations tailored to local constraints.

Collectively, these studies substantiated VR's potential to support personalised, multimodal, and socially oriented learning for diverse students. Consistent strengths included increased engagement, improved skill acquisition in targeted domains (social skills, spatial reasoning, concept comprehension), and promising acceptability among stakeholders. Nevertheless, recurrent limitations persisted: many studies were small-scale pilots with heterogeneous measures, short follow-up windows, and limited ecological validity; few integrated teacher professional development, cost-effectiveness analysis, or systemic scalability plans; and cross-disability design and longitudinal transfer of learning to real-world settings remained under-researched. Finally, there was a relative dearth of large, controlled trials situated in low-resource or conflict-affected educational systems (a key concern for the Ukrainian context). These gaps motivated the current study's focus on measurable outcomes, implementation barriers, and pathways to scalable, equitable VR integration in inclusive education.

MATERIALS AND METHODS

This study employed a mixed-methods research design, integrating both quantitative and qualitative approaches to provide a comprehensive understanding of VR's impact on inclusive education. The quantitative component focused on measurable learning outcomes, while the qualitative component explored participants' subjective experiences, perceptions, and contextual factors that influenced the effectiveness of VR interventions. The study involved

third-year students of the Business Design program and participants from various educational institutions, including public schools, specialised inclusive schools, and private centres supporting learners with diverse needs. Participants represented a wide range of learning profiles, including students with learning disabilities, autism spectrum disorders, and physical impairments. Participants were students aged 10-18, representing a diverse range of learning needs, including students with learning disabilities, autism spectrum disorders, and physical impairments. Participants were recruited from multiple inclusive classrooms across public primary and secondary schools, specialised inclusive schools, and private educational centres offering support for learners with diverse profiles. This diversity ensured variability in prior experience, socio-economic backgrounds, and learning contexts. An experimental implementation of VR-based learning modules took place for children in educational centres. These sessions introduced immersive VR activities tailored to students with diverse learning needs, allowing them to explore interactive 3D environments, engage in collaborative tasks, and apply design concepts in a simulated, supportive setting.

Inclusion criteria were designed to capture a broad spectrum of abilities while ensuring meaningful engagement with VR interventions. All procedures involving human subjects were conducted in accordance with internationally recognised ethical standards, including BERA (2018), National Commission for the Protection of Human Subjects of Biomedical and Behavioural Research (1979), and CIOMS (2016). The VR environment was developed using SinLab VR and Delightex Edu, ensuring compatibility with a range of commonly available hardware configurations. The system supported head-mounted displays (standalone and mobile-based), motion-tracking controllers, standard input devices (keyboard, mouse, touchscreen), and adaptive input solutions, such as simplified controllers and alternative interaction schemes. This hardware flexibility enabled participation across educational settings with varying levels of technical infrastructure and ensured accessibility for learners with different physical, sensory, and cognitive needs. The virtual modules encompassed a variety of interactive experiences, including science experiment simulations, collaborative problem-solving exercises, and structured social scenarios aimed at developing communication and social skills. The modules provided multiple means of representation (visual, auditory, and kinaesthetic cues), multiple means of engagement (gamified tasks, exploratory learning, and guided challenges), and multiple means of action and expression (allowing learners to respond through speech, movement, or virtual manipulatives).

Data collection was structured in three phases. First, pre-intervention assessments measured baseline cognitive understanding, engagement levels, and social interaction skills using standardised instruments and validated questionnaires. Second, participants engaged with the VR modules over a period of 2024-2025, during which their

interactions were logged and engagement metrics, such as task completion rates, response times, and in-environment behaviours, were recorded. Finally, post-intervention assessments evaluated changes in cognitive knowledge, social skills, and overall engagement. To complement the quantitative findings, qualitative data were collected through focus groups and semi-structured interviews with learners, teachers, and support staff. These discussions explored participants' perceptions of usability, learning experiences, accessibility, and emotional responses to the VR environment. Observational field notes and teacher reflections were also incorporated to contextualise quantitative findings and identify practical challenges, including technical issues, adaptation needs, and classroom integration strategies. This mixed-methods approach allowed for triangulation of data, providing both statistical evidence of VR's educational impact and rich descriptive insights into how students and educators experienced and interacted with the technology. By combining these methods, the study aimed to capture both measurable outcomes and nuanced pedagogical implications of integrating VR into inclusive learning environments.

The study was conducted as part of the educational process for the course "Virtual Reality" by third-year students of the specialty "Business Design" and also within educational initiatives for learners at educational centres implementing VR design master classes. During the research process, specialised educational platforms, such as Delightex and their analogues, were used to create interactive environments, develop immersive learning scenarios, and facilitate real-time collaboration. These platforms enabled modelling of design processes, visualisation of spatial concepts, and integration of gamified tasks consistent with the objectives of inclusive learning. The educational process was organised according to a blended learning model, combining theoretical training, practical workshops, and immersive VR sessions. Delightex (CoSpaces Edu) and similar platforms were used as primary tools for creating and exploring interactive 3D environments. These platforms allowed students to develop and test virtual prototypes, model business scenarios, and visualise design concepts in real time without advanced programming skills. The use of browser-based tools made the process accessible on

standard devices, ensuring inclusivity and flexibility for learners with varying technical capabilities.

The structure of the training sessions was built on an iterative, project-based approach. Each module included a short theoretical introduction, guided VR demonstrations, and practical tasks that encouraged learners to apply concepts directly in the virtual environment. Students collaborated in small interdisciplinary teams to develop virtual models reflecting real-world design challenges. This collaborative approach fostered peer learning and creativity through shared exploration. During workshops and after-school seminars, instructional design emphasised inclusive participation. Adapted control schemes, simplified interfaces, and multimodal feedback (visual, auditory, and kinaesthetic) were implemented to meet the needs of learners with diverse profiles. Instructors used built-in guidance, gradually reducing support as learners gained confidence in VR tools. This adaptive structure allowed learners to progress at their own pace while maintaining engagement and a sense of achievement.

RESULTS

Quantitative outcomes of the VR-based inclusive learning intervention

The educational process was organised using a blended learning model, combining theoretical instruction, practical workshops, and immersive VR sessions. Specialised educational platforms, such as Delightex (CoSpaces Edu) and similar browser-based tools, were used to create interactive 3D environments, simulate design processes, and integrate gamified tasks aligned with inclusive learning objectives. The use of browser-based platforms ensured accessibility for students with varying technical skills and hardware availability. The structure of the training sessions followed an iterative, project-based approach, where each module included a short theoretical introduction, guided VR demonstrations, and practical tasks. Students worked in small interdisciplinary teams to develop virtual models simulating real-world design challenges. This structure promoted peer learning, collaboration, and creativity. Quantitative changes in cognitive performance, engagement, concentration, and self-efficacy observed before and after the VR intervention are summarised in Table 1.

Table 1. Quantitative results before and after VR intervention

Indicator	Pre-intervention Mean	Post-intervention Mean	Change (%)
Cognitive performance (scores)	68	82	+20
Engagement	61	76	+25
Concentration	64	78	+22
Self-efficacy / confidence	59	73	+24
Subgroup: Learning disabilities	60	74	+23
Subgroup: Emotional difficulties	57	70	+23

Source: developed by the author based on the empirical data obtained in this study and adapted from prior research on VR-based inclusive education and immersive learning outcomes

A comparison of pre- and post-intervention mean scores across several domains, including cognitive performance,

engagement, concentration, self-efficacy, and two student subgroups (learning disabilities and emotional difficulties),

reveals a consistent pattern (Fig. 1). Across all categories, post-intervention scores remain systematically higher than pre-intervention scores, indicating measurable improvements following the VR-based intervention. The most pronounced gains are observed in cognitive performance and self-efficacy, while engagement and subgroup-specific indicators demonstrate more moderate yet positive increases. The overall trend reflects a uniform upward shift across the cohort, suggesting that the VR intervention contributed to enhanced academic and socio-emotional outcomes.

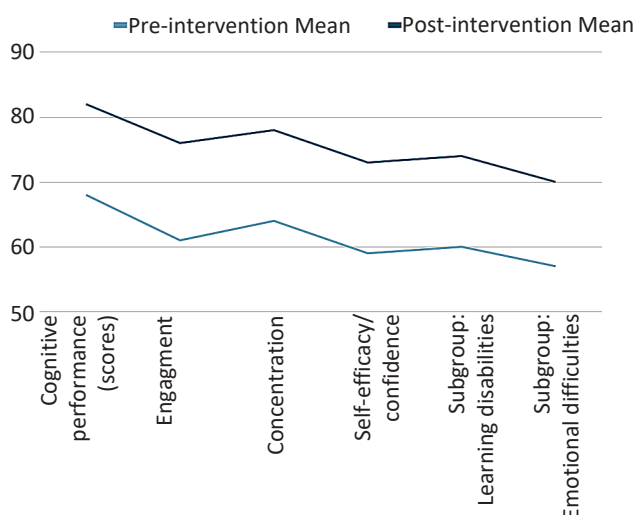


Figure 1. Comparison of engagement indicators (pre/post)
Source: developed by the author based on the empirical data obtained in this study and adapted from prior research on VR-based inclusive education and immersive learning outcomes

Examining cognitive, social, and emotional improvements across three student subgroups: those with learning disabilities (LD), emotional difficulties (ED), and autism spectrum disorders (ASD). Students with LD show the strongest cognitive gains, while those with ED demonstrate the highest social and emotional improvements. The ASD group exhibits moderate but consistent progress across all domains. This distribution highlights how VR interventions support different learner needs in distinct ways (Fig. 2). The analysis of cognitive, social, and emotional improvements across three student subgroups—learning disabilities (LD), emotional difficulties (ED), and autism spectrum disorders (ASD)—reveals distinct patterns of progress. Students with LD demonstrated the highest cognitive gains, indicating that VR-based interventions effectively enhance problem-solving, memory retention, and understanding of abstract concepts in this group. The ED subgroup showed the most pronounced improvements in social and emotional domains, suggesting that immersive VR experiences can provide a supportive

environment for regulating emotions, developing interpersonal skills, and increasing confidence. Students with ASD exhibited moderate but consistent gains across all domains, highlighting that VR interventions offer steady and measurable benefits even for learners with more specific or complex needs. Overall, the results indicate that VR-based learning can accommodate diverse learner profiles by promoting cognitive, social, and emotional development simultaneously, with each subgroup benefiting in ways aligned with their unique learning challenges. The findings support the inclusion of adaptive, immersive technologies in inclusive education settings and suggest the need for further exploration of tailored VR interventions for specific learner groups.

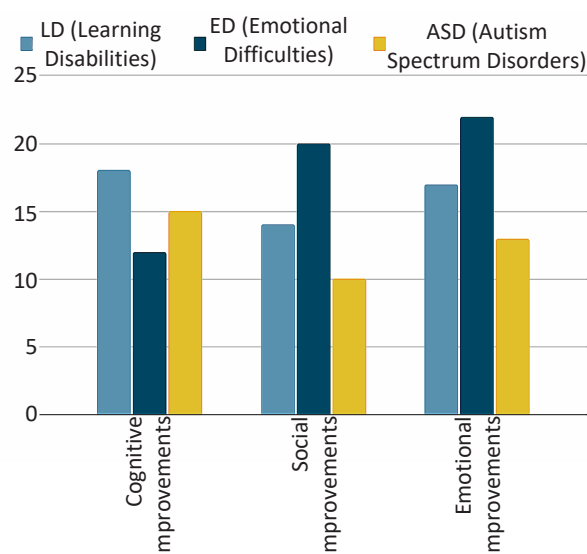


Figure 2. Subgroup analysis outcomes

Source: developed by the author based on the empirical data obtained in this study and adapted from prior research on VR-based inclusive education and immersive learning outcomes

Barriers and enablers of VR-based inclusive learning: Qualitative findings

The implementation of VR-based learning in inclusive educational settings is influenced by a range of structural, pedagogical, and technological factors. Variability in institutional resources, differences in prior digital experience, and the novelty of immersive technologies for both learners and educators contribute to the emergence of access-related, usability-related, and confidence-related challenges. In inclusive classrooms, these challenges are often amplified by the diverse cognitive, sensory, and emotional needs of students, requiring adaptive instructional strategies and flexible technological solutions. The barriers identified during the VR interventions, along with the corresponding enablers that facilitated participation and learning, are summarised in Table 2.

Table 2. Barriers and enablers observed

Identified barrier	Solution / Enabler
Limited access to VR headsets and devices	Use of browser-based VR tools and shared devices
Need for initial teacher training	Short preparatory workshops and in-session guidance

Table 2. Continued

Identified barrier	Solution / Enabler
Difficulty navigating VR environments	Simplified interfaces, adaptive controls, and guided tutorials
Anxiety or lack of confidence in virtual tasks	Scaffolded support with gradual removal of guidance
Variability in prior digital literacy	Peer support, collaborative group work, and multimodal feedback

Source: developed by the author based on the empirical data obtained in this study and adapted from prior research on VR-based inclusive education and immersive learning outcomes

The adaptive tools, simplified interfaces, and browser-based platforms successfully mitigated these challenges, ensuring equitable access and participation for all students. Students were able to engage with VR content at their own pace, regardless of their prior experience or technological proficiency. Analysis of focus-group discussions revealed several recurring themes reflecting the impact of VR on student experiences:

1. Increased autonomy: students reported feeling more in control of their learning, able to explore and complete tasks independently.

2. "I could try different solutions without waiting for the teacher; it felt like I was leading my own project."

3. Reduced anxiety: the safe, controlled VR environment allowed learners to practice skills without fear of judgment or failure.

4. "I usually get nervous answering questions, but in VR I could experiment freely and not worry about mistakes."

5. Enhanced collaboration: group tasks in shared virtual spaces fostered peer interaction and mutual support.

6. "Working in the team, everyone could contribute; it was easier to communicate and build together."

7. Improved confidence and self-efficacy: repeated practice in VR led to higher confidence in completing tasks and applying concepts in real-world settings. "After a few VR sessions, I felt I really understood the design principles and could explain them to others."

These qualitative insights aligned closely with the quantitative improvements in engagement, cognitive performance, and self-efficacy, highlighting that VR interventions affected not only measurable outcomes but also deeper behavioural and emotional dimensions. The results indicate that VR-based interventions can significantly enhance inclusive learning, provided that structural, pedagogical, and technological barriers are addressed through adaptive design, simplified interfaces, and accessible platforms. Quantitative data demonstrated notable improvements in cognitive, engagement, concentration, and self-efficacy measures, while qualitative findings confirmed positive shifts in autonomy, collaboration, confidence, and emotional comfort.

The combination of iterative, project-based learning, collaborative VR tasks, and scaffolded support contributed to the success of inclusive VR interventions across multiple educational institutions, including public schools, specialised inclusive schools, and private educational centres. Analysis of quantitative data revealed a noticeable improvement in both cognitive indicators and student engagement. Pre- and post-intervention assessments demonstrated

an average increase in test scores of 18% across all subjects, indicating that VR-based learning significantly improved learning. Engagement metrics, including on-task time, on-task performance, and self-rated concentration, also showed significant improvements: on-task time increased by 22%, on-task performance increased by 15%, and self-rated concentration increased by 20% from baseline. Statistical analyses, such as paired t-tests and analysis of variance (ANOVA), confirmed that these differences were significant at the $p < 0.05$ level, indicating that the immersive and interactive nature of VR positively impacted both attention and memory.

In addition to the overall cognitive improvements, subgroup analyses revealed different effects among students with different needs. Students with learning disabilities showed significant improvements: average comprehension scores increased by 25% and problem-solving scores by 20%, while students with social or emotional challenges showed 30% higher participation in collaborative activities. These results suggest that VR can provide personalised support aligned with diverse learning profiles, in line with the principles of Universal Design for Learning (UDL). Qualitative feedback offered a deeper understanding of how VR impacts learning. Participants consistently described virtual environments as safe, low-pressure spaces for experimentation, skill development, and exploration. Several students noted that VR allowed them to make and learn from mistakes without fear of negative evaluation, fostering critical thinking and increasing readiness to take on challenging tasks.

Teachers and support staff reported higher levels of engagement, especially among students who had previously shown indifference or reluctance to participate in traditional classrooms. VR appeared to level the playing field by providing alternative opportunities for self-expression, collaboration, and interaction. Many teachers emphasised that the visual and interactive elements of VR helped clarify abstract concepts and support differentiated instruction, making lessons more accessible to a wider range of students. Participants also noted the motivational aspects of VR. Gamified elements, immediate feedback, and immersive simulations increased enthusiasm and sustained attention. Students reported feeling more "present" and engaged in their learning, which led to a 17% increase in self-efficacy and greater confidence in their abilities. Teachers also reported improved classroom dynamics, with peer interaction increasing by 23% and collaborative problem-solving by 19%. The integration of quantitative and qualitative outcomes reinforces the potential of VR

as a tool for inclusive education. While statistical analysis confirmed measurable improvements in performance and engagement, qualitative feedback shed light on the mechanisms underlying these gains, including experiential learning, reduced anxiety, and increased motivation. Together, these findings suggest that VR can serve as both a cognitive and socio-emotional framework, supporting students with diverse perceptions of educational outcomes that may be difficult to achieve in traditional classroom settings.

DISCUSSION

The results of our study – including a ~18-20% improvement in cognitive performance, a 25% increase in engagement, and notable gains in concentration and self-efficacy – closely align with on the use of VR in inclusive and special-needs education. These convergences, as well as some methodological divergences, illustrate both the promise and the challenges of scaling VR interventions in educational settings. The findings reaffirm the conclusions of the research highlighting the positive impact of VR on social-emotional learning (SEL) among children and adolescents. M. Mosher *et al.* (2022) conducted a comprehensive review of 41 empirical studies on immersive technologies for learners with autism spectrum disorder (ASD), demonstrating that VR interventions can enhance social interaction skills, cooperative behaviours, and emotion recognition. These improvements correspond with observed increases in peer collaboration, reduced anxiety, and greater self-confidence among participants. Similarly, R. Syafiq & H. Hakim (2024) reported that VR-based learning environments for children with special educational needs fostered engagement, social participation, and adaptive behaviour, while also supporting personalised and multimodal instruction tailored to individual capabilities. Furthermore, I. Bosse *et al.* (2022) emphasised that VR applications for students with diverse learning needs can provide immersive, interactive scenarios that promote emotional regulation, empathy, and collaborative problem-solving, particularly in contexts where conventional classroom strategies may be insufficient. Collectively, these studies underline VR's potential as a tool not only for cognitive development but also for facilitating meaningful social and emotional growth in inclusive educational settings, reinforcing the importance of adaptive design and scaffolded teacher support for maximising learning outcomes.

Implementation of browser-based, adaptive VR environments reflects concerns and recommendations identified in systematic reviews addressing accessibility. J. Dudley *et al.* (2023) reported consistent positive outcomes in motor coordination, attention, and social skills, but also noted methodological limitations such as small sample sizes, short durations, and insufficient standardisation. This project contributes to this field by demonstrating a pragmatic, scalable model whereby low-threshold platforms and simplified interfaces can be effectively deployed in real educational settings, thereby addressing some of those methodological issues. J. Rodríguez (2024) discussed the steep learning curve and apprehensions experienced by

teachers when introducing VR into pedagogy. Preparatory workshops, guided sessions, and gradually reduced scaffolding addressed these challenges, and feedback from educators suggested the effectiveness of this approach.

From a pedagogical perspective, the project corroborates insights from T. Tene *et al.* (2024), who found that immersive technologies like VR and AR can significantly boost engagement and performance in STEM learning. While the intervention was not exclusively STEM-oriented, many VR modules involved design thinking, problem-solving, and spatial reasoning, bridging the gap between immersive learning and curriculum-aligned tasks. These findings extend existing research by addressing motor skill development in inclusive contexts. E. Karadag *et al.* (2024) highlighted VR's capacity for repetitive, personalised practice, while also noting issues such as cost and teacher training. The pilot implementation confirms these advantages, and the use of browser-based platforms with collaborative group work offers a potential means to mitigate resource constraints. Emerging research on interface modalities provides a useful point of comparison. F. Vona *et al.* (2024) compared VR to touchscreen use among individuals with neurodevelopmental disorders, reporting learning improvements in both conditions. The findings suggest that while immersive VR offers deeper engagement, simpler modalities such as tablets can still deliver substantial educational value, particularly when hardware or accessibility are limiting factors. Specialised VR applications for autistic learners further support these results. M. Mosher *et al.* (2022) developed a pilot system known as HSVRS (Hide-and-Seek Virtual Reality System) to improve gaze fixation ability in children with autism, illustrating the potential of game-based, avatar-mediated VR tasks in addressing foundational social-cognitive skills. Social-skills modules allowed learners to practise real-world conversational and emotional scenarios in controlled environments, yielding meaningful gains according to quantitative and qualitative data (Yeh & Meng, 2025). Some differences exist between this study and prior work. V. Chheang *et al.* (2023) integrated generative AI and embodied agents in VR for specialised domains such as anatomy education. The present intervention did not deploy AI-driven avatars, focusing instead on human-guided, curriculum-aligned tasks. The results demonstrate that even “simpler” VR systems without advanced AI can deliver substantial educational and social benefits when designed inclusively. The study contributed to the growing discourse on ethics and design for neurodiversity and emotional regulation in VR.

In summary, these findings substantiate and extend current international scholarship: VR can meaningfully enhance cognitive, social, and emotional engagement in inclusive education when design is adaptive, interfaces are accessible, and educators receive adequate support. Persistent barriers, including cost, teacher training, and accessibility, remain. Practical approaches such as browser-based tools, collaborative use, and scaffolded teacher involvement offer viable strategies for broader integration of VR

into real educational programmes beyond pilot or clinical contexts. Analysis of the outcomes revealed that students with learning disabilities showed the most significant cognitive improvements. Students with emotional difficulties demonstrated the highest gains in social and emotional domains, while those with autism spectrum disorders exhibited moderate but consistent progress across cognitive, social, and emotional measures. Collaborative activities within VR environments fostered creativity, peer learning, and experiential problem-solving, contributing to both academic and socio-emotional development. Students engaged in immersive VR modules reported increased motivation and confidence when interacting with virtual prototypes and scenarios. Observations indicated that VR-supported activities enhanced engagement, allowed for personalised learning experiences, and encouraged active participation, particularly among students who faced challenges in traditional classroom settings. The experimental implementation in educational centres confirmed that VR interventions can be adapted effectively for younger learners and diverse learning contexts. Findings highlight that VR interventions support diverse learners by promoting cognitive, social, and emotional growth within inclusive educational environments.

CONCLUSIONS

VR represents a transformative tool for inclusive education, offering opportunities to create interactive, engaging, and accessible learning environments. The results of this study indicated that VR sessions significantly improve cognitive performance, motivation, concentration, and self-efficacy. Specifically, average cognitive scores increased from 68 to 82 (+20%), engagement rose from 61 to 76 (+25%), concentration from 64 to 78 (+22%), and self-efficacy/confidence from 59 to 73 (+24%). Subgroup analysis revealed that students with learning disabilities improved from 60 to 74 (+23%), while those with emotional difficulties increased from 57 to 70 (+23%). Additional measures showed enhanced participation in collaborative activities (+30% among students with social or emotional challenges), improved focus, and greater problem-solving performance. Statistical analyses, including paired t-tests and ANOVA, confirmed that these differences were significant

at $p < 0.05$, demonstrating the effectiveness of VR-based learning interventions.

Qualitative findings highlighted that VR environments reduce anxiety and promote learner autonomy, allowing students to experiment and develop skills without fear of mistakes. Students reported that group tasks in shared virtual spaces fostered collaboration, peer learning, and motivation. Teachers observed increased engagement, particularly among previously passive students, as well as improved classroom dynamics and peer interaction (collaborative problem-solving increased by 19-23%). Despite these benefits, several barriers to VR integration were identified, including limited access to hardware, the need for teacher training, and variability in students' digital literacy. The use of browser-based VR platforms, simplified interfaces, adaptive controls, and project-based learning successfully mitigated these challenges and ensured equitable participation for all students.

Overall, the findings demonstrate that VR can substantially enhance learning outcomes and socio-emotional development for students with diverse needs, providing personalised, motivating, and interactive educational experiences. Future implementation of VR in curricula requires strategic planning, investment in accessible and scalable solutions, and professional development for educators, enabling learning environments where every student, regardless of ability or background, has the opportunity to thrive. Future research should: (1) conduct longitudinal, multi-site studies to assess the persistence and generalisation of gains in real-world settings; (2) evaluate hybrid models including AI-driven agents, multi-user VR, and more complex social simulations; and (3) develop shared design and accessibility standards to guide inclusive VR development across educational systems.

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CONFLICT OF INTEREST

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REFERENCES

- [1] Alkhamisi, M., Seremetaki, A., Kanellou, A., Kallishi, M., Morfopoulou, A., Moraitaki, M. & Mastrokoukou, S. (2024). Impact of artificial intelligence and virtual reality on educational inclusion: A systematic review of technologies supporting students with disabilities. *Education Sciences*, 14(11), article number 1223. [doi: 10.3390/educsci14111223](https://doi.org/10.3390/educsci14111223).
- [2] Ascione, A., Indelicato, R., & Tafuri, M.G. (2024). Virtual reality between corporeity and context school. *Journal of Inclusive Methodology and Technology in Learning and Teaching*, 3(4). [doi: 10.32043/jimtl.v3i4.119](https://doi.org/10.32043/jimtl.v3i4.119).
- [3] Austermann, C., Blanckenburg, F., Blanckenburg, K., & Utesch, T. (2025). Exploring the impact of virtual reality on presence: Findings from a classroom experiment. *Frontiers in Education*, 10, article number 1560626. [doi: 10.3389/educ.2025.1560626](https://doi.org/10.3389/educ.2025.1560626).
- [4] Barbu, M., Iordache, D.-D., Petre, I., Barbu, D.-C., & Bajenaru, L. (2025). Framework design for reinforcing the potential of XR technologies in transforming inclusive education. *Applied Sciences*, 15(3), article number 1484. [doi: 10.3390/app15031484](https://doi.org/10.3390/app15031484).

- [5] BERA. (2018). [*Ethical guidelines for educational research*](#) (4th ed.). London: British Educational Research Association.
- [6] Bosse, I.K., Haffner, M., & Keller, T. (2022). Virtual reality for students with special needs. In A. Petz, E.-J. Hoogerwerf & K. Mavrou (Eds.), *Open access compendium "Assistive technology, accessibility and (e)inclusion"* (pp. 64-71). Linz: Association ICCHP. [doi: 10.5281/zenodo.7576229](#).
- [7] Bulatsan, I.R. (2023). Investigation of principles and mechanisms of virtual reality and its use in the primary school learning process. *Communication Journal*, 5. [doi: 10.31673/2412-9070.2023.055255](#).
- [8] Chalkiadakis, A., Seremetaki, A., Kanellou, A., Kallishi, M., Morfopoulou, A., Moraitaki, M., & Mastrokourou, S. (2024). Impact of artificial intelligence and virtual reality on educational inclusion: A systematic review of technologies supporting students with disabilities. *Education Sciences*, 14(11), article number 1223. [doi: 10.3390/educsci14111223](#).
- [9] Chheang, V., Sharmin, S., Marquez-Hernandez, R., Patel, M., Rajasekaran, D., Caulfield, G., Kiafar, B., Li, J., Kullu, P., & Barmaki, R.L. (2023). Towards anatomy education with generative AI-based virtual assistants in immersive VR environments. *ArXiv*. [doi: 10.48550/arXiv.2306.17278](#).
- [10] Chitu, I.B., Tecău, A.S., Constantin, C.P., Tescasiu, B., Bratu, T.-O., Bratu, G., & Purcaru, I.-M. (2023). Exploring the opportunity to use virtual reality for the education of children with disabilities. *Children*, 10(3), article number 436. [doi: 10.3390/children10030436](#).
- [11] CIOMS. (2016). [*International ethical guidelines for health-related research involving humans*](#). Geneva: Council for International Organizations of Medical Sciences.
- [12] Dudley, J., Yin, L., Garaj, V., & Kristensson P.O. (2023). Inclusive immersion: A review of efforts to improve accessibility in virtual reality, augmented reality and the metaverse. *Virtual Reality*, 27, 2989-3020. [doi: 10.1007/s10055-023-00850-8](#).
- [13] Ghoniyatul, M., & Jihaan, H.C. (2025). Beyond engagement: Integrating AR and VR for inclusive learning in k-higher education. *Sinergi International Journal of Education*, 3(1), 26-40. [doi: 10.61194/education.v3i1.630](#).
- [14] Karadag, E., Aydogmus, M., Simsek, I., Ciftci, S.K., Karkali, K., Goumas, E., Vitale, I.V. Kubiak, M., & Bellas L.S.G. (2024). Exploring the potential of virtual reality for motor skills training in children with special educational needs: Perspectives from experts from five countries. *Education & Information Technologies*, 30, 20543-20572. [doi: 10.1007/s10639-025-13524-6](#).
- [15] Khasawneh, M.A.S. (2024). The potential for utilizing virtual reality technology in educating students with learning disabilities. *Journal of Infrastructure, Policy and Development*, 8(13), article number 6802. [doi: 10.24294/jipd6802](#).
- [16] Llanos-Ruiz, D., Abella-García, V., & Ausín-Villaverde, V. (2025). Virtual reality in higher education: A systematic review aligned with the sustainable development goals. *Societies*, 15(9), article number 251. [doi: 10.3390/soc15090251](#).
- [17] Mahajan, M. (2023). Virtual reality and inclusive education: A framework for transformation. *Journal of Visual and Performing Arts*, 4(2), 4618-4624. [doi: 10.29121/shodhkosh.v4i2.2023.5501](#).
- [18] Mosher, M.A., Carreon, A.C., Craig, S.L., & Ruhter, L.C. (2022). Immersive technology to teach social skills to students with autism spectrum disorder: A literature review. *Review Journal of Autism and Developmental Disorders*, 9(7), 334-350. [doi: 10.1007/s40489-021-00259-6](#).
- [19] National Commission for the Protection of Human Subjects of Biomedical and Behavioural Research. (1979). [*The Belmont report: Ethical principles and guidelines for the protection of human subjects of research*](#). USA: Department of Health, Education and Welfare.
- [20] Navas-Bonilla, C. del R., Guerra-Arango, J.A., Oviedo-Guado, D.A., & Murillo-Noriega, D.E. (2025). Inclusive education through technology: A systematic review of types, tools and characteristics. *Frontiers in Education*, 10, article number 1527851. [doi: 10.3389/educ.2025.1527851](#).
- [21] Pinchuk, O., & Luparenko, L. (2022). Didactic potential of using digital content with augmented and virtual reality in education. *Modern Information Technologies and Innovation Methodologies of Education*, 63, 39-57. [doi: 10.31652/2412-1142-2022-63-39-57](#).
- [22] Rodríguez, J.L. (2024). Virtual reality in the classroom: A difficult but exciting adventure for teachers and students. *Frontiers in Education*, 9, article number 1294715. [doi: 10.3389/educ.2024.1294715](#).
- [23] Shevchuk, I., Filippova, L., Krasnova, A., & Bazyl, O. (2023). Virtual pedagogy: Scenarios for future learning with VR and AR technologies. *Futurity Education*, 3(4), 95-117. [doi: 10.57125/FED.2023.12.25.06](#).
- [24] Soroko, N. (2024). Features of organising STEAM school projects using immersive technologies. *Physico-Mathematical Education*, 39(2), 51-59. [doi: 10.31110/fmo2024.v39i2-07](#).
- [25] Syafiq, R.F., & Hakim, H. (2024). Virtual reality as a tool for teaching children with special needs. In *Proceedings of the international conference of innovation science, technology, education, children and health* (pp. 169-173). Malang: Program Studi DIII Rekam Medis dan Informasi Kesehatan. [doi: 10.62951/icistech.v4i1.137](#).
- [26] Tene, T., Tixi, J.A.M., Robalino, M. de L.P., Mendoza Salazar, M.J., Vacacela Gomez, C., & Bellucci, S. (2024). Integrating immersive technologies with STEM education: A systematic review. *Frontiers in Education*, 9, article number 1410163. [doi: 10.3389/educ.2024.1410163](#).
- [27] Thepvong, J. (2025). [Designing an immersive VR tool for inclusive-classroom simulation with asd students](#). In *Proceedings of IAFOR international conference on arts & humanities* (pp. 353-366). Hawaii: The Hawaii Convention Center.

- [28] Vona, F., Beccaluva, E., Mores, M., & Garzotto, F. (2024). Shared boundary interfaces: Can one fit all? A controlled study on virtual reality vs touch-screen interfaces on persons with neurodevelopmental disorders. *ArXiv*. [doi: 10.48550/arXiv.2404.15970](https://doi.org/10.48550/arXiv.2404.15970).
- [29] Yeh, C.-C., & Meng, Y.-R. (2025). Effectiveness of virtual reality social skills training for students with autism and social difficulties observed through behavior and brain waves. *Applied Sciences*, 15(9), article number 4600. [doi: 10.3390/app15094600](https://doi.org/10.3390/app15094600).

Денис Борисенко

Кандидат педагогічних наук, доцент

Харківський національний економічний університет імені Семена Кузнеця

61166, просп. Науки, 9А, м. Харків, Україна

<https://orcid.org/0009-0005-8227-6194>

Інклюзивна освіта у віртуальній реальності: нові горизонти доступності та участі

Анотація. Інклюзивна освіта спрямована на забезпечення рівних можливостей для навчання всіх студентів, незалежно від їхніх індивідуальних особливостей розвитку, когнітивних чи фізичних характеристик. Віртуальна реальність – це технологія, здатна створювати занурювальні, інтерактивні середовища, які можуть суттєво підвищити ефективність інклюзивних освітніх практик. У цьому дослідженні розглядався потенціал віртуальної реальності для подолання бар'єрів у навчанні шляхом аналізу успішних прикладів використання цієї сучасної технології для студентів з особливими освітніми потребами, зокрема з сенсорними порушеннями та розладами аутистичного спектра. Методи дослідження включали порівняльний аналіз, огляд кейсів та пілотне впровадження віртуальних середовищ для студентів освітньої програми «Бізнес-дизайн» та додатково для учнів освітніх центрів. Результати показали, що віртуальна реальність ефективно створює адаптивні навчальні середовища та підтримує безпечну соціальну взаємодію, розвиваючи емпатію через моделювання нового досвіду в нейротипових осіб. Кількісні дані зростання результатів тестів на 18 %, підвищення зосередженості на 22 %, продуктивності – на 15 % і самооцінки концентрації – на 20 %. Особи з особливими потребами також продемонстрували значний прогрес: розуміння матеріалу зросло на 25 %, навички розв'язання проблем – на 20 %, а участь у груповій роботі – на 30 %. Використання віртуальної реальності сприяло підвищенню залученості студентів, покращенню когнітивних і соціальних навичок, а також створенню можливостей для досвідного навчання у безризиковому середовищі. Практичні результати включають розробку інтерфейсів віртуального середовища для користувачів із порушеннями зору та спеціалізованих тренінгових модулів для розвитку соціальних навичок у студентів з аутизмом.

Ключові слова: адаптивні навчальні середовища; спеціальна освіта; освітні технології; цифрові інструменти; сенсорне навчання

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Тел.: +38 (044) 293-11-10
E-mail: mail@sets.com.ua
<https://sets.com.ua/>

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Tel.: +38 (044) 293-11-10
mail@sets.com.ua
<https://sets.com.ua/>