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Professional training of future teachers in the provision pre-medical aid with basics of tactical medicine in educational institutions

Abstract. The research is relevant due to life, health and safety threats to children and adolescents during the Russian-Ukrainian war. It led an increase in the number of injuries requiring urgent medical care. First aid knowledge in tactical conditions is essential for teachers working in combat zones, occupied territories and territories under fire. Teachers are responsible for children's safety at any time, in peace or war. The research was aimed at studying the theoretical and methodological aspects of training future teachers to provide pre-hospital medical care to children in educational institutions. Research methods: scientific medical and biological literature analysis showed a lack of foreign publications on the teacher training in providing pre-hospital care to children in educational institutions; scientific modelling helped to create models for training future teachers to apply knowledge and to process quantitative and qualitative empirical data analysis; questionnaires, pedagogical experiment and methods of mathematical statistics helped to determine the level of knowledge and practical skills in providing pre-hospital medical care among pedagogical specialities students of Hryhorii Skovoroda University in Pereiaslav. The discipline structure and content of "Pre-hospital medical training with the basics of tactical medicine" for pedagogical specialities is revealed. The discipline introduction has increased interest in its study and the expediency of mastering practical skills. Research among Hryhorii Skovoroda University in Pereiaslav students has shown the training effectiveness of future teachers in this area. The future teachers professional training in the martial law conditions in Ukraine requires knowledge and practical skills of providing pre-medical care to children in educational institutions. The discipline studying "Pre-hospital medical training with the basics of tactical medicine" develops competences in the tactical medicine basics, ability to diagnose and provide pre-hospital care. This will contribute that future teachers will work effectively and be ready to help children if necessary

Keywords: war; trauma; emergencies; training; students; pre-school education; school education

INTRODUCTION

Children's and adolescents' safety and health in emergencies is one of the most pressing issues of modern days. In this regard, there is a need to develop competencies in health protection and safe behaviour as a prerequisite for a stable and fulfilling life. In that context, the study focused on fill the gap in children's awareness of emergency

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behaviour and lack of knowledge and practical skills in providing pre-hospital care. In the period of the large-scale Russian-Ukrainian war, these issues are particularly important for all participants in the educational process. An important step in this direction were the changes in the future teachers' professional training in providing pre-hospital medical care to children in educational institutions. A special emphasis is placed on tactical medicine.

Not only military personnel, but also other professionals who are in combat zones, occupied territories and territories that are exposed to artillery and rocket attacks need to be provided with the specifics of pre-hospital care in tactical conditions. According to medical research, the absence of pre-hospital medical care for victims within the first hour after injury increases the likelihood of death by 30%, within 3 hours – by 60%, and within 6 hours – by 90% (Gudzevych & Prokopenko, 2021). That is why, in the present martial law conditions, every Ukrainian citizen should know the basic rules of pre-hospital medical care. At the same time, timely and properly provided pre-hospital medical care not only saves the victim's life, but also contributes to further successful treatment and prevents the serious complications development, reduces the risk of injury and disability. Pre-hospital medical care and the basics of tactical medicine knowledge is essential for a future teacher who bears moral and legal responsibility for the safety, children and adolescents' life and health preservation. In this regard, in professional teacher training process, there is a necessity to study the following disciplines: "Fundamentals of Medical Knowledge", "Pre-hospital Medical Care", "Pre-hospital Medical Aid with the Basics of Tactical Medicine".

One of the main tasks for the New Ukrainian School is to create a safe educational environment in educational institutions. This is also stated in the Law of Ukraine No. 2925 (2023) and the Law of Ukraine No. 2849-IX (2022). The expediency of future teachers' knowledge formation on the basics of providing pre-hospital medical care in emergencies is also evidenced by a number of legal documents. In particular, Article 1 of the Law of Ukraine No. 2581-IX (2022) states that premedical care is provided by persons who do not have a medical education, but in accordance with their professional duties must have knowledge and practical skills to provide such care in emergency conditions in order to save human life (We know, we act, 2022). Accordingly, the timely provision of pre-hospital medical care to all participants in the educational process in order to preserve their lives and health requires appropriate knowledge and practical skills of teachers and the ability to apply them if necessary. In this regard, the study purpose was to examine the theoretical and methodological aspects of training future teachers to provide pre-hospital medical care to children in educational institutions.

According to the research purpose, the following tasks were formulated: to analyse the state of future teachers' training in pre-hospital medical care and the tactical medicine basics in domestic and foreign literature; to reveal the structure of the educational component "Pre-hospital medical care with the basics of tactical medicine" and its content; to find out the content and essence of the "tactical medicine" concept in the training process of future teachers in higher pedagogical educational institution; to determine the level of future teachers' training to provide pre-hospital medical care to children and adolescents in the educational process. The scientific novelty of the results obtained is that the knowledge level and practical skills of pedagogical specialities' higher education students in the study process of the EC "Pre-hospital care with the basics of tactical medicine" and its significant importance and effectiveness during martial law in Ukraine are determined.

MATERIALS AND METHODS

The study was carried out within the framework of the research topic of the Hryhorii Skovoroda University in Pereiaslav on the Health and Life Safety Department "Health Saving Competence Formation in Children, Pupils and Students in the Continuing Education System: Medical, Biological, Psychological and Pedagogical Aspects". Research methods used: theoretical (review and analysis of Ukrainian and foreign scientists' medical and biological literature on the problem under study, scientific modelling method to create a model of training future teachers to apply pre-hospital medical care knowledge and skills to students in educational institutions; empirical: (questionnaires, observations, pedagogical experiment among higher education students of Hryhorii Skovoroda University); mathematical statistics methods to process quantitative and qualitative empirical analysis data. The study was conducted during the academic years 2022-2023 and 2023-2024 among 462 students of 1-4 years full-time and part-time studying in pedagogical specialities: "012 Preschool Education", "013 Primary Education", "014 Secondary Education (Ukrainian Language and Literature)", "014 Secondary Education (Language and Literature (English))", "014 Secondary Education (Biology and Human Health)", "014 Secondary Education (Geography)", "014 Secondary Education (Natural Sciences)", "014 Secondary Education (Physical Education)", "014 Secondary Education (Mathematics)", "015 Vocational Education (Occupational Health and Safety)", "015 Vocational Education (Digital Technologies)". All study participants were informed about the survey results use and that all the provisions of the Declaration of Helsinki (2013) were followed during the survey. An anonymous survey was conducted to determine the future teachers desire to acquire knowledge of providing pre-hospital medical care to children and adolescents in educational institutions and tactical medicine basics. The author's questionnaire consisted of ten questions and four answers to them:

1. Do you think it is important to know pre-hospital care and tactical medicine basics: a) yes, very important; b) yes, but not necessarily; c) not sure; d) no, not important.

2. Are you interested in providing pre-hospital medical care with the basics of tactical medicine in extreme

situations: a) yes, very interested; b) yes, a little; c) not very interested; d) no, not interested.

3. Are you ready to attend additional classes on pre-hospital medical care with tactical medicine basics: a) yes, I am ready; b) yes, if I have time; c) not sure; d) no, I am not ready.

4. How often do you think about the possibility of providing pre-hospital medical care with tactical medicine basics in an emergency case: a) very often; b) sometimes; c) rarely; d) never.

5. Do you think that the pre-hospital medical care knowledge with tactical medicine basics can be useful in your future profession: a) yes, definitely; b) maybe; c) not sure; d) no.

6. Are you ready to devote your personal time to studying pre-hospital medical care with tactical medicine basics: a) yes, I am ready; b) yes, but not much; c) not sure; d) no, I am not ready.

7. Which learning format would be more convenient for you to master pre-hospital medical care knowledge with tactical medicine basics: a) lectures and practical classes; b) online courses; c) materials self-study; d) not interested.

8. Are you ready to participate in practical trainings on pre-hospital medical care providing with the basics of tactical medicine: a) yes, definitely; b) yes, maybe; c) not sure; d) no, not ready.

9. Do you think that tactical medicine knowledge can increase your confidence in crisis situations: a) yes, of course; b) maybe; c) not sure; d) no.

10. How would you rate your current awareness of pre-hospital and tactical medical care: a) very high; b) medium; c) low; d) not aware at all.

The survey results were analysed and presented in the table below.

RESULTS AND DISCUSSION

In martial law conditions in Ukraine, the educational process is endangering children's and adolescents' lives and health. It is associated with air raid warning signals, rocket and artillery attacks, hostilities and the presence of a significant number of children in the occupied territories. All this requires readiness to provide emergency pre-hospital medical care to children in case of various injuries. These issues are constantly on doctors' and teachers' minds. Future teachers' professional training in providing pre-hospital medical care to children in educational institutions is addressed in a number of educational and methodological manuals and work programmes published by Ukrainian scholars in recent years. For example, in the textbook "Pre-hospital care with the basics of tactical medicine", which is recommended for pedagogical specialities of higher education institutions, the authors N.I. Kotsur *et al*. (2023) highlight the basic rules for providing pre-hospital care to victims both in peacetime and in military field conditions for various injuries and traumas. The authors focus on providing pre-hospital care for bleeding, open and closed injuries, transport immobilisation methods, first aid for injuries of various locations, head, chest, abdomen, artificial lung ventilation and indirect heart massage, emergency medical care for acute poisoning and exposure to high and low temperatures. Pre-hospital medical care provision to victims in peacetime is described by N.I. Kotsur & L.P. Tovkun (2021), also in the textbook "Medical Knowledge Fundamentals". Similar manuals for non-medical specialities applicants were published by R.V. Burdeniuk & S.P. Gvozdiy (2021), T.L. Bilous (2020), A.M. Lyashevych *et al*. (2021) and others.

Theoretical and practical foundations of medical knowledge, presented at the modern level are disclosed in the textbook "Pre-hospital care in emergency conditions" by I.O. Kalynychenko *et al*. (2023). Based on updated methodological approaches, the authors present a modern algorithm for providing pre-hospital medical care to injured persons in emergency conditions. Authors' particular attention is paid to the preparation of higher education students for practical classes and situational tasks during distance learning. Pre-hospital medical care provided to victims of emergencies issue is highlighted in a number of educational and methodological manuals. For higher medical education students, it is recommended to use manuals that provide more thorough coverage of first aid for various traumatic injuries in the combat zone and describe methods of transporting victims to medical facilities. In particular, the textbook "First Emergency and Tactical Medical Care at the Pre-Hospital Stage" edited by V.S. Tarasiuk *et al*. (2021) analyses the methods of providing emergency medical care in emergencies. The authors recommend certain aspects of pre-hospital medical care for non-medical specialists to master their practical skills. Similar information is covered in the textbook "Emergency and Urgent Medicine. First Aid and Medical Care" by G.I. Slobodianyk (2021). This manual is recommended both for military medics in providing emergency medical care in the combat zone and for civilian doctors to provide such care in emergencies.

The practical manual "Premedical Training at the Incident Site" by P.B. Volyansky *et al*. (2020) covers the algorithms for providing premedical care at the incident site by rescuers of the State Emergency Service (SES). The manual content is adapted to "The First on the Spot" educational and training programme. According to the authors, the manual is also useful for teaching non-medical higher education students and heads of executive authorities, various institutions and organisations. Teachers' professional training issues in providing pre-hospital care to children in pre-school and school education institutions are covered in the working curricula of higher education institutions, which are published on their websites. In particular, Hryhorii Skovoroda University website has published a working curriculum for the educational component "Pre-medical training with tactical medicine basics", which is recommended by the Academic Council for all pedagogical specialities (Working curriculum..., 2023); the work programme of the discipline "Pre-medical aid in emergency conditions" is recommended for the speciality 227 "Physical therapy,

occupational therapy" at the Petro Mohyla Black Sea National University (Mykolaiv) (Work programme of the discipline "Pre-medical aid in emergency conditions", 2022); the work programme of the discipline "Pre-medical aid" for the specialty 227 "Physical therapy, occupational therapy" at Uzhhorod National University (Work programme of the discipline "Pre-medical aid", 2022), and others. Future teachers can get acquainted with the practical course "First medical aid in war conditions" on the Prometheus educational platform, where they can learn the MARCHE algorithm (massive haemorrhage, airway, respiration, circulation, head injury/hypothermia, everything else), the general chronology of first aid for victims, signs of bleeding and how to stop it, the external cardiac massage basics, etc. The mentioned course is aimed at improving academic and pedagogical staff's competencies in first aid basic skills in war conditions (First medical aid in war conditions, 2022).

The training programme for pre-hospital medical care provision "We Know and Act", published on Ukrainian Medical Centre for Road Safety and Information Technology portal website, is designed for non-medical workers whose professional duties are related to pre-hospital medical care provision in accordance with the Order of the Ministry of Health of Ukraine No. 1627 (2022) and Order of the Ministry of Health of Ukraine No. 441 (2022), Order of the Ministry of Education and Science of Ukraine No. 64 (2022). The training and professional development programme for pedagogical staff includes theoretical and practical training and includes the following 3 premedical training courses: premedical care in case of sudden cardiac arrest in adults; premedical care in case of sudden cardiac arrest in children; premedical care in case of massive bleeding. It should be emphasised that the "We Know and Act" programme meets the standards set out in international requirements, in particular the BLS (Basic Life Support) programme, which focuses on life support basics and mastering practical techniques for providing emergency medical care in case of respiratory distress or respiratory arrest, cardiovascular disorders (We know, we act, 2022).

The theoretical and methodological aspects of training higher education students to provide pre-hospital medical care in emergency conditions and situations are covered in a number of publications by Ukrainian scientists. Particularly significant and valuable on this issue are the studies of T.S. Vaida (2019) and L.S. Gudzevych & Y.S. Prokopenko (2021). The authors conducted a medical and social substantiation of teaching students and adolescents premedical care practices, listed the practical premedical care skills that should be formed in Vinnytsia Mykhailo Kotsiubynskyi State Pedagogical University students, analysed teaching forms and methods. The study also reveals the stimulation technologies effectiveness in mastering practical premedical aid skills. The author highlights certain topics related to pre-hospital medical care provision, in particular, the importance of studying basic cardiopulmonary resuscitation by non-medical higher education students (Gudzevych, n.d.). The scientific work by V.M. Zyuz *et al*. (2021) highlights the relevance of teaching higher education students of all non-medical specialities the first aid basics, and the consequences of untimely first aid. The authors recommend the introduction of modern evidence-based data on injury prevention in the educational process, and in order to improve first aid effectiveness, they propose a knowledge and skills manual developed in accordance with the course curriculum "Medical Knowledge Fundamentals" and "Medical Training Course for Rescuers", which is approved by the Medical Department of the Ministry of Emergency Situations of Ukraine.

Innovative approaches to the teaching methodology of the discipline "Pre-hospital medical care" in the training process of future bachelors are revealed in the study by M. Demianchuk (2022). Some aspects of teaching higher education students the basics of pre-hospital care on the basis of 5 subject-subject interaction are disclosed in the monograph by S.P. Hvozdiy *et al*. (2021). In O.V. Kornilova's studies (2020; 2021), medical care is considered as a social security type. The author analyses the regulatory and legal support for medical care provision in emergencies and the main features of medical care. In line with modern scientific developments, it is worth noting the study conducted by M. Matvienko & V. Didkovsky (2023). The authors examine medical care basics as a knowledge area and an academic discipline for Ukrainian higher education institutions. The article points to the knowledge formation process on premedical training basics and its theoretical substantiation and methodological improvement as an academic discipline for students, cadets, and trainees.

Over the last few years, the scientific space has seen the foreign scholars publications on certain aspects of this issue. These are mainly publications that address general issues of first aid and pre-hospital care in emergency conditions and situations, which medical and non-medical students should master. In particular, the knowledge and practical first aid skills developed by medical and non-medical students are described in the study by S.O. Bashtan *et al*. (2019) and S. Basuhail *et al*. (2022). The study was conducted to determine the knowledge level and skills of first aid in case of emergencies among students of Kuwait Al-Hamis. The study results showed that the knowledge level of first aid in emergencies among medical students was significantly higher than among philology students. The knowledge and practical skills formation in first aid among non-medical undergraduate of Karachi University students and their attitude to the study of this issue is revealed in the scientific work by Z. Ahmer *et al*. (2020). The authors' research results indicate a low knowledge level of bachelor's students on providing first aid to victims in emergencies. In this regard, the authors proposed a first aid training programme recommended for school, college and university students and the general public. Similar studies were conducted by R. Riaz *et al.* (2020). By surveying medical and non-medical students from different universities in Karachi (Pakistan) on first aid provision for burns, it was found that most students had an insufficient level of knowledge

on this topic. This demanded the need to integrate this topic into the curriculum and to improve knowledge through multimedia and formal training courses as a mandatory way to improve knowledge.

The awareness level analysis of premedical care among multidisciplinary university students (Pakistan) conducted by Z. Hussain *et al*. (2021) also shows a low training level. The authors note that medical students are not sufficiently taught the theoretical aspects and practical first aid skills at the pre-hospital stage, and non-medical students are not taught this issue at all. As a result, many people in Pakistan die in road accidents or other emergencies due to first aid inaccessibility at the incident scene. In a publication by T. Huabbangyang *et al.* (2023) conducted a quasi-experimental study on the effectiveness of developing the operational pre-hospital emergency skills medical personnel in Thailand in hazardous areas. The researchers analysed hazardous sources related to terrorism or war, which lead to public health risks in developed and developing countries around the world. Using pre-test, post-test and questionnaire surveys on knowledge and confidence in cardiopulmonary resuscitation skills, the researchers evaluated the training programme effectiveness, which included three courses: the Emergency Medicine in Chemical, Biological, Radiation and Nuclear Hazards course (EM-CBRN); the Thai Tactical Emergency Medical Services course (TTEMS); and the Cooperation and Preparedness for Disasters course (CPD).

According to foreign sources analysis, there are few publications on this issue, which is connected with the absence of the extreme threats to human life and health that Ukraine is facing in 2014-2024. Despite the fact that children, adolescents, pupils and students are trained in knowledge and practical skills in foreign educational institutions, it has not been the subject of a separate study on the state of future teachers' training in providing pre-hospital medical care to children in recent years. At the same time, the publications of foreign scientists published in 2020-2024 are dominated by studies aimed at training medical students and military personnel in tactical medicine. M. Lv *et al*. (2022) on the successful and effective use of portable simulators to teach medical students first aid skills during combat; R. Cole *et al*. (2023) on the impact of high-fidelity simulation on medical students' readiness to provide care to the wounded in combat. F.K. Butler (2021) describes the developed course on tactical medicine for SEAL mission commanders. The authors K. Conyers *et al*. (2023) pointed out the importance of using tactical combat training guidelines by NATO's international partner military forces to provide medical care to the wounded.

The importance of studying the educational component (EC) "Pre-hospital medical care with the basics of tactical medicine" for future teachers is evidenced by the following facts: 1) the full-scale Russian-Ukrainian war, which causes a high injury rate among the civilian population, and especially among children and adolescents as a result of rocket and artillery shelling. All this requires a competent approach to the provision of pre-hospital care and appropriate training of specialists in higher education institutions, as well as qualified graduates training in tactical medicine; 2) insufficient medical care level for preschool and school-age children. The absence of medical staff in a number of educational institutions and, in this regard, the need to train teachers to provide pre-hospital care to children; 3) state regulatory documents implementation, in particular: Decree of the President of Ukraine No. 195/2020 (2020); Decree of the President of Ukraine No. 210/2020 (2020); Decree of the President of Ukraine No. 894 (2019); Concept for the implementation of state policy in the field of reforming general secondary education "New Ukrainian School" for the period up to 2029, approved by the Cabinet of Ministers of Ukraine (Order of the Cabinet of Ministers of Ukraine No. 988..., 2016); Concept for the development of mental health care in Ukraine for the period up to 2030; The National Programme of Mental Health and Psychosocial Support (National programme of..., 2022); 4) the absence of healthy and safe lifestyle habits among the vast majority of children and students, insufficient safe behaviour and non-violent, conflict-free communication skills development, etc; 5) psychological well-being disorders among children and adolescents, manifested by depression, increased anxiety and aggression, suicide attempts; 6) insufficient education effectiveness that provides safety, social and health education components, media and digital literacy of students, which can contribute to safe living, health maintenance and promotion, healthy lifestyle, and secure communication.

Developing a responsible attitude to life, health and safety in children and adolescents is an integrated process that should involve not only healthcare professionals, but also teachers and parents. It is only through joint efforts that we can ensure a healthy and safe educational environment to preserve children's lives and health, promote their somatic and mental health, and raise an educated, healthy and harmonious personality. A key part in this process is the future teachers professional training to develop their knowledge and practical skills in providing pre-hospital medical care to children in urgent conditions and emergencies. In this regard, the inclusion of the discipline "Pre-hospital medical care with the basics of tactical medicine" in the educational professional programmes (EPP) for all pedagogical specialities contributes to solving this problem, especially in the context of martial law in Ukraine.

Purpose of teaching the discipline is to teach higher education students to provide pre-hospital medical care at the scene, in emergency situations or dangerous circumstances, in war, active combat zones, areas of shelling. *The main tasks* solved in the teaching process of the EC "Pre-hospital medical care with the basics of tactical medicine" are: to master the basic principles of tactical medicine and their application in real situations; mastering the correct assessment skills of the victim's condition and rapid life threats detection; learning effective pre-hospital care methods for injuries, traumas or diseases; communication and

leadership skills development for cooperation with other team members and pre-hospital care organisation in emergency situations. In studying the EC "Pre-hospital medical care with the basics of tactical medicine", future teachers should develop both general and special (professional) competences. General competences include the ability to make informed decisions about the personal and public health preservation, pre-hospital medical care provision at the scene, in emergency or dangerous circumstances, in war, active combat zone, shelling areas; the ability to learn and master modern knowledge about health preservation and provision of necessary pre-hospital medical care and tactical medicine under certain conditions. Special (professional) competencies include the ability to master basic concepts and ideas about tactical medicine basics, special equipment knowledge for rescuing the wounded during hostilities; ability to timely diagnose the scope of pre-hospital medical care; methodological rules for providing first aid to victims and rules for evacuating the wounded to hospitals.

The study subject of the EC "*Pre-hospital medical care with the basics of tactical medicine*" is the scientific and methodological foundations of pre-hospital medical care organisation with tactical medicine basics, which are aimed at the effective formation of future teachers' motivations, skills and abilities, useful vital competences of human health care in the life process. A special place in the discipline study is given to familiarising future teachers with pre-hospital medical care providing and tactical medicine techniques for bleeding, open and closed injuries, acute poisoning, exposure to high and low temperatures, transport immobilisation, pre-hospital medical care for head, chest, abdominal injuries, artificial lung ventilation and indirect heart massage. As a studying result and mastering the main provisions of the EC "Pre-hospital medical care with the basics of tactical medicine" the higher education student should know clinical and biological death signs; resuscitation basics; pre-hospital medical care basics for some pathological conditions (burns, frostbite, electric shock, prolonged compression syndrome, poisoning, fractures, bleeding, traumatic shock, wounds, etc.) and sudden illnesses in normal conditions and in extreme situations; pre-hospital diagnostics basics, sudden illnesses (including epidemic processes) and pathological conditions classification; pre-hospital medical care techniques in different conditions aimed at preventing complications and rescuing the victim; medical care basics during military operations.

The theoretical and practical training of future teachers in the EC "Pre-hospital medical care with the basics of tactical medicine" according to the working curriculum approved by the Academic Council of Hryhorii Skovoroda University in Pereiaslav in 2023 involves the following topics study:

1. Medical care and tactical medicine general concepts;
2. Bleeding. Open injuries (wounds). Pre-hospital medical care in stopping bleeding and open injuries;
3. Closed injuries. Pre-hospital medical care;
4. Pre-hospital medical care for head, chest and abdominal injuries;
5. Pre-hospital medical care in emergency conditions;
6. Restoration of airway patency for the wounded in military field conditions;
7. Providing pre-hospital medical care to children in emergency conditions;
8. Pre-hospital medical care in case of exposure to high and low temperatures, electric current, poisoning, poisonous snake, insect and animal bites.

While studying the topic "*Medical care and tactical medicine general concepts*", higher education students get acquainted with medical care types, tactical medicine general concepts, determining the scope of pre-hospital care at the scene, pre-hospital medical care stages for the wounded in military field conditions, using first aid means. As noted above, it is important for a teacher to have knowledge and practical skills in providing pre-hospital medical care, which includes a set of basic urgent (operational) measures aimed at providing medical care to children in case of emergency critical conditions that may arise in the educational environment, during man-made accidents, disasters, acute therapeutic, neurological, terminal conditions in order to preserve their life and health, reduce the severity of the injury or disease, and prevent complications.

Under martial law, teachers should have knowledge of tactical medicine. It is important to distinguish between the concepts of "first aid" and "tactical medicine". First aid includes emergency medical measures that are carried out urgently at the accident scene. As a rule, it is provided by non-medical workers directly at the accident scene. By analysing the literature, the essence of "tactical medicine" concept was clarified. The vast majority of scholars interpret this concept as pre-hospital medical care provision in the combat zone. A similar definition is given in online sources. According to researchers, medical care provision in tactical conditions is significantly different from the provision of such care in hospitals, ambulances, etc. (Tactical medical aid: self-help and life-saving skills for the wounded, 2022).

It should be emphasised that tactical medicine emerged as an independent medicine field after the emergence of the TCCS, TEMS (National Association of Emergency Medical Technicians (NAEMT) guidelines and similar algorithms and training programmes. These associations belong to the professional union of emergency medical service (EMS) workers in the United States of America, which represents all emergency medical technicians (EMT) and paramedics. In recent years, NAEMT has become an international organisation. In Ukraine, this medical care area began to spread in 2014 during the Anti-Terrorist Operation in eastern Ukraine to provide pre-hospital medical care in combat zones according to NATO (North Atlantic Treaty Organisation) standards. According to researchers, the introduction of this course in the armies of NATO countries has led to a significant reduction in the number of deaths from injuries (Tarasiuk *et al.*, 2021). Given its high effectiveness, TCCS is now recommended for all military personnel and medics involved in combat operations.

The algorithm for assessing the victim's condition is particularly important in tactical conditions. For various terminal conditions, standard pre-hospital care measures have been established, approved by the Order of the Ministry of Health of Ukraine No. 398 (2014). The document substantiates the victim's assessment timeframe and the sequential examination rule according to the "ABCC" scheme: A – airway patency examination; B – respiratory assessment; C – blood circulation; C – if a spinal injury is suspected, cervical spine observation and cervical collar application. These are the measures that should be followed when providing pre-hospital medical care to victims of war (Kotsur *et al*., 2023).

Given the combat injuries, pre-hospital medical care effectiveness depends primarily on special equipment for rescuing the wounded during hostilities. For this purpose, tactical individual first aid kits (IFAKs) are used, which must be provided to all military personnel. When providing pre-hospital medical care, a modern tactical first aid kit should be equipped with all the means in accordance with the rules of care (C-A-B-C). During the practical classes, future teachers get acquainted with individual first aid kits (IFAK – Individual First Aid Kit) means such as haemostatic agents, airway aids, respiratory aids, and master practical skills in their use. When considering the topic "*Bleeding. Open injuries (wounds). Pre-hospital medical care in stopping bleeding and open injuries*", higher education students learn about bleeding and wound types, bleeding features to stop in tactical conditions. During the practical training, students learn the points of pressure on the arterial trunks and master the technique of temporary bleeding control using this method; applying a pressure bandage; tight wound tamponade; maximum limb flexion in the joint; and the rules for applying a tourniquet and tourniquet twist.

Mastering the technique and skills of tourniquet application is of great importance for a future teacher. The most common bleeding stops methods in military field conditions include: 1) applying an Israeli compression bandage; 2) Esmarch's tourniquet, SVAT (Self-Adjusting Venous Arterial Tourniquet); 3) C.A.T. tourniquet (Combat Application Tourniquet). Particular attention is paid to the correctness and timeliness of tourniquet application. In this regard, higher education students make several attempts. As noted in the study by L.S. Gudzevych (n.d.), the experiment participants learned to apply tourniquets correctly under normal conditions on average after 14 attempts (Esmarch tourniquet), 12 attempts (SVAT), and 12 attempts (CAT). The tourniquet application time was 10 seconds.

Studying the topic "*Closed injuries. Pre-hospital medical care*", students' special attention is focused on closed injuries types and pre-hospital care for them. During the class, higher education students get acquainted with transport splints; master transport immobilisation techniques for fractures of the spine, collarbone, ribs, upper extremities, pelvic and lower extremities; learn the behavioural rules for injured victims; methods of transferring victims. The practical skills development of immobilisation (creating immobility (rest) in various injuries in case of various diseases) is carried out through the various splints usage (fixation and distraction). An example of a fixation splint is a ladder splint (Kramer), and a distraction splint is a Dieterichs splint. In addition, higher education students master the technique of applying improvised (from improvised materials) splints to various injured parts of the human body. In the practical lesson on "*Pre-hospital medical care for head, chest and abdominal injuries*", students learn the pre-hospital medical care sequence for skull and brain injuries; closed and open chest injuries; injuries to the eyes, ears and nose; closed and open chest injuries; abdominal injuries and acute abdominal diseases. Particular attention is paid to the following issues such as the main symptoms of closed head injuries (concussion, bruise, brain compression); penetrating head injuries symptoms; main symptoms of closed chest and thoracic injuries; the pneumothorax and haemothorax concept; closed abdominal injuries, main symptoms; main symptoms of acute abdominal diseases.

A prominent place in studying the discipline is occupied by the topic "*Pre-hospital medical care in emergency conditions*". Higher education students master the concepts of resuscitation and terminal conditions, study the factors that contribute to terminal conditions onset, clinical and biological death symptoms. During the class, higher education students learn about the indications for resuscitation and the victim's preparation for it; master the methods for performing mouth-to-mouth, mouth-to-nose, mouth-to-mouth and nose artificial lung ventilation for children and the Kalistov method, external (indirect) heart massage for adults and children. The topic study focusses on the effectiveness of pre-hospital medical care in terminal conditions. When defining biological death, special attention is paid to its relative and obvious signs. Future teachers also learn the algorithm for providing pre-hospital medical care to unconscious victims by non-medical professionals. In military field conditions and during artillery and rocket attacks as for respiratory damage and heart failure as a result of injuries, the victim's life will depend on pre-hospital medical care timeliness. In this regard, the topic studying "*Restoration of airway patency for the wounded in military field conditions"* is particularly important. During the class, higher education students learn about restoring airway patency methods to the wounded in military field conditions; master such breathing recovery methods as tilting the head back and lifting the chin, "look – listen – feel", the use of a nasopharyngeal airway and medical equipment to open the airway and support the wounded breathing, including an Ambu bag, an I-Gel supraglottic airway, and an intubation kit for unconscious wounded. The class uses tables and thematic stands, presentations, and appropriate equipment for opening the airway and maintaining the wounded's breathing.

It is known that during the war, the number of wounded children increases, both in the educational environment and outside it, which requires immediate pre-hospital

medical care. That is why it is important for a teacher to have knowledge of the topic "*Peculiarities of providing pre-hospital medical care in case of emergency and terminal conditions to children*". It should be emphasised that pre-hospital medical care provision for children is different from that for adults. This is primarily due to the anatomical and physiological characteristics of their body. When studying the topic, higher education students learn the rules for providing pre-hospital medical care for the following emergency conditions in children such as sudden respiratory and cardiac arrest, first aid; fainting; burns, degrees of severity, frostbite, drowning; ingestion of foreign bodies into the nose, trachea, bronchi; bruises, dislocations, fractures: causes, manifestations; sunstroke and heatstroke; acute food poisoning, its prevention; non-bacterial poisoning, its causes, manifestations; poisonous snakes, animals, insects bites and pre-hospital medical care.

In studying the topic "*Pre-hospital medical care in case of high and low temperatures, electric current*", higher education students learn the rules and techniques of providing first aid due to various burns types, hypothermia, frostbite, electrical injuries, and lightning strikes. The practical course "Pre-hospital medical care with the basics of tactical medicine" is aimed at consolidating theoretical material and developing skills in providing pre-hospital medical care to children. In the practical training process, future teachers acquire diagnostic skills, classification of sudden illnesses and pathological conditions (ability to measure body temperature, blood pressure, determine and assess pulse, breathing, etc); techniques for providing pre-hospital medical care and tactical medicine for bleeding, open and closed injuries, acute poisoning, exposure to high and low temperatures, transport immobilisation, pre-hospital medical care for head, chest, abdominal injuries, artificial lung ventilation and indirect heart massage; use the acquired knowledge not only in everyday life and daily professional activities in peacetime, but also during martial law in Ukraine.

Checking the preparedness level of future teachers to provide pre-hospital medical care to children in preschool and secondary education institutions is carried out through current control. The current control objects are systematic and active work of higher education students in practical classes; independent tasks performed by higher education students. In order to test students' knowledge, each lesson includes control questions, situational tasks, test tasks and tasks for independent work, which is carried out on specific topics in accordance with the work curriculum. Solving situational tasks enables higher education students to improve their theoretical knowledge and practical skills. Upon studying the EC "Pre-hospital medical care with the basics of tactical medicine", future teachers should be able to analyse and assess risks, problems in professional activities and choose effective ways to solve them in the case of providing pre-hospital medical care and tactical medical care; be responsible for decision-making within their competence, adhere to professional ethics standards; apply national and international standards and practices in professional activities to provide pre-hospital medical care in educational institutions. In this regard, during the academic year 2022-2023, an empirical study was conducted to determine students' desire to gain pre-hospital medical care knowledge with tactical medicine basics. Based on anonymous questionnaire responses from 1-4 year students of full-time and part-time forms of study at Hryhorii Skovoroda University in Pereiaslav, the results are presented in Table 1:

Table 1. Results of the questionnaire, %

1. Do you think it is important to know pre-hospital care and tactical medicine basics:							
a) yes, very important		b) yes, but not necessarily		c) not sure		d) no, not important	
number of students	%	number of students	%	number of students	%	number of students	%
337	72.9	83	17.9	32	6.9	10	2.2
2. Are you interested in providing pre-hospital medical care with the basics of tactical medicine in extreme situations:							
a) yes, very interesting		b) yes, a little		c) not very interesting		d) no, not interested	
number of students	%	number of students	%	number of students	%	number of students	%
296	64.1	88	19.04	41	8.8	37	80
3. Are you ready to attend additional classes on pre-hospital medical care with tactical medicine basics:							
a) yes, I am ready		b) yes, if I have time		c) not sure		d) no, I am not ready	
number of students	%	number of students	%	number of students	%	number of students	%
263	56.9	83	17.9	69	14.9	47	10.17
4. How often do you think about the possibility of providing pre-hospital medical care with tactical medicine basics in an emergency case:							
a) very often		b) sometimes		c) rarely		d) never	
number of students	%	number of students	%	number of students	%	number of students	%
281	60.8	143	30.9	36	7.8	2	0.43

Table 1. Continued

5. Do you think that the pre-hospital medical care knowledge with tactical medicine basics can be useful in your future profession:							
a) yes, definitely		b) maybe		c) not sure		d) no	
number of students	%	number of students	%	number of students	%	number of students	%
228	49.4	97	20.9	69	14.9	68	14.72
6. Are you ready to devote your personal time to studying pre-hospital medical care with tactical medicine basics:							
a) yes, I am ready		b) yes, but not much		c) not sure		d) no, I am not ready	
number of students	%	number of students	%	number of students	%	number of students	%
185	40.04	106	22.9	87	18.8	84	18.18
7. Which learning format would be more convenient for you to master pre-hospital medical care knowledge with tactical medicine basics:							
a) lectures and practical classes		b) online courses		c) materials self-study		d) not interested	
number of students	%	number of students	%	number of students	%	number of students	%
251	54.3	124	26.8	60	12.9	27	5.84
8. Are you ready to participate in practical trainings on pre-hospital medical care providing with the basics of tactical medicine:							
a) yes, definitely		b) yes, maybe		c) not sure		d) no, not ready	
number of students	%	number of students	%	number of students	%	number of students	%
297	64.3	87	18.8	50	10.8	28	6.06
9. Do you think that tactical medicine knowledge can increase your confidence in crisis situations:							
a) yes, of course		b) maybe		c) not sure		d) no	
number of students	%	number of students	%	number of students	%	number of students	%
241	52.2	170	36.7	36	7.8	15	3.24
10. How would you rate your current awareness of pre-hospital and tactical medical care:							
a) very high		b) medium		c) low		d) not aware at all	
number of students	%	number of students	%	number of students	%	number of students	%
-	-	-	-	217	46.9	245	53.03

Source: developed by the authors

Consequently, the respondents majority (72.9%) considered knowledge of pre-hospital care and tactical medicine to be very important, while only a small proportion (2.2%) considered it not important. The overwhelming majority of respondents (64.1%) showed a strong interest in the topic, while only 8% were not interested in the topic at all. More than half of the respondents (56.9%) are ready to attend additional classes, which indicates a high motivation to learn. A significant proportion of respondents (60.8%) often thought about providing first aid, which indicated their awareness and readiness to act in crisis situations. Almost half of the respondents (49.4%) considered this knowledge to be definitely useful for their future teacher profession, which underlined its importance in the professional context. 40.04% of respondents are ready to devote personal time to studying pre-hospital care and tactical medicine basics, which demonstrates their high motivation to learn. Lectures and practical classes (54.3%) were considered the most convenient learning format by respondents majority, which underlined the importance of a combined approach to learning. The respondents majority (64.3%) indicated their willingness to participate in practical training, which indicates a high interest in practical skills. More than half of the respondents (52.2%) believed that tactical medicine knowledge could increase their confidence in crisis situations. The respondents majority (53.03%) considered their awareness of pre-hospital care and tactical medicine to be low or not aware at all, which highlighted the need to increase the knowledge level in this area. Overall, the survey showed that the respondents majority were aware of that knowledge was important for pre-hospital care and tactical medicine, showed a strong interest in this topic and were ready to devote time to study and practical training. At the same time, a significant number of respondents considered their current awareness to be low, which underlined the need to introduce the educational component "Pre-hospital medical care with the basics of tactical medicine" into professional education programmes. Following the preparatory work, the Academic Council of the Hryhorii Skovoroda University in Pereiaslav recommended in June 2023 that the EC "Pre-Hospital Medical Care with Tactical Medicine Basics" to be introduced as a mandatory educational professional programme component for all specialities. During the 2023-2024 academic year, according to the working curricula of pedagogical specialities, students mastered theoretical knowledge and practical skills in providing pre-hospital medical care with the basics of tactical

medicine. Based on the examination data of the final test control in this discipline for the first and second semesters, students received the following results on the ECTS scale (Table 2):

Table 2. The assessment of the final test control results of students' knowledge of 1-4 courses in the EC "Pre-hospital medical care with the basics of tactical medicine" for the first and second semesters of the academic year 2023-2024

Points	ECTS score	National score	Number of students	%
90-100	**A**	excellent	47	10.17
82-89	**B**	good	133	28.78
74-81	**C**	good	175	37.87
64-73	D	satisfactorily	48	10.39
60-63	**E**	satisfactorily	36	7.79
35-59	FX	unsatisfactory with the possibility of retaking	23	4.98
0-34	F	unsatisfactory with mandatory re-study of the discipline	-	-

Source: developed by the authors

Consequently, only 10.17% of students received the highest grade of "excellent" according to the ECTS (European Credit Transfer and Accumulation System), which indicates the high complexity of the discipline. More than half of the students (66.65%) received a grade of "good", which indicates a generally high level of knowledge. 18.18% of students passed the test with a satisfactory grade. This indicates that some students need additional attention or support in learning the material. 4.98% of students failed to pass the test the first time, but passed it successfully the second time. This is a relatively small proportion, which indicates some difficulties in learning the material. No student received the lowest grade, which required repeating the course. This is a positive indicator that shows that all students have achieved the minimum required knowledge level.

In summary, the assessments showed that the students' majority had a sufficient or high knowledge level of pre-hospital medical care with tactical medicine basics. More than 66% of students received a "good" grade, and only a small proportion (less than 5%) needed to repeat the course, which indicated that students generally mastered the material successfully. Comparing the study results with similar foreign studies, it should be noted that the level of students' knowledge of pre-hospital medical care depends on the feasibility and importance of studying this issue, the structure of the curriculum and its content. For instance, in the above-analysed studies by foreign scientists S. Basuhail *et al*. (2022), Z. Ahmer *et al*. (2020) found that medical students had a high level of readiness to provide medical care in emergencies. At the same time, non-medical students had a low level of such knowledge, which indicates that they were not adequately trained in this area at higher education institutions. The high and sufficient knowledge of pre-hospital medical care among pedagogical specialities students, as shown in this study, indicates the need and importance of studying this problem, especially during martial law, as well as in the emergencies event and situations in peacetime.

CONCLUSIONS

The current training state of future teachers in pre-hospital medical training and the basics of tactical medicine in pedagogical higher education institutions shows the expediency and importance of including the EC "Pre-hospital medical training with the basics of tactical medicine" in the EPP of all specialties; its structure and content are aimed at the effective formation of future teachers' motivations, skills and abilities, useful vital competences aimed at preserving the life, safety and health of children in educational institutions; knowledge of tactical medicine is necessary in the context of martial law in Ukraine, as teachers are legally and morally responsible for the safety and life of children. The analysed structure and content indicate the formation of a competence-based approach to pre-hospital care provision with tactical medicine basics for children in educational institutions, which contributes to the provision of safety, social and health components of education.

The theoretical and methodological aspects of preparing teachers to provide pre-hospital medical care to children in educational institutions have been the subject of scholarly research. At the same time, the lack of publications on this issue in the sources indicates the absence of the challenges and threats to human life and health that are typical during wars, in particular the large-scale Russian-Ukrainian war. The effectiveness of future teachers' professional training in providing pre-hospital medical care to children in preschool and school education is evidenced by the sufficient and high knowledge level of the studied problem among applicants (bachelors) for higher pedagogical education. The conducted research has shown the desirability of higher education of pedagogical specialities in acquiring knowledge and practical skills in providing pre-hospital medical care in emergency conditions and situations. Prospects for further research are to compare the knowledge and practical skills of providing pre-hospital care in emergency conditions and situations among higher education students of non-medical specialties.

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CONFLICT OF INTEREST

None.

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Професійна підготовка майбутніх педагогів із надання долікарської медичної допомоги з основами тактичної медицини у закладах освіти

Анотація. Актуальність дослідження зумовлена загрозами для життя, здоров'я та безпеки дітей і підлітків під час російсько-української війни. Вона спричинила зростання кількості травм, які потребують термінової медичної допомоги. Знання долікарської допомоги в тактичних умовах необхідні педагогам, які працюють у зонах бойових дій, на окупованих територіях і територіях, які обстрілюються. Педагоги відповідають за безпеку дітей у будь-який час, мирний чи воєнний. Метою дослідження стало вивчення теоретичних і методологічних аспектів підготовки майбутніх педагогів до надання долікарської медичної допомоги дітям у закладах освіти. Методи дослідження: аналіз наукової медико-біологічної літератури засвідчив про нестачу зарубіжних публікацій щодо підготовки педагогів із надання долікарської допомоги дітям у закладах освіти; наукове моделювання допомогло створити моделі підготовки майбутніх педагогів до застосування знань і для обробки кількісного і якісного аналізу емпіричних даних; анкетування, педагогічний експеримент і методи математичної статистики дали змогу з'ясувати рівень знань і практичних навичок із надання долікарської медичної допомоги серед студентів педагогічних спеціальностей Університету Григорія Сковороди в Переяславі. Розкрито структуру і зміст дисципліни «Долікарська медична підготовка з основами тактичної медицини» для педагогічних спеціальностей. Впровадження цієї дисципліни підвищив інтерес до її вивчення і доцільність оволодіння практичними навичками. Дослідження серед студентів Університету Григорія Сковороди в Переяславі показали ефективність підготовки майбутніх педагогів із цієї проблеми. Професійна підготовка майбутніх педагогів в умовах воєнного стану в Україні вимагає знань і практичних навичок надання долікарської допомоги дітям у закладах освіти. Вивчення дисципліни «Долікарська медична підготовка з основами тактичної медицини» формує компетентності щодо основ тактичної медицини, вміння діагностувати і надавати долікарську допомогу. Це сприятиме ефективній роботі майбутніх педагогів та їх готовності надавати допомогу дітям у разі необхідності

Ключові слова: війна; травми; невідкладні стани; підготовка; студенти; дошкільна освіта; шкільна освіта

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Specific pedagogical features of learning a second foreign language: Experience of Central Asian universities

Abstract. Mastering foreign languages expands the possibilities of communication and cooperation with international partners, which determines the relevance and significance of investigating the specific features of language competence in modern education. The purpose of this study was to examine the specific features of pedagogical activity in the field of language education, considering the challenges and requirements determined by the dynamics of the 21st century. This study employed the methods of systematic analysis, comparison, generalisation, and survey. The study found that learning a second foreign language for Central Asian university students is of immense importance for their educational, professional, and personal development. It was found that this process helps students to expand their language repertoire and increase opportunities for intercultural communication. Furthermore, the study highlighted that learning foreign languages contributes to the development of international cooperation and intercultural understanding, which is key to successful functioning in a global environment. The study found that a combination of conventional and modern language learning methods contributes to the comprehensive development of language skills and achievement of better learning outcomes. The study found that the conditions of the 21st century require higher education institutions to actively introduce modern digital technologies into learning foreign languages. The use of digital tools, such as virtual reality (VR), helps to create an engaging and effective learning environment that stimulates student motivation and promotes individual development. The survey of teachers found that a variety of methods and approaches to language teaching contributes to the development of students' language and communication skills. The findings of this study can be used by universities in Central Asia to improve foreign language learning programmes, develop more effective teaching methods and organise the learning process

Keywords: computer technologies; teaching methods; student motivation; intercultural communication; digitalisation of education

INTRODUCTION

The study of the pedagogical features of learning a second foreign language is necessary in the context of modern education. It helps understanding the processes of language learning and teaching in greater depth and identify effective approaches to optimise them. This allows considering the concrete cultural and social conditions that influence foreign language learning and adapting teaching methods and strategies to the needs of students. The study of pedagogical features contributes to the development of innovative approaches to teaching, the identification of new methods and technologies that improve the quality of learning and increase student motivation. It also promotes the professional development of teachers and the dissemination of modern pedagogical practices. The study of pedagogical features helps to improve the efficiency of the educational process and the development of intercultural communication, creating favourable conditions for language learning and contributing to the development of

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culturally competent individuals. Thus, the present study plays a key role in improving the quality of education and developing the modern educational environment.

The problematic of the study is that pedagogical aspects of foreign language learning cover a wide range of factors, such as teaching methods, student motivation, use of technology. Consideration of these aspects requires attention to detail and in-depth analysis. Pedagogical approaches may differ depending on cultural and social contexts, and therefore it is necessary to consider these variations and their impact on the effectiveness of foreign language learning.

H. Chmiel-Bożek (2023) notes the difficulties that teachers face when working with literature in secondary school foreign language classes, which are especially relevant in the context of initial language learning. The researcher emphasises that although the basic principles of the curriculum recommend the inclusion of literary texts, in practice this proves to be a challenge for many teachers. The researcher believes that by implementing simple exercises, it is possible to provide students with basic knowledge about the literary works of a given cultural environment and encourage them to create their own creative work using literary materials. However, a detailed investigation of this issue may reveal additional methods and strategies that will help teachers to integrate literature more effectively into learning a foreign language.

According to R. Kucharczyk (2022), the development of strategies in foreign language learning based on the use of the learner's own language resources is important. According to the researcher, this requires students to be able to manage their learning process and the emotions that occur in this process. Furthermore, the teacher should support students in adopting a reflective attitude towards their learning based on their previous experience of learning foreign languages, the researcher notes. The researcher emphasises that teachers should be aware of the importance of supporting students in managing their learning and emotions, as well as promoting the development of a reflective attitude towards their own learning. Additional study of the specific features of foreign language teachers' pedagogical activity will provide a better insight and allow implementing these strategies in teaching practice.

According to M. Pawlak (2022), expectations for foreign language teachers are constantly growing. Following the researcher's findings, if earlier it was important to be able to simply speak the language and know the teaching methodology, now there are much more requirements for teachers. The researcher emphasises that teachers should be experts in various fields, including promoting student autonomy, using strategic teaching methods, developing intercultural competence, considering individual differences, and using modern technologies. Furthermore, according to the researcher, teachers are expected to be practitioners of continuous improvement, actively involved in professional development. It is worth investigating the specific features of teaching a second foreign language by teachers of higher education institutions in greater detail.

The 21st century has seen considerable progress in digital technologies, which has opened new opportunities for modern language education. R. Zhang & D. Zou (2022) emphasise the potential of these technologies to respond to current and future challenges in the education sector. They define four key principles and benefits of using modern educational technologies, which include developing practical skills, providing quality learning material, increasing interactivity between participants in the learning process, and revising pedagogical strategies. Studying the use of innovative technological solutions, specifically the use of virtual platforms, can help to adapt educational systems to modern requirements and develop key competences in teachers working in the field of second language teaching.

As noted by researcher Y.J. Lan (2020), the use of virtual reality (VR) in the context of foreign language teaching is proving to be a key aspect. The researcher argues that VR can provide students with a deep immersion in the language environment, which is critical for successful language learning. According to Y.J. Lan's research, the use of VR allows for the creation of interactive language scenarios where students can interact with language in realistic situations, which helps to develop language skills and facilitates their acquisition. Specifically, the scientist notes that a prominent degree of immersion in VR creates authentic situations that reproduce various aspects of life, where students must use their language skills. Y.J. Lan emphasises that the use of VR in language teaching can make the learning process more interesting and effective, contributing to the development of language skills and understanding of speech. These observations demonstrate the significance and potential of using VR as an effective tool for teaching foreign languages, and therefore it is important to explore the features of VR implementation in the context of second language learning, namely, its impact on students' motivation and performance.

This study aimed to explore and evaluate the pedagogical methods used in Central Asian universities for teaching a second foreign language, for identifying effective strategies that improve linguistic skills and cultural knowledge among students.

MATERIALS AND METHODS

The systemic analysis method helped to consider the issue in a comprehensive manner, including various aspects and interrelationships between them. The application of this method offered a deeper insight into the processes of foreign language learning by students of Central Asian universities and their impact on educational, professional, and personal development. The method used also helped to illuminate this process, which contributed to a broader understanding of students' preparation for effective functioning in a global environment. In addition, the systemic analysis method identified the nuances of foreign language learning in Central Asian universities as an aspect of the development of international cooperation and intercultural understanding within the framework of training qualified personnel for various fields of international activity.

Using the method of comparison, it was found that the conditions of the 21st century require higher education institutions to actively introduce modern digital technologies into learning foreign languages. The application of this method revealed the specific features of using digital tools, specifically VR, as a favourable element for the learning environment, and also found how it contributes to individualisation of learning and increases student motivation. This method helped to investigate a variety of methods and approaches to language teaching. In addition, the method of comparison revealed the nuances of introducing modern technologies into language education at Central Asian universities.

The method of generalisation helped to investigate the aspects and nuances of VR, which made it possible to formulate and establish patterns that proved to be important for the further development of the problem under study. This method also helped to highlight the specific features of literature integration through various approaches and strategies as one of the important components of foreign language learning. This method also helped to clarify the aspects of combining conventional and modern methods of language learning within the framework of the comprehensive development of language skills of university students and achieving better results in foreign language learning.

The survey was conducted orally. The survey involved 100 foreign language teachers, which helped to collect a considerable amount of primary data on their opinions, views, and experiences regarding the process of teaching foreign languages at Central Asian universities. Women predominated among the survey participants, with 75 people, while men accounted for 25. The age range of respondents was quite wide, from 26 to 54 years for women and from 30 to 48 years for men. The survey was conducted anonymously, and all respondents were informed of how the information received would be used, all the provisions of the Declaration of Helsinki (2013) were also observed. The survey method helped to collect empirical data based on authors' own observations and the experience of direct participants in the educational process. The survey was conducted from 4 to 11 March 2024 in Warsaw, Poland.

The survey used closed questions:

1. Can the use of VR become a powerful tool for immersive language learning in Central Asian universities?

2. Do you often use modern digital technologies in your practice?

3. Is it important to adapt language teaching methods for students in a particular region, considering their cultural and linguistic characteristics?

4. Do Central Asian universities pay attention to the use of digital technologies in foreign language classes?

As well as open questions:

1. Which method is most effective in your teaching practice?

2. What digital tools do you usually use in your language lessons?

3. What problems usually arise when using digital technologies in foreign language lessons?

The results of the survey became a source for further analysis of the methods of teaching foreign languages in higher education institutions in Central Asia. Considering the wide range of opinions and views of the survey participants, conclusions were drawn about the effectiveness and feasibility of using different approaches to teaching foreign languages in higher education institutions.

RESULTS

Language education, especially in the context of learning a second foreign language, is crucial at universities in the Central Asian region. Central Asia has a complex linguistic map with a variety of language groups, such as Turkic, Iranian, and Indo-European languages. Studying a second foreign language enables students to expand their language repertoire and increase their opportunities for intercultural communication. This is critical in a university environment where students from different countries and language communities can learn and communicate together. Central Asia is at the centre of geopolitical and economic processes, which requires young people to be proficient in languages that are key to global communications and international relations. The study of foreign languages by the region's universities helps to prepare personnel who can communicate and work effectively in an international environment. The development of international tourism, business, and cultural exchange requires the availability of qualified translators, language teachers, and other professionals who can work in an intercultural environment. Universities in Central Asia play a key role in training such specialists through foreign language programmes. Thus, language education in the context of learning a second foreign language at Central Asian universities is important for the development of intercultural communication, international cooperation, and the training of qualified specialists who can work in a global environment.

In Asia, including Central Asia, several key trends can be identified that point to a wide range of challenges and strategies used in the field of language policy in the region. The first tendency is to try to promote and support the use of one language as the national language, which is often part of nation-building. This is especially true in countries where linguistic diversity is a major obstacle to the development of a unified national identity. The second trend is the declining prevalence of indigenous languages other than the national language and their absence in education in many countries in the region, which is of great importance for linguistic diversity and the preservation of the cultural heritage of national minorities, as such languages are often a key element of identity and community. The third trend is the promotion of English as the first foreign language in education systems, with other "foreign" languages playing a minimal role. This is due to globalisation strategies and countries' efforts to ensure that their citizens are competitive in the international labour market. However, this approach can also lead to the devaluation of linguistic diversity and cultural heritage (Liddicoat & Kirkpatrick, 2020).

In general, these trends demonstrate the complexity and diversity of language policy in Asia, including in its central region, where national, cultural, and global factors interact and influence the development of language strategies in the region. Research into these trends can contribute to a better understanding of the challenges faced by contemporary language policies and to achieving more effective and diverse approaches to language education and multilingualism. For students from the Central Asian region, learning a second foreign language in higher education may have some specific features due to cultural and linguistic differences (Table 1).

Table 1. Specific features of learning a second foreign language at Central Asian universities

Aspect	Description
Cultural context	Students from Central Asia may have a specific understanding and perception of cultural aspects that affect their foreign language learning. Their home environment and cultural values may influence their preferences and approaches to language learning.
Language fund	Depending on the language background of Central Asian students, they may face specific challenges, such as learning a language with a different linguistic structure or phonetic features.
Motivation	The motivation of Central Asian students to learn a foreign language can be related to various factors, such as international career opportunities, educational programmes abroad, or communication with representatives of other cultures.
Language policy	Certain aspects of language policy in the region may also have an impact on second language learning. For instance, the priority language of instruction at universities or the level of its implementation in the educational process can make a big difference for students.

Source: compiled by the author

In general, second language learning for university students in Central Asia takes place in the context of their unique cultural, linguistic and educational conditions, which affect their opportunities and approaches to learning. Integration of literature using various approaches and strategies is also important for learning a second foreign language. Starting with simple texts that are adapted to the students' level of knowledge, teachers can integrate literature into the language learning process. Such texts can include short stories, poems, or even excerpts from classical works (Gustanti & Ayu, 2021). Creating literary circles according to the interests and level of students. This can include discussions of the works studied, analysis of literary styles and themes, and creative assignments such as writing stories or poems. Using role-playing games based on literary scenes or characters can be an interesting tool for practising speaking and developing language competence. Tasks related to creating projects based on literary works can include writing book reviews, creating video presentations, theatrical performances, or dramatizing selected scenes. The use of audio and video materials based on literary works can provide a visual and aural experience that helps learners to better comprehend the text and expand their understanding of the language. These approaches can contribute not only to language learning, but also to the development of literary competence and the improvement of critical thinking of students in higher education.

Apart from the integration of literature, there is a range of conventional methods of teaching a second foreign language used in educational practice, including the grammar-translation method (Müller, 2023). The grammatical-translation method is one of the conventional methods of learning a second foreign language, which is actively used in educational practice. This method focuses on the grammatical aspects of language and their use in different communication situations. This method involves the systematic study of the grammatical rules of the language, such as tenses, moods, verb types, sentence structures. Students learn these rules and how to use them in practical tasks aimed at developing the ability to create their sentences and expressions. The principal idea is that students learn basic grammatical structures and can use them in their communication. When using the grammatical-translation method, students learn the rules of grammar and practice applying them through a variety of practical tasks. For instance, they can do exercises on translating or converting sentences from one tense to another or compose dialogues using grammatical structures they have learnt in their university language classes. This approach allows students to actively apply the rules they have learnt and acquire the ability to build logical and grammatically correct sentences.

The advantage of using the grammatical-translation method is that it provides a systematic approach to learning grammar, which helps learners to learn it consistently and effectively. Furthermore, this method helps to develop students' analytical skills and improve their language competence. However, it is important to bear in mind that the grammatical-translation method has its limitations. For instance, some learners may feel bored or tired of learning grammar rules all the time. Therefore, teachers need to combine this method with other approaches to provide variety in the learning process and keep students motivated. The grammatical-translation method stays a valuable and effective tool for language learning at Central Asian universities, but its use should be tailored to the individual needs and characteristics of students and complemented by other methods to achieve the best results.

Another approach to learning a second foreign language is the audiolingual method (Febriani & Setyawan, 2023; Bunyamin *et al*., 2023). The audiolingual method of learning a second foreign language is also one of the conventional approaches based on intensive listening and speaking training. This method is based on the idea that speaking should be taught like any other skill, through systematic practice and repetition. The purpose of the audiolingual method is to develop listening and speaking skills. Students listen to audio clips containing model utterances or real-life communication situations and try to imitate them, learning to pronounce words and phrases correctly. This method involves intensive immersion in the language environment, where students can immediately apply the structures and expressions they have learnt in real-life communication situations. Furthermore, the audiolingual method also includes the creation of one's own audio materials for training. Learners record their speech and play it back, and then analyse the results to identify mistakes and improve their skills. This process helps to activate language abilities and improves their oral communication.

One of the advantages of the audiolingual method is the emphasis on listening and speaking, which is crucial for the development of students' communication skills. Repeating the audio clips allows learners to improve their pronunciation and learn a natural intonation and rhythmic speaking style. However, the audiolingual method also has its limitations. For instance, it does not pay enough attention to grammatical structures and written language. This method may also be less effective for learning the complex grammatical aspects and academic style of speech inherent in studying at Central Asian universities. Therefore, it is important to combine the audiolingual method with other approaches to ensure the comprehensive development of students' language skills.

The dialogue method is one of the key conventional approaches to teaching a second foreign language and is based on the use of authentic dialogues and conversations to teach students the language. Students analyse the structure of dialogues, learn new words and expressions, and practice using them in real-life communication situations. This method helps to develop communication skills and language understanding through practical application. It allows students not only to learn individual language units, but also to enrich their vocabulary and improve their pronunciation by observing authentic examples of language use in real-life situations. Furthermore, the dialogue method helps to increase learners' motivation as it ensures their active involvement in the learning process and gives them the opportunity to feel more confident in communicating in the language as they practice using the language in real situations similar to those they may encounter in everyday life. The dialogue method is a vital component of second language teaching at universities, as it promotes active use of the language in real-life situations, which helps to improve the communication skills of students in the Central Asian region.

However, apart from conventional approaches to teaching a second foreign language, it is important for teachers of higher education institutions in Central Asia to use modern digital technologies, as globalisation, which is one of the key characteristics of the modern world affecting all spheres of life, including teaching and learning foreign languages. This influence is manifested through the increased mobility of people, capital, and technology, which leads to challenges and changes in learning methods. One of the principal consequences of globalisation is the destabilisation of traditional norms and conventions that have been used to prepare learners for effective language use outside the classroom. These changes make it necessary for pedagogy to develop more modern and effective approaches. Global dynamics require revision and adaptation of approaches to language teaching, so that they meet the current challenges and realities of global society. Specifically, the growth of international contacts and the need for intercultural communication creates a demand for foreign language skills. Accordingly, teaching methods should be aimed at developing such competences as understanding cultural differences, the ability to adapt and cooperate with representatives of different cultures.

Modern approaches to language teaching also include the use of digital technologies and interactive tools. Thanks to this, university students can actively interact with the language material and receive feedback in real time. Furthermore, the use of online resources allows students to learn a language at a time and place convenient for them, which contributes to increasing the accessibility of education (Kramsch, 2014). An essential part of the modern approach is also the development of language skills in real-life situations, which may include role-playing, discussions, interviews, and other forms of active communication. This helps students not only learn the language material but also gain confidence in using it. Globalisation requires constant updating of foreign language teaching methods to effectively prepare students for the demands of the modern world. This requires not only technical innovations, but also changes in pedagogical strategy aimed at actively integrating changes into the learning process.

The development of computer technologies has substantially changed the paradigm of foreign language learning in higher education institutions in Central Asia, providing new opportunities and tools for students and teachers. Virtual tools and resources open great prospects for improving the learning process and provide innovative methods of language learning. One of the principal advantages of using digital technologies is the ability to make the learning process more interesting and effective for students. Using interactive programmes, video tutorials, games, and virtual laboratories, students can actively interact with language material, which contributes to better learning and understanding of the subject (Blake, 2008). Technology also solves problems related to the convenience and availability of materials. Using online resources and mobile applications, students can have constant access

to learning materials, even outside the classroom, allowing them to study at any time and place of their choice, making the learning process more flexible and efficient. Individualisation of the learning process is another important advantage of using digital technologies. Using personalised programmes and adaptive exercises, teachers can factor in the different needs and knowledge levels of students, providing individual support and assistance to each one. The popularity of interactive online courses and language learning platforms shows a growing interest in the use of digital technologies in education. They provide students with the opportunity to learn a language at their own pace and according to their own schedule, while ensuring high quality learning.

Stimulating students' motivation in learning a second foreign language is a critical component for achieving success in learning and developing language skills. It is known that a motivated student is more likely to take an active part in classes and can achieve better results (Bagea, 2023). Therefore, educators focus on developing and implementing strategies to stimulate student interest and motivation. One of the key aspects of stimulating the motivation of university students is the creation of an encouraging immersive learning environment. The use of interactive teaching methods such as gaming technologies and VR can considerably increase students' interest in language learning. For example, game elements can be used to create engaging exercises and tasks that encourage students to actively take part and compete. Furthermore, it is important to consider the individual characteristics of students and their personal motives. University educators can use a variety of approaches, including differentiated instruction and individual counselling, to maintain and enhance each student's motivation. To ensure effective motivation of students, teachers should also consider the changes in communication style and language perception that occur when learning a foreign language. Specifically, students can develop a new style of speech and perception of cultural aspects of language under the influence of the learning process. Teachers need to be prepared to adapt their teaching and communication methods to these changes, contributing to the further development of students' language skills. It is important to emphasise that stimulating students' motivation in language learning not only improves their results, but also prepares them for successful communication in an international environment. A profound understanding of the cultural aspects of a language, as well as the motivation to learn it, create a solid foundation for effective international cooperation and understanding of intercultural differences.

Specifically, the use of VR can become a powerful tool for immersive language learning in higher education, as it opens promising opportunities (Yeh *et al.*, 2022). VR allows creating immersive learning environments where students can interact with language material by being transported to virtual situations. These are realistic scenarios where students can use their language skills in practical circumstances, such as virtual travel or communicating with people from a different culture. The use of VR can stimulate students' motivation to learn by making the process more interesting and exciting, and interactive scenarios can be a source of new opportunities for their development. Furthermore, VR allows creating situations of interaction with different cultures, which contributes to the development of intercultural competence. Thanks to individual scenarios designed to meet the needs and language proficiency of each student, VR facilitates personalised learning and more effective acquisition of language skills (Parmaxi, 2023). Notably, VR provides flexibility and accessibility to the learning process, allowing students to access virtual lessons and exercises wherever and whenever. The study surveyed teachers of higher education institutions in Warsaw who are familiar with approaches to language education in Central Asian higher education institutions (Table 2).

Table 2. Specific features of learning a second foreign language at Central Asian universities

No.	Question	Yes	No
1	Can the use of VR become a powerful tool for immersive language learning in Central Asian universities?	95%	5%
2	Do you often use modern digital technologies in your practice?	80%	20%
3	Is it important to adapt language teaching methods for students in a particular region, considering their cultural and linguistic characteristics?	96%	4%
4	Do Central Asian universities pay attention to the use of digital technologies in foreign language classes?	75%	15%

Source: compiled by the author

Most teachers are convinced that universities in Central Asia use a variety of methods and approaches to teach a second foreign language, just like their Polish colleagues. One of the most common methods mentioned by teachers is communicative and grammatical-translation methods combined with modern approaches. Furthermore, teachers emphasise that they often use interactive methods such as role-playing games, debates, and group projects in their practice, which allow students to actively interact with each other and develop not only language but also communication and social skills. According to the teachers, based on their personal experience of communicating with teachers in the Central Asian region, they also use these methods in their teaching. According to university professors, the effectiveness of these methods in the context of language education in Central Asia may vary depending on the particular university, group of students, and the specific features of the learning process. However, many teachers note the positive impact of the communicative method and interactive approaches on students'

language proficiency both among their colleagues and in their own practice.

The interviewed teachers note that it is important to adapt language teaching methods to the students of a particular region, factoring in their cultural and linguistic specifics. Some students may have particular learning needs in certain aspects of the language or may be more interested in certain methods, and therefore teachers need to adapt their approaches to the concrete needs and interests of their students. One of the problems that can arise when using some digital approaches in language education in higher education is the lack of resources or restrictions on access to modern technology, which can make it difficult to conduct practical classes or use interactive methods that require specific hardware or software. However, some universities are already introducing modern technologies into the educational process to improve foreign language learning. Many teachers said that they use video conferencing to interact with native speakers or specialised mobile applications for self-study. The advantages of modern technologies in language education, according to respondents, include convenience, accessibility, and the possibility of individualised learning. However, limitations may include technical problems, lack of teacher training in the use of modern technologies, and the need to constantly update software and equipment. The majority of teachers noted that universities in Central Asia are focusing on further developing the use of modern technologies in language education and are looking for ways to integrate the latest developments and approaches to improve the effectiveness and accessibility of foreign language learning for students.

Considering the respondents' answers and the findings of this study, it is worth noting that in the context of language teaching it is important to consider the role of the teacher's personality. The individual characteristics of the teacher and their interaction with the institutional identity and specifics of the educational process play a key role in shaping the learning environment. Understanding how teachers bring their personal characteristics and professional competences to bear on language teaching has implications for the quality of learning. Elements of teacher identity in the context of language teaching emerge from scientific research into individual and professional aspects of teaching. Personal traits, pedagogical views, professional values and practices influence language teaching methods and strategies (Pennington & Richards, 2016). Understanding and considering the individual characteristics and professional competences of the teacher helps to improve the quality of language teaching. The interaction of the teacher with students and the creation of a learning environment are key factors in the learning process. Language teachers play a significant role in shaping the quality of education. The development of successful pedagogical practices is based on understanding and considering the individual characteristics and professional competences of the teacher, which contributes to the effectiveness of language teaching and the development of sustainable pedagogical practice.

DISCUSSION

Studying a second foreign language at Central Asian universities is an important aspect of the educational process that helps to expand students' language repertoire and prepare them for the global environment. Integrating literature through a variety of approaches helps to improve language comprehension and develop critical thinking. The use of modern digital technologies, including VR, creates an encouraging learning environment and individualises the learning process. The results of teachers' research confirm the effectiveness of various teaching methods that promote the development of language and communication skills. The introduction of modern technologies into language education is an urgent task, but it is also necessary to factor in the individual characteristics of teachers to achieve best results. Additional research on the positions of researchers and their comparison with the findings of this study will improve understanding and help improve the methods of teaching foreign languages in higher education institutions in Central Asia.

A. Aprianto *et al*. (2020) investigated the impact of audiolingual methods on the conversational skills of foreign language learners. The findings of this study confirmed the considerable impact of using audiolingual methods on the development of students' oral communication. According to the researchers, students who were actively involved in listening to and imitating audio fragments had better pronunciation and were able to use language structures in different communication situations. According to the results above, it should be noted that they confirm the importance of audiolingual methods in foreign language learning, as the use of conventional methods does contribute to the enrichment of learners' language practice and improve their communicative competence. However, the findings of the present study emphasise the significance of using digital technologies in learning a foreign language as a tool that increases learners' motivation and contributes to the successful acquisition of a second foreign language.

As J. Williams (2012) emphasises, the study of writing in the context of a second language is substantially overestimated. The researcher believes that the written component can play a key role in the development of speech. In her research, the researcher focuses on three main aspects of writing: its pace, duration, and accuracy, which can facilitate cognitive processes and stimulate active movements aimed at mastering a language. The scientist notes that the speed of writing affects the speed of information processing in the brain. According to the researcher, fast writing can stimulate the brain's quick response to learning and memorising language. Specifically, when writing fast, the brain has less time to reflect, making it work faster and more efficiently. The researcher also argues that the duration of writing can have a positive impact on memorising and learning a language. The researcher is convinced that written learning requires prolonged concentration, which contributes to an in-depth analysis and understanding of language structures and expressions. The researcher

emphasises that accuracy in the use of language can encourage learners to refer to their knowledge and improve it. The desire for accuracy, according to the researcher, can support learners in carefully reviewing and improving their speech production. The findings described above also demonstrate the significance of writing in learning a foreign language and emphasise the importance of developing writing skills as a way of improving learners' language competence. However, as noted in the previous section, it is important to introduce a combination of conventional methods of teaching a second language and digital educational tools.

T. Dhimolea *et al*. (2022) note that the use of digital tools in learning foreign languages creates a high level of immersion in VR, which is an essential factor for successful language acquisition. The researchers emphasise that high-intensity VR enables the students to interact with language in realistic scenarios, which contributes to the effective adaptation of language skills. This approach, according to the researchers, allows for the creation of scenarios in which students use the language in practical situations and receive real-time feedback, which helps to improve the learning process. Researchers note that the result of such training is an increase in students' interest and motivation to learn the language. As mentioned in the previous section, the use of VR in the learning process contributes to a more effective and dynamic development of students' language skills.

According to M. Fondo (2021), the use of virtual environments in education plays a major role in improving the quality of the learning process, especially in the context of developing language competences and intercultural understanding. Her research reflects the prospects of innovative technologies in language learning. The use of virtual environments, following the researcher, allows creating interactive language scenarios that promote deep immersion of students in the language environment and interaction in authentic communication situations. The researcher notes that one of the key advantages of using digital technologies is the ability to adapt the educational process to the individual needs of students using artificial intelligence. Furthermore, according to the scientist, virtual environments contribute to the objective assessment of language skills and the creation of interactive scenarios for the development of intercultural sensitivity. The researcher's study confirms that the use of virtual environments in the learning process helps to develop students' language skills and intercultural competence more effectively, making the learning process more dynamic and engaging. As mentioned in the previous section, the use of VR in the learning process contributes to a more effective and dynamic development of students' language skills, making the learning process more productive.

S. Bahry (2020) highlights the significance of language learning in Central Asia, especially in the context of globalisation and growing international interaction in the region. He focuses on the role of language as a means of promoting cultural and educational development in this region. One of the key aspects highlighted by the researcher is the importance of understanding and preserving linguistic and cultural traditions in Central Asia. The scientist notes that linguistic diversity in this region is a source of richness and uniqueness that should be preserved and developed. The findings of the research suggest that language education in this region should promote not only the study of specific languages, but also an understanding of their cultural context and importance in international communication. Comparing the findings of the cited study with the results of the present study, it is worth noting that the specific features of language learning in Central Asia have their own unique aspects related to the history, culture, and geopolitical environment of the region, and it is in understanding and factoring in these unique features that the key to successful language education in this region lies.

As a result of the comparative study of the authors' research and this study, it should be noted that the use of the audiolingual method in teaching foreign languages contributes to significant progress in the development of students' oral communication. The focus of immersive methods on intensive listening and speaking training has proven to be a crucial factor in their effectiveness. The results of the comparative analysis also indicate the importance of introducing digital technologies into the language learning process, which increases students' motivation and improves their communicative competence. However, scientists emphasise the importance of learning writing in the context of a second language, which can substantially increase the level of students' language competence and contribute to their successful learning of a foreign language. The study emphasises the importance of modern approaches to language teaching and expresses the need for further development of language education, especially in the context of globalisation, particularly in regions with unique linguistic and cultural traditions.

CONCLUSIONS

Learning a second foreign language for students of higher education institutions in Central Asia is of significant importance for their educational, professional, and personal development. Specifically, it helps them to expand their language repertoire, increase their ability to communicate interculturally, and prepare for successful functioning in a global environment. The study of foreign languages at Central Asian universities contributes to the development of international cooperation, intercultural understanding, and the training of qualified personnel for various fields of international activity. It is vital to consider the integration of literature through a variety of approaches and strategies to improve language comprehension and develop critical thinking. The combination of conventional and modern methods of language teaching allows for the comprehensive development of students' language skills and achievement of the best results in learning a foreign language. All these aspects of learning a foreign language contribute not only to the educational process, but also to preparing the

younger generation for life in a global world where the ability to communicate in different languages and understand different cultures is becoming increasingly important.

The conditions of the 21st century require higher education institutions to actively introduce modern digital technologies into learning foreign languages. The use of digital tools, such as VR, helps to create an engaging and effective learning environment that promotes individualised learning and stimulates student motivation. The results of the survey of teachers show a variety of methods and approaches to language teaching, which contributes to the development of students' language and communication skills. Universities in Central Asia are actively working to introduce modern technologies into language education. Therewith, understanding and factoring in the individual characteristics of the teacher's personality is key to successful language learning. In the future, researchers may pay attention to the impact of foreign language learning in the development of intercultural competence and the perception of other cultures by students of higher education institutions.

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CONFLICT OF INTEREST

None.

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Педагогічні особливості вивчення другої іноземної мови: досвід університетів Центральної Азії

Анотація. Оволодіння іноземними мовами розширює можливості спілкування та співпраці з міжнародними партнерами, що зумовлює актуальність і значущість дослідження особливостей формування мовної компетентності в сучасній освіті. Метою даного дослідження було вивчення особливостей педагогічної діяльності у сфері мовної освіти з огляду на виклики та вимоги, зумовлені динамікою 21 століття. У дослідженні використано методи системного аналізу, порівняння, узагальнення та опитування. Дослідження показало, що вивчення другої іноземної мови для студентів університетів Центральної Азії має величезне значення для їхнього освітнього, професійного та особистісного розвитку. Виявлено, що цей процес допомагає студентам розширити свій мовний репертуар і збільшити можливості для міжкультурної комунікації. Крім того, дослідження підкреслило, що вивчення іноземних мов сприяє розвитку міжнародного співробітництва та міжкультурного взаєморозуміння, що є запорукою успішного функціонування в глобальному середовищі. Дослідження показало, що поєднання традиційних і сучасних методів вивчення мови сприяє всебічному розвитку мовних навичок і досягненню кращих результатів навчання. Дослідження виявило, що умови 21 століття вимагають від вищих навчальних закладів активного впровадження сучасних цифрових технологій у вивчення іноземних мов. Використання цифрових інструментів, таких як віртуальна реальність, допомагає створити цікаве та ефективне навчальне середовище, яке стимулює мотивацію учнів та сприяє індивідуальному розвитку. Опитування викладачів показало, що різноманітність методів і підходів до викладання мови сприяє розвитку мовних і комунікативних навичок студентів. Результати цього дослідження можуть бути використані університетами Центральної Азії для вдосконалення програм вивчення іноземних мов, розробки більш ефективних методів викладання та організації навчального процесу

Ключові слова: комп'ютерні технології; методи навчання; мотивація студентів; міжкультурна комунікація; діджиталізація освіти

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Features of studying classical Greek and Latin in the process of teaching theology

Abstract. The need to study the characteristic features of teaching classical languages within the framework of theological education is primarily conditioned by constant changes in approaches to educational methods and strategies, in particular, to linguistic training of specialists. The study used such methods as pedagogical and contextual analysis, comparative, and analytical and synthetic methods. The purpose of this study was to investigate the specifics of teaching the basics of classical languages in higher educational institutions in theological specialities. With this in mind, an analysis of Ukrainian and Polish curricula on classical linguistic training was carried out. In particular, it was pointed out that the main purpose of studying Latin and ancient Greek is the ability to translate classical works of art and religious texts. The analysis of educational programmes showed that its main characteristics were such as the study of aphorisms and idioms, lexical minimum (up to 300 words), attention to syntactic constructions, the development of orthoepic and spelling skills, a combination of traditional and interactive methods and educational materials, translation of texts that differ in genre, style, and time of writing. In Polish curricula, more attention was paid to historical linguistics and comparative studies, in particular, the comparison of Latin and ancient Greek, as well as other European languages. The main subtopics of the linguistic sections were indicated: orthoepy (pronunciation, stress, diphthongs, alphabet), phonetics (vowels and consonants, long and short sounds), morphology (grammatical structure, grammatical categories, inflections, conjugation), syntax (subject and predicate matching, word order, peripheral constructions, functions of sentence members, specifics of subordinate clauses). In the future scientific perspective, this paper can be used to develop new educational programmes to improve the classical training of students, compare the educational experience in teaching Latin and ancient Greek in various fields

Keywords: theology; curriculum; translation; linguistic skills; religious texts

INTRODUCTION

The study of the key characteristics of training in classical philology of theology specialists is relevant primarily because in pedagogical science there is a need for constant updating of methods and strategies, including theological education, to improve the level of educational knowledge and philological skills of students and future professionals. Although the study of approaches to teaching classical languages in philological and medical higher educational institutions is popular, however, it is worth noting that the study of classical linguistic training in theological specialities requires more attention among scientists. It is advisable to investigate the specifics of teaching classical Greek and Latin at theological faculties to consider the main tasks and goals of courses, and strategies for achieving the goals set. This implies the relevance of analysing the features of studying classical languages in linguistic sections, in particular orthoepic, spelling, phonetic, lexical, grammatical, and syntactic characteristics. Comparing the experience of teaching classical languages in different countries can help improve the curriculum for learning Latin and ancient Greek.

Author Z.P. Bakum (2023) worked out the problem of forming linguistic competence and outlined the ways

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of its development. The monograph covers the issues of Ukrainian language and literary education at bachelor's and master's degrees. However, the analysis is carried out based on Ukrainian and English, and not classical Latin and Greek. A comprehensive analysis of the functional and semantic field of religious vocabulary in British and American discourse is presented in the dissertation by M.I. Boychuk (2021). In particular, the study applied a polyparadigmal approach to the investigation of the religious term system, which was manifested at such levels as conceptual and semantic, lexical and grammatical, psycholinguistic, functional and semantic, but effective methods of assimilation of the religious term system were not considered. The innovative methods in teaching the course "Latin Language and Medical Terminology" are considered by L. Pylypiv & O. Pylypiv (2023). The paper develops a mechanism of positive motivation for learning, analyses the key factors that affect the level of effectiveness of the educational process and the development of linguistic competence among students of medical universities, although the specifics of studying classical languages in the theological context were not considered.

The key features of the theological education of the Ukrainian Greek Catholic Church (UGCC) after the proclamation of independent Ukraine are indicated in the paper by R. Delyatinskyi (2022). Aspects of the development of the clergy, the restoration of seminaries, the division of theological education into certain organisational levels are noted, but the problem of providing classical education in the religious studies context has been rather neglected. Latin was perceived not only as the language of intellectual life, but also as the language of European culture. L. Shevchenko (2023) reviewed texts accompanied by Latin annotations, Latin poems, crosswords and humorous stories, focused on New Latin poetry, allegorical works in Latin, but did not pay attention to the pedagogical aspects of teaching classical languages. The purpose of this study was to identify the key characteristics of studying classical languages, in particular Latin and ancient Greek, related to the training of specialists in theological affairs. In particular, such tasks were set as reviewing curricula for learning Latin and ancient Greek, comparing the features of teaching classical languages for theologians in Ukraine and Poland.

MATERIALS AND METHODS

To analyse the main characteristics of the study of Latin and Ancient Greek, the curricula for classical philological training of King Danylo University (Ukraine) (Working programme of..., 2018a; 2018b) and The John Paul II Catholic University of Lublin (Poland) (Teaching Programme Greek..., 2022; Teaching Programme Latin..., 2022) for theological specialities were selected. In the course of this study of these curricula, the main aspects related to the teaching of Latin and ancient Greek were investigated, in particular, the features of studying various linguistic sections: spelling, orthoepic, phonetic, lexical, grammatical, syntactic and communication in general.

Pedagogical analysis in this study was primarily aimed at studying the main issues related to the teaching of Latin and ancient Greek, in particular, the goals of philological training in classical languages of theological students. When analysing Ukrainian and Polish curricula, the features of studying various linguistic sections, in particular orthoepic, spelling, lexical, grammatical, syntactic, were considered. The main goals, objectives, methods, and teaching materials related to the classical philological training of theological students were also analysed in a fragmented manner. Comparative analysis in this study was used to contrast the features of classical language curricula in Ukraine and Poland. In particular, the Polish practical experience of teaching was compared with the Ukrainian practical experience of teaching classical Latin and Greek in theological specialities. The results of comparing the features of teaching were concentrated in a table that noted similar and distinctive features of learning classical languages considering the curricula. It should be noted that the comparison of educational processes was carried out in the study of pedagogical and philological aspects of teaching.

The analytical and synthetic method was used to study the modern scientific paradigm in linguistic, theological, and philosophical science. In particular, such issues as the review of the functional range of classical Latin and Greek languages, the specific features of teaching classical languages on the basis of primary schools, changes in modern theological education based on the transformational processes in the world, the selection of strategies for learning languages using original text fragments were considered. The issues of the role of classical Latin and Greek, the relationship between language and religion, practical experience of using theological and religious programmes, and the features of the concept of "religious language" were also discussed. With the help of analytical and synthetic analysis, the main theoretical points related to the provision of philological theological education were clarified.

Contextual analysis was used to demonstrate fragments of texts of religious content necessary for the study of classical languages by theological students. In particular, excerpts from the New Testament were provided: the Gospels of Matthew and Luke (Greek New Testament, 2023), the prayers "Hail Mary" (2022), "The Glory Be" (2024). Based on these fragments, the main methods of working with the text were shown, in particular, reading, translating, comparing text passages necessary for future professional activities of theology specialists. Thus, contextual analysis was used to consolidate the results obtained when considering curricula using pedagogical and comparative analysis.

RESULTS

Language is a powerful tool used to convey religious knowledge, and classical languages convey knowledge about the experience of forming religions from ancient times to the present (Balraj *et al.*, 2020). The study of Latin and ancient Greek for theological students is necessary primarily for

the opportunity to translate and interpret classical texts, in particular of a religious nature. This requires knowing at least 300 basic Latin words, including terminology and maxims, being able to work with a dictionary, having text reading skills, distinguishing between basic grammatical and syntactic structures and being able to translate them (Ryan, 2018; Perry & Leidenhag, 2023). Ukrainian theological education affects the younger generation especially during the war, so it is important to develop and support Bible colleges, theological seminaries and higher education institutions that provide theological knowledge (Oldenburg & Cox, 2022). However, ensuring the study of classical languages is important not only in the theological and medical fields, but also in others, in particular, there is a need to introduce the study of classical philology in schools (Perale, 2023).

When working out the curriculum of the first level of higher education in the speciality 041 "Theology" at King Danylo University, the Department of Theology and Social Sciences named after Academician of the Ukrainian Academy of Sciences Ivan Lutsky, the key features of studying Latin and ancient Greek were identified. In particular, the purpose of studying Latin by theological students is to develop skills in reading and translating Latin-language sources, learn the general terminology base related to religious studies, and initially prepare for practical language courses. After completing the basic Latin language course, students must master the lexical minimum (about 300 words), the basics of grammatical structure, syntactic features and spelling norms, know the basic rules of reading and translation, distinguish between terms and aphoristic expressions (Working programme of..., 2018a; 2018b). Among the Latin terms of religious content, the following can be distinguished:: *"absolutus"* (unconditional, perfect), *"adventus"* (coming), *"animatus"* (alive), *"destructia"* (destruction), *"indulgentia"* (mercy), *"confessio"* (confession, confession). All these linguistic skills are necessary for the study of textbook texts in the future, in particular samples of Latin literature of different writing times: classical (Cicero, 1914; Cato, 2011), medieval (Orzechowski, 1548; De Jandum, 2006), and legal writing of the 17th and 18th centuries. Thus, education, language, and religion have ensured the prosperity of the Western world for centuries (Portilla, 2021).

Learning Latin covers orthoepy (features of pronunciation, diphthongs and letter combinations, stress rules, stress, specifics of long and short syllables), historical linguistics (stages of Latin language formation). One of the most widely represented sections of linguistics is morphology, which includes general ideas about the grammatical structure, variable and unchangeable parts of speech, noun (category and declension of nouns, specifics of the gender category and translation of nouns of the first declension), verb (categories and conjugations of verbs, *praesens indicativi activi, imperativus praesentis*, basic verb forms), adjective (first and second group of adjectives, supletivism), adverb (infinitive turns, active and passive constructions, *ablativus instrumenti* and *auctoris, ablativus comparationis* and *genetivus partitivus*), pronoun (personal, interrogative, relative and negative pronouns), numeral (categories, declensions and matching with nouns) (Working programme of..., 2018b). To train translation skills, students can use excerpts from medieval texts translated into Ukrainian, for example, from the works of S. Orzechowski (1548).

The purpose of studying classical Greek is to provide theology students with key skills in working with the ancient Greek language: reading the original New Testament, translating texts using a dictionary and retelling in Ukrainian, elementary writing, abstracting and compiling annotations to textbook texts. The specifics of the use of the ancient Greek language within the framework of theological education implies a focus on the study of the lexical layer, written speech necessary for professional communication, oral and written translation from Ukrainian to ancient Greek, and vice versa, retelling the content of texts. It is also necessary to consider the specifics of the use of specific Greek terminological units in canonical texts: "*ἄξιος* (valuable), *ἀνάθεμα* (curse), *ἀπόστολος* (messenger), *ἄσκησις* (well-trained), *γνῶσις* (knowledge), as well as idioms: "*Ἀπὸ τῆς ψυχῆς*" (from the depths of the soul), "*Γνώμαις καὶ σώμασι*" (with soul and body).

When studying classical Greek, attention is paid to such sections as orthoepy (pronunciation rules, Erasmus and Reichlin pronunciation, stress rules, proclitics and enclitics), spelling (Greek alphabet), phonetics (consonants and vowels, long and short sounds, breath). It also provides for a detailed study of grammar, in particular verbs (grammatical categories, dictionary forms, conjugations, classes, aorist, present, affect and pluskvamperfect, contrasted verbs, augment, medial and passive state, specifics of the present tense of the active state, active and passive constructions, future and past tense of the verb), adjective (first and second declensions, dictionary forms), pronoun (personal, relative, possessive, interrogative, demonstrative, undefined and inverse pronouns, mutual pronoun), preposition (meaning and specifics of using prefixes), numeral (quantitative, ordinal numbers), adverb (degrees of comparison, meaning of suffixes, complementary degrees of comparison). Considerable attention is paid to functional syntax: features of the vocative, genitive, dative case (also in the sense of locative and instrumental), syntactic attributes of the verb (method, state, adjective verbs, accusative, nominative + indefinite verb form, generic and accusative independent), complex sentence (word order in the sentence, particles, conjunctions), matching the subject with the predicate, indirect speech, types of subordinate sentences (goals, causes, consequences, conditions, admission, tense, relative).

When studying classical Latin and Greek, both traditional and interactive technologies are used, in particular, working in groups, using video materials (presentations), problem-finding methods, games, discussions, case studies, "brainstorming". The main forms of monitoring the acquired knowledge and skills are performing test tasks,

translations from Ukrainian to Latin, and blitz surveys. When performing translations, it is possible to use several versions of the same prayer or text and compare them in terms of lexical content, grammatical and syntactic features (Working programme of..., 2018a). For example, when comparing the prayer "Our Father" ("*Πάτερ ἡμῶν, Κυριακή προσευχή*") in the Gospel of Luke and the Gospel of Matthew, differences in semantic completeness and grammatical and syntactic structure of sentences can be distinguished (Greek New Testament, 2023).

At the John Paul II Catholic University of Lublin, the curriculum in ancient Greek at the level of training "Theology A, musicology" contains topics from the following sections of philology: historical linguistics (history of the Latin language), orthoepy (pronunciation, alphabet, rules of inflating words), vocabulary (basic vocabulary, phraseology and Latin maxims, connection with other languages with the Latin basis), syntax (subject, predicate, appendix, simple and complex sentences, translation technique, passive and active peripheral constructions, ablative, double accusative, genitive, nominative case with infinitive). The grammar section is devoted primarily to the study of inflections of nouns of I-V declensions, various groups of pronouns (relative, interrogative, personal, possessive, indicative), numerals (quantitative, ordinal), the creation of adverbs from adjectives, degrees of comparison of adverbs. Special attention is paid to conjugation, in particular, the main verb forms, the specifics of distinguishing four conjugations, six tenses (present, imperfect, future first and second, perfect, plusquamperfect), two moods (active, passive), three modes (active, conditional, imperative). Separate sub-topics were also highlighted: compound words, noun verb formations, infinitives, participles, gerunds, supers, and deponent verbs. The main skills that a theologian student should have after a preparatory course in Latin: be able to read texts, recognise and identify flexion forms, case functions, translate both simple and complex sentences, identify their parts, distinguish Latin maxims in original texts, and compose short sentences. After the second year, the student must correctly translate sentences, considering all the features of Latin syntax, theological texts of various genres (biblical, medieval Christian works, church hymns), sentences from polish to Latin, and vice versa, and build up the above skills. Mastering ancient Greek at the John Paul II Catholic University of Lublin at the level of "Theology in, musicology" begins with studying the life of Jesus Christ (Teaching Programme Greek..., 2022). The study of ancient Greek texts ranges from the analysis of scenes related to the meetings and conversations of literary heroes with Jesus in the Gospel and the Acts of the Apostles in the New Testament, to the original New Testament texts. Attention is paid to such areas of linguistics as orthoepy (emphasis on words, reading rules), lexicology (lexical minimum – 300 words, study of prayer texts: "Our Father" ("*Πάτερ ἡμῶν, Κυριακή προσευχή*"), "Hail Mary" ("*Χαῖρε κεχαριτωμένη Μαρία*"), "The Glory Be" ("*Δόξα Πατρὶ*"), a comparison of Greek words with Polish and Latin, and modern languages). It is also advisable to compare ancient Greek texts with Latin ones (Battezzato, 2009). For example, the prayers "Hail Mary" in Greek ("*χαρρε κεριτωμένη Μαρία*") (Hail Mary in..., 2022) with *"Ave Maria, gratia plena"* in Latin (Ave Maria Translation, 2023). Another important point in acquiring translation competence is to compare the Latin and ancient Greek versions of prayer with the variants in modern European languages. For example, the prayers "*Δόξα Πατρὶ*" in Greek with "*Gloria Patri...*"in Latin (Doxa Patrì (Gloria..., 2009) and" "Glory to the Father..." in English (The Glory Be..., 2024).

The grammar is taught using the inflectional approach, including articles, basic declension patterns and specifics of nouns of the first, second and third declensions, adjectives of the first, second and third declensions, personal, demonstrative, relative, possessive and interrogative pronouns, verbs (aorist, indicative, imperative, perfective), numerals (quantitative, ordinal, declensions 1 to 4). The syntactic features of the use of attributive and predicative constructions, double accusative, genitive case, syntactic functions of the case (subjunctive of time, purpose, effect and condition) were also actively studied. The main skills a student should have are: reading a prose text, recognising parts of speech, identifying forms, cases and conjugations, translating simple and complex sentences. Among the main forms of work, such as a lecture, exercises, conversation are used, and among the educational tools – theoretical materials (textbooks, dictionaries, encyclopedias, Christian literature, theological journals), video materials (films, programmes for Interactive Learning) (Teaching Programme Greek..., 2022; Teaching Programme Latin..., 2022). The main features of studying Latin and ancient Greek by theology students are presented in Table 1.

Table 1. Features of learning Latin and ancient Greek

Characteristics	King Danylo University	John Paul II Catholic University of Lublin
Learning aphorisms and idioms	+	+
Lexical minimum – 300 words	+	+
Inflectional approach to learning grammar	-	+
Attention to functional syntax and syntactic patterns	+	+
Emphasis on historical linguistics and comparative studies (comparison of Latin, Ancient Greek and modern European languages)	-	+
Development of orthoepic and spelling skills	+	+

Table 1. Continued

Characteristics	King Danylo University	John Paul II Catholic University of Lublin
Combining traditional teaching methods with interactive ones	+	+
Translation of texts of different genres and time periods	+	+

Source: prepared based on the materials of the Teaching Programme Greek Language Course at Beginning Level (2022), Teaching Programme Latin Language Course at Beginning Level (2022), Working programme of the academic discipline "Greek language" (2018a), Working programme of the study discipline "Latin language" (2018b)

Therefore, it can be argued that the main features of teaching classical languages at theological faculties include the study of the lexical minimum, aphorisms and idioms, development of orthoepic and spelling skills, translation of multi-genre texts, a combination of traditional and interactive teaching methods, attention to functional syntax. Features of teaching classical languages in Poland also include paying attention to historical linguistics, in particular comparing Latin and ancient Greek, and the inflectional approach to grammar.

DISCUSSION

The key features of studying Latin and ancient Greek in teaching theology include the use of traditional methods of work together with interactive ones, the combination of studying grammar and syntax to ensure correct translation, orthoepic and spelling norms, the assimilation of terminological vocabulary of a religious nature, popular expressions and aphorisms. They are inherent in teaching classical philology all over the world, and in particular, in Ukraine and Poland. A broad overview of the functional range (historical, social, and geographical) of Latin and ancient Greek usage is presented in the study by E.P. Archibald *et al*. (2015). The researchers indicated what teaching methods were used to master Latin and ancient Greek. In particular, the study of the basics of teaching classical languages focused not only on the experience of elite students, but also on the dialogue between the periphery and the centre, conservatism and transformational processes, government, and society. The study of Latin and ancient Greek languages in teaching in theological specialities showed that modern Ukrainian and Polish educational programmes offer a fairly large number of methods for mastering classical languages, in particular, combining conventional (presentation of lecture material, solving exercises) and interactive methods (role-playing games, "brainstorming").

Since ancient languages are the basis for learning many other languages, the study of Latin and ancient Greek is necessary due to the close ties between them. The paper by A. Holmes-Henderson & K. Kelly (2022) was about teaching ancient languages in elementary schools. In particular, the authors emphasised that political support has been in effect since 2014, but in order to activate the process of learning Latin and ancient Greek, it is necessary to expand access to these languages in primary schools. Considering the teaching of classical languages in modern universities, it was shown that when mastering theology in Ukrainian education, not enough attention is paid to comparing Latin and ancient Greek with modern languages (English, French, Italian). At the same time, Polish education is more focused on comparing different languages in the context of common Latin or ancient Greek roots, so classical education is actively introduced into the educational process from primary school. Modern theological education is constantly changing, which is associated with transformations of the global context. H. Knoetze (2023) examines the three main issues that most closely reflect changes in the paradigm of theological education: the need to review the methodological foundations for curricula, the "constitutive interest in knowledge" (human-centred awareness), and the importance of realising that theological education is associated with lifestyle changes. Comparing this research with the conclusions of the current study, it can be stated that in modern Ukrainian theological education, a combination of methods (traditional, interactive) of work, a focus on improving the technological base and on implementing Western European standards in the training of theological students is of particular importance.

The strategy of learning classical languages through the use of adapted original texts was considered by S. Hunt (2022). The study focused on the selection of methods, in particular deductive, inductive and active, and on the principles of structuring excerpts from classical books for use in the process of listening, reading, speaking, and writing. The researcher formulated the concept of high-quality learning, which consists of three components: access, diversity, and inclusion. When studying the experience of teaching Latin and ancient Greek in the Ukrainian context, it became clear that the main principle was to master the translation technique with an understanding of grammatical and syntactic rules for constructing structures, orthoepic and spelling norms. Within the framework of classical Greek, P. Poupounaki-Lappa *et al*. (2021) proposed a development that provides for the creation of a special test for obtaining linguistic qualifications. The developed communication reading test should contain both grammatical and functional elements. When assessing linguistic competences in the study of classical languages from the perspective of theological training, it is worth noting that the main competences are orthoepic, orthographic, communicative, translation, grammatical and syntactic.

The role of Latin for the scientific and educational sphere was considered in the study by P. Roelli (2021). In this paper, a diachronic panorama of the functioning of the

Latin language from ancient times to the present was developed. Special attention is paid to the problem of losing the status of the world's leading language in Latin, which the author considered through active corpus linguistic research. The study of Latin and ancient Greek in theological specialities was justified from the standpoint of the need to translate religious works written in classical languages, in particular Latin and ancient Greek, and the need for their reading and translation. The study by D. Lewin (2019) was based on consideration of the relationship between linguistic and religious tools. In particular, the paper showed that formal indicators of religious speech are aimed at the development of personality, affective and cognitive at the same time. When studying educational processes at theological faculties and curricula in classical philology, it was investigated how the process of studying Latin and ancient Greek languages takes place with the involvement of texts of religious content. Therefore, the researcher's opinion on the close connection between religion and language is appropriate through the prism of theological science.

Theological training involves not only practical experience, but also a broader context, in particular, teaching in theological, religious and spiritual programmes. The relationship between these disciplines was considered by K.I. Lizardy-Hajbi (2021) through three main principles: embodiment, reflection, and formation. An important achievement of the researcher was that the paper offers a combination of academic fields and theological education in the so-called integrative curriculum. The study has demonstrated a balance between academic knowledge of classical languages and the direct use of this knowledge in practice when translating theological texts. Features of the study of religious language were considered by M. Scott (2010). The following topics were investigated: religious discourse, reductionism, expressionism, subjectivism, religious metaphor, religious fiction. It also focused on the relationship between religious language and the philosophy of religion. Since classical languages were born in particular as scientific and religious languages, taking into account the considered curricula, it is important to study not only grammar, syntax and other theoretical aspects, but also artistic models (tropes and stylistic figures) of classical languages.

The study of lexical, morphological and syntactic features of the texts of Catholic epistles written in Latin was conducted by A. Persig (2021). The relationship between Greek texts and their Latin features was also investigated. A statistical analysis of the lexicon used in the translation of the Vulgate and *Vetus Latina*. When studying the main features of teaching classical languages in the theological educational process, it was proved that for theological education, first of all, it is important to master basic skills in classical languages, since this knowledge is necessary for understanding the texts of divine services, religious vocabulary, and the historical context of the development of religious thought in the world. Therefore, the basics of teaching Latin and ancient Greek in the study of theology primarily concerned such aspects as understanding teaching methods and strategies, forming linguistic competencies, discussing the relationship between linguistics and religion, using and developing innovative technologies. The issues that were considered by modern researchers were related to educational processes in schools and higher educational institutions that provide classical education.

CONCLUSIONS

A study of classical languages in teaching at the theological faculties of King Danylo University and the John Paul II Catholic University of Lublin showed that the training is mainly aimed at translating Latin and ancient Greek sources, studying terms related to religious topics. After mastering the general course of classical philology, students should understand the basic grammatical structures and syntactic constructions, know orthoepic and spelling rules, and be able to distinguish aphorisms and phraseological phrases in texts written in classical languages. The purpose of training specialists in theology is to translate textbook texts, classical and medieval works, and the legal texts of the 17th and 18th centuries. In Ukrainian higher educational institutions, training in classical linguistics includes the study of orthoepic norms (pronunciation, diphthongs, stress, long and short syllables, proclitics and enclitics), phonetics (long and short, vowels and consonants), historical linguistics (development of languages), morphology (grammatical structure, specifics of grammatical categories of nouns, verbs, adverbs), syntax (syntactic attributes of verbs, features of the use of cases and subordinate clauses, coordination of members and word order in a sentence). There is still a need for active practice of reading and translating texts, in particular the New Testament written in ancient Greek, abstracting and compiling annotations to textbook works, improving spelling and writing skills, and retelling texts. The main teaching methods are both traditional and interactive, in particular blitz surveys, games, case studies, and problem-based search methods.

The curriculum of classical languages in Polish higher educational institutions focuses on such philological fields as historical linguistics (conditions of language development and formation), orthoepy (alphabet, stress, pronunciation features), vocabulary (study of lexical minimum, phraseological expressions), syntax (functions of different members of a sentence, simple and complex sentences, peripheral constructions), grammar (study of inflections, features of adjective creation, conjugation, verb methods). Theologian students should read and translate texts, including theological, medieval Christian ones, and compare Latin and Greek versions of religious texts. A special feature of the curriculum in Poland, in contrast to the Ukrainian programme, is the use of an inflectional approach to the study of classical languages and an emphasis on historical linguistics and comparative studies (comparison of Latin, Ancient Greek, and modern European languages). Among the educational tools used are both traditional (textbook, dictionary, encyclopaedia) and interactive materials (videos, training programmes). The priority tasks in further

research may be to study the main standards of teaching classical languages in various fields, develop new programmes and methods to improve educational outcomes in Latin and ancient Greek, compare the experience of different countries in training specialists in classical philology.

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CONFLICT OF INTEREST

None.

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Особливості вивчення класичної грецької та латинської мов у процесі викладання богослов'я

Анотація. Необхідність дослідження характерних рис викладання класичних мов у межах богословської освіти зумовлена передусім постійними змінами підходів щодо освітніх методів та стратегій, зокрема щодо лінгвістичної підготовки спеціалістів. У цій роботі було використано такі методи, як педагогічний та контекстуальний аналіз, порівняльно-зіставний та аналітико-синтетичний методи. Метою цього дослідження було вивчення особливостей викладання основ класичних мов у вищих освітніх закладах на богословських спеціальностях. З огляду на це, було здійснено аналіз українських та польських навчальних програм із класичної лінгвістичної підготовки. Зокрема було вказано, що основною метою вивчення латинської та давньогрецької мов є уміння перекладати класичні художні твори та релігійні тексти. Аналіз навчальних програм показав, що основними його характеристиками стали такі, як вивчення афоризмів та крилатих фраз, лексичного мінімуму (до 300 слів), увага до синтаксичних конструкцій, формування орфоепічних та орфографічних навичок, поєднання традиційних та інтерактивних методів та навчальних матеріалів, переклад текстів, різних за жанром, стилем та часом написання. У польських навчальних програмах більше уваги було приділено історичній лінгвістиці та компаративістиці, зокрема порівнянню латинської та давньогрецької мов, а також інших європейських мов. Було вказано основні підтеми мовознавчих розділів: орфоепії (вимова, наголос, дифтонги, алфавіт), фонетики (голосні та приголосні, довгі та короткі звуки), морфології (граматичний устрій, граматичні категорії, флексії, дієвідмінювання), синтаксису (узгодження підмета та присудка, порядок слів, перифрастичні конструкції, функції членів речення, специфіка підрядних речень). У подальшій науковій перспективі цю роботу можна використовувати для розробки нових освітніх програм для покращення класичної підготовки студентів, порівняння освітнього досвіду при викладанні латинської та давньогрецької мов у різних сферах

Ключові слова: богослов'я; навчальна програма; переклад; лінгвістичні вміння; релігійні тексти

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Integration of digital technologies and artificial intelligence into the dual methodology of teaching bachelors of vocational education

Abstract. The special relevance of integrating artificial intelligence into the educational process arises due to the rapid development of digital technologies in the 21st century, which opens up new opportunities for pedagogical practice and at the same time poses new challenges to it, especially in the context of dual education, where combining academic training with practical experience can significantly increase the effectiveness of training specialists. The purpose of the study was to identify the most effective ways to integrate digital technologies and artificial intelligence in order to meet modern challenges in education and prepare students for the requirements of the modern labour market. To achieve the goal, the authors used a literature review, statistical analysis of data, and the development of recommendations for optimising the use of digital technologies in dual education. The paper identifies innovative approaches that can significantly improve the quality of education, ensuring individualisation of the educational process and optimisation of educational methods using modern technologies. The paper offers a comprehensive look at the theoretical and practical aspects of implementing digital innovations in education, providing methodological recommendations for teachers to optimise the learning process. The authors consider the problem of introducing the latest artificial intelligence technology into the educational process with examples of the use of artificial intelligence to improve the efficiency of the educational process and increase the safety of students. The opinion is expressed about the need to reform the modern educational system for more effective implementation of the latest technologies in the learning process. The influence of digital technologies on the effectiveness of dual education is analysed, emphasising the main advantages and challenges of integrating these technologies into the modern educational environment. The practical significance of this study lies in the fact that its results can be used by teachers and developers of educational programmes for bachelors of professional education to integrate artificial intelligence and digital technologies into dual education, providing an effective combination of theoretical training with practical experience

Keywords: educational programme; academic studios; professional practice; modern information systems; algorithms; intelligent data processing; individualisation of training; effectiveness of the educational process

INTRODUCTION

The relevance of investigating artificial intelligence in the educational sphere has increased due to the development of digital technologies in the 21st century, known as the age of artificial intelligence. Since its introduction in the mid-20th century, artificial intelligence has become an important element of modern human history, finding application in such industries as energy, robotics, medicine, and in particular education. The spread of artificial intelligence through various applications, such as chatbots, has opened up new opportunities for scientific research and teaching practice, and raised questions about the ethical aspects of its use. This dynamic has contributed

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to the integration of artificial intelligence into dual educational methods, making this area particularly relevant and promising for training a new generation of specialists who can effectively use digital innovations.

The accessibility of artificial intelligence through applications such as chatbots opens up new opportunities for research and teaching practice, while raising questions about the ethical aspects of its use (Altman *et al.*, 2023; Elkin, 2023). Such dynamics makes the study and integration of artificial intelligence into the methods of dual training of future bachelors of professional education an actual and promising direction for the development of educational programmes aimed at training new generation specialists who can effectively use the potential of digital innovations. This is especially true in the context of the current state of need to introduce distance education (Order of the Cabinet of Ministers of Ukraine No. 660-p, 2018). The need for distance learning and flexibility is becoming important due to current challenges, such as the pandemic. These challenges highlight the importance of flexible learning systems that can function effectively remotely. Digital technologies play a key role in this context, providing an opportunity to improve the learning process and ensure its continuity.

Interest in dual education in Ukraine began to develop actively closer to the 2010s, when the country experienced the need to modernise its education system to increase competitiveness in the labour market. There was a significant impetus for the development of dual education in 2015, when Ukraine started the processes of reforming vocational education in accordance with the needs of the labour market and the standards of the European Union. An important step was the introduction of new regulations that stimulate the development of dual education, in particular, the Resolution of the Cabinet of Ministers of Ukraine and relevant legislative initiatives that allow educational institutions and enterprises to officially cooperate in the format of dual education. According to the analytical report prepared based on the results of the fourth year of the pilot project in accordance with the Order of the Ministry of Education and Science of Ukraine (MES) No. 1296 (2019), the dual form of education demonstrates significant potential in training qualified specialists (Buchynska *et al.*, 2023). Analysis of the study by O. Buchynska *et al.* (2020) indicates the positive attitude of employers towards this model of education, emphasising its importance for the development of skills required in today's labour market. Thus, it can be argued about the integration of AI and digital technologies in professional education, which can further increase its effectiveness, in particular, in the context of training bachelors of professional education.

The creation of an advanced educational environment is influenced by globalisation and integration processes with the European Union, with the aim of adhering to international professional standards. This creates an urgent need not only to improve existing pedagogical methods, but also to introduce innovative approaches to the educational process (Kosubai & Shemet, 2020; Kravchenko *et al.*, 2022; Yaroshenko, 2023). Researchers are actively analysing how artificial intelligence can improve dual teaching methods for undergraduate vocational education students. The importance of such research increases in the context of rapid changes in the field of education, which adapts to the needs of modern students and the requirements of their educational environment. According to S.H. Halili (2019), the development of technology contributes to these changes, especially in the field of education, where innovation activity is particularly intense. The current need for distance education, actualised by the pandemic and other global challenges, points to the importance of flexible learning systems that can function effectively in an online format. Digital technologies play a key role in this process, helping to optimise learning and ensure its continuity. Interest in dual education in Ukraine intensified in the early 2010s, when the need to modernise the educational system to increase its competitiveness became obvious. The reforms of 2015, in particular, the introduction of new regulations, contributed to the development of dual education, allowing educational institutions and enterprises to officially cooperate. An analysis of employers' attitudes towards dual education shows a positive attitude towards this model, as it contributes to the development of practical skills required in the labour market.

The importance of artificial intelligence in dual learning lies in its ability to adapt educational materials to the individual needs of students, increasing their motivation and academic results. The integration of academic learning with practical experience is made possible by innovative approaches that consider the requirements of the modern educational and professional environment. The educational process in the context of globalisation and integration with the European Union requires not only updating traditional methods, but also applying advanced approaches, including the use of digital technologies and artificial intelligence. This allows meeting international standards and train specialists who can meet the needs of the modern labour market. Thus, artificial intelligence and digital technologies play a key role in modern education, in particular in dual training programmes, which contributes to the training of highly qualified specialists who are ready for the challenges of the new century.

The purpose of the study was to investigate the potential of artificial intelligence in educational processes, in particular, in the context of dual training of future bachelors of professional education from the experience of Berdyansk State Pedagogical University (BSPU).

Research objectives in dual education included:

- evaluate the potential of digital tools and technologies to support a dual learning model that combines theoretical learning with practical experience;
- analyse the impact of digital technologies on the effectiveness of dual education, in particular, on academic achievements and motivation of students to learn in real working conditions;

➥ explore the possibilities of digital technologies to create an integrated educational environment that helps to attract students to actively participate and independently solve professional problems.

The originality of this study consists in the analysis of the impact of artificial intelligence and digital technologies on dual bachelor's education, based on the experience of Berdyansk State Pedagogical University. It includes assessing the potential of digital tools to support theoretical and practical learning, analysing their impact on academic performance and student motivation, and exploring the possibilities of creating an integrated educational environment for active student participation. A special feature is the investigation of the role of AI in creating personalised curricula and ensuring security in the digital space, offering new approaches to dual learning in the context of digitalisation of education.

MATERIALS AND METHODS

To achieve the research goal, namely, the analysis of the potential of artificial intelligence in educational processes with a focus on dual training of future bachelors of professional education, an integrated approach was chosen, which includes both quantitative and qualitative research methods. The research was conducted at the BSPU and continues until 2026. This paper is part of the complex topic "Development of methods of dual training of future bachelors of vocational education in the field of digital technologies" of the Department of Computer Technologies in Management and Education and Informatics and describes its first stage (2021-2023). The first stage of the study was a review of the scientific literature aimed at determining the main areas of using digital technologies and artificial intelligence in dual education. The literature review was chosen as the first stage of the study, as it allows systematising existing knowledge about the use of artificial intelligence and digital technologies in dual education. This method helped to identify key trends and potential areas for further analysis.

Analysis of research papers, for example by O. Buchynska *et al*. (2020), helped to obtain up-to-date data on research in the industry, while the materials of reports of expert organisations by O. Buchynska *et al*. (2023) were used to provide a more formal and balanced review of the topic. Conference proceedings of I.V. Kozubai & U.R. Shemet (2020) contributed to understanding recent discussions and debates in the academic community. Information sites, such as the website of BSPU "University word" (Meeting with stakeholders, 2023) were included to get acquainted with current news and events taking place at the university and relevant to the research topic. Analysis of monographs by V.G. Khomenko (2015) helped to summarise existing knowledge and identify potential opportunities and challenges. The empirical study was chosen as the second stage because it allows collecting primary data directly from stakeholders – students and teachers involved in dual education. The developed computerised curriculum improvement system was aimed at integrating dual professional competencies, which optimises the structure and content modules of the curriculum, ensuring connectivity between the technical and pedagogical components necessary for the preparation of bachelors in the field of computer technology. Data analysis included statistical methods and correlation analysis to ensure the objectivity and accuracy of conclusions, facilitating the assessment of the current state of technology use and identification of effective strategies for their implementation in dual education.

The development of recommendations was based on analysis data and was aimed at creating practical guidelines for teachers and developers of educational programmes so that they can effectively integrate digital technologies and artificial intelligence into dual education. This included proposals for optimising theoretical and practical training, and measures to increase students' activity and independence in solving professional problems. This integrated approach provided a deep understanding of the capabilities of artificial intelligence and helped to identify effective methods of its application to improve the quality of dual education.

RESULTS AND DISCUSSION

In the modern world, where the speed of technology development and their impact on all spheres of society are growing every day, education faces the need to adapt to new conditions and challenges (Alekseeva, 2012; Havrylenko *et al*., 2020). This is especially true for the preparation of bachelors of professional education, where the issue of integrating digital technologies and artificial intelligence into the educational process is becoming relevant. The dual teaching methodology, which combines theoretical knowledge with practical experience in real-world working conditions, opens up new horizons for the educational process, allowing students to better assimilate professional skills and adapt to the requirements of the labour market. The use of digital technologies and artificial intelligence in dual learning can significantly improve the effectiveness of the educational process, providing individualisation of learning, access to a wide range of information and resources, and the opportunity to study in conditions as close as possible to future professional activities. However, along with the advantages, the integration of the latest technologies also introduces certain challenges, in particular, related to the need to update curricula, train teaching staff, and ensure ethical standards for the use of artificial intelligence.

The impact of artificial intelligence on the dual teaching methodology of bachelors of professional education is a key area of scientific research within the modern educational paradigm, according to S.A.D. Popenici & S. Kerr (2017), AI has a significant impact on the development of Society 4.0, modernisation of educational systems, introduction of innovative pedagogical approaches and integration of the latest scientific achievements and technologies, as confirmed by V. Antonov (2023), L.M. Gren (2019), I. García-Martínez *et al*. (2020) and M. Shyshkina & Y. Nosenko (2023). These research efforts focus on assessing the potential of AI to improve the effectiveness of the

learning process, especially in the context of dual education, which involves integrating academic learning with practical experience. It also explores how the integration of artificial intelligence can improve the personalisation of learning by adapting learning materials and methods to the individual needs and characteristics of each student, thereby increasing their motivation and academic performance. Studying such aspects helps to identify the best strategies to effectively engage students and ensure a deeper understanding of the learning material, which is especially important in today's rapidly changing educational environment. For example, I.M. Gabenko (2019) highlights the use of dual education in the preparation of students of the speciality "Food Technologies" at the Sumy National Agrarian University, where the results of surveys indicate low motivation of students for this form of education. The main barriers, according to the study, are the fear of failure in production tasks and lack of work experience, which increases doubts about the effectiveness of dual training for this speciality. The researcher suggests increasing motivation through "organising seminars among students to get acquainted with the dual system".

N. Momot (2022) presents the organisation and results of using the dual form of education based on the research implemented by the KROK University of Economics and Law within the framework of the international project "Integration of dual higher education in Moldova and Ukraine / COOPERA Erasmus+". This study examines in detail the distribution of theoretical and practical training hours between academic institutions and production partners, highlighting how dual education contributes to the professional self-determination of future journalists in choosing a specialisation – be it news, sports or politics – and preparing them for a specific workplace, such as news agencies, radio or television studios. Especially significant is the author's emphasis on how dual education can adapt to the conditions of martial law, providing future journalists with the necessary practical training in difficult conditions.

S.M. Zinchenko & A.L. Zinchenko (2021) analysed the practice of social partnership in French educational institutions, in particular, through the prism of the activities of the GRETA Association (Groupements d'établissements). This organisation plays a key role in the professional training and professional development of graduates, collaborating with leading enterprises to develop relevant educational programmes that include the introduction of the latest technologies and certification of professional aptitude. The specificity of GRETA is their ability to adapt educational programmes to the requirements of the modern labour market, which makes their experience especially valuable for Ukrainian research and teaching staff who seek to integrate such approaches into dual teaching methods. A significant part of studies focuses on the analysis and popularisation of Germany's experience in using the dual education system. Y.O. Dovhenko *et al*. (2021), S.V. Cherkashyn (2021) and I.S. Kramarenko (2023) emphasise that the German dual vocational education system, recognised for its long history of success at the international level, serves as the foundation for the country's economic efficiency. This system not only increases the professional opportunities of young people, but also contributes to overall economic development.

These publications do not cover the key methods of implementing dual education in Ukraine, despite its successful foreign experience. Lack of awareness and lack of necessary methodological materials for participants of dual education turned out to be the main obstacles. This has led to a gap between the large number of graduates with higher education and their low level of employment in their speciality in Ukraine. The development of interaction between higher education institutions and employers is becoming key to meeting the needs of the labour market for qualified specialists, emphasising the need for scientific research of dual education. The creation of a progressive educational space that meets professional standards at the global level requires not only the revision of traditional teaching methods, but also the introduction of the latest forms of education, which is made possible by the integration of digital technologies and artificial intelligence into the educational process (Song & Wang, 2020; Yang *et al*., 2021; Zhai *et al*., 2021). This approach encourages a deep reformation of educational programmes to train specialists who can meet modern labour market requirements and globalisation challenges (Order of the Cabinet of Ministers..., 2023).

Further, aspects that emphasise the importance of optimising the educational process are considered. One of them is an individualised approach to learning, using digital technologies, which allows creating unique curricula and tasks based on the characteristics and needs of each student. Digital tools provide an opportunity to learn at their own pace, which helps students to understand the material more deeply or speed up learning depending on their abilities and understanding. Interactivity and gamification increase the effectiveness of students ' involvement in the educational process. The use of interactive platforms, video and multimedia tools makes the learning process more interesting and helps to attract students' attention. Gamification motivates and encourages students to participate more actively. Active participation of students in learning is stimulated through collaboration and interaction due to digital technologies that contribute to the development of online communities for discussion, exchange of ideas and teamwork. Online tools with asynchronous access and the ability to receive real-time feedback provide students with learning flexibility and contribute to better assimilation of the material. In the context of dual education, automated systems for evaluating and tracking students' progress greatly facilitate the process of monitoring their achievements, making assessment faster, more accurate and objective. Digital technologies in dual education improve assessment methods and allow teachers and students to track academic progress in real time, identifying areas for further development and improvement. Within dual education, the integration of digital technologies provides

unique opportunities to improve the quality of education and ensure greater efficiency of the educational process. Individualisation of learning through digital tools allows developing curricula that meet the personal interests and level of knowledge of students, providing the opportunity to independently choose the pace and areas of study.

E-learning platforms support active interaction through virtual discussions and forums, stimulating the exchange of knowledge and opinions between students. Online collaboration allows implementing group projects and tasks, overcoming the barriers of physical distance, and promotes the development of team interaction and collaboration skills. Using cloud services and interactive tools for group work and project activities not only simplifies student collaboration, but also opens up space for creativity and improved communication skills, which are key in dual education. The introduction of gaming technologies, in particular gamification, virtual (VR) and augmented reality (AR), in the educational process contributes to the growth of motivation and interest among students, creating immersive environments that facilitate deep learning of the material. Automated assessment and progress tracking systems simplify the assessment process and provide fast, objective feedback, enabling students and teachers to effectively monitor progress and identify needs for additional improvement. Online learning, with its accessible lectures and video tutorials, provides students with the opportunity to learn without space and time constraints, while video conferencing supports real-time interaction, facilitating more active discussion and problem solving.

In the context of the challenges that Ukrainian education faces as a result of martial law and the relocation of universities, the development and improvement of dual education is of particular importance. Cooperation between displaced higher education institutions and educational institutions is becoming a key element in training qualified professionals who can adapt to rapidly changing conditions and contribute to the country's recovery. Thus, the experience of Berdyansk State Pedagogical University is presented. On March 23, 2023, an important online meeting was held, which brought together leading representatives of Berdyansk State Pedagogical University, including Rector Professor Ihor Bohdanov, First Vice-Rector and Professor Olha Hurenko, Dean of the Faculty of Physical and Mathematical, Computer and Technological Education Professor Victoria Zhyhir, and other prominent educators. This meeting was held with the participation of the management and teaching staff of the municipal institution "Pokrovsky Pedagogical College", headed by the Director, Candidate of Pedagogical Sciences Olena Oliynyk, and was implemented through the Zoom web platform.

The main purpose of this event was a constructive discussion on professional orientation and improvement of educational and professional programmes at the bachelor's and master's levels in the speciality 014 Secondary Education (Labour training and technology). In particular, the meeting discussed modifications of educational programmes with an emphasis on patriotic education and integration of elements of national culture into applied technological disciplines, considering modern challenges and martial law in the country. Such interaction is key to training future specialists who will be able to play an active role in the post-war reconstruction of Ukraine and become competitive teachers, highly valued in the educational sector (Meeting with stakeholders, 2023). Consequently, these technological innovations in education, including game technologies and distance learning, lead to the need to include artificial intelligence in dual education tools. Artificial intelligence, as a key component of digital technologies, opens up new horizons in teaching methods and approaches to education. It not only complements existing tools, but also offers unique opportunities for personalising the learning process, automating assessment, and creating adaptive learning environments that can independently respond to the needs of each student. Thus, the integration of AI into dual education not only enhances the effects of using digital technologies, but also opens up new ways to optimise the educational process, making it more flexible, efficient, and individualised.

The concept of artificial intelligence is defined as a branch of computer science that focuses on the development of machines and systems capable of performing tasks normally requiring human intelligence, such as learning, problem solving, and decision-making. AI is based on the idea of creating machines that can think and reason like humans, and can learn from their own experience to improve their productivity over time (Artificial intelligence tools..., 2024). It may seem that discussions about the use of AI in learning are only about using certain tools to do written homework or generate texts, but this topic is deeper than it seems at first glance. A. Synytska (2023) argues that this involves adherence to university and general education values along with the creation of a sufficiently flexible learning environment that will facilitate development, and therefore, should correspond to the inevitable changes in the activities of the participants in the educational process.

With the introduction of ChatGPT in the educational space, the European University Association (EUA) expressed its thoughts on the widespread concern among the community about the impact of this application on the educational process in higher education institutions: "Noting the current disadvantages and potential advantages of these technologies ... the higher education sector must adapt its approaches in such a way that artificial intelligence is used effectively and appropriately. Therefore, the Association invites universities to consider key factors related to the immediate impact of artificial intelligence tools on learning and teaching, continuous innovation in teaching and learning, and the broader role of universities in the impact of such technologies on our societies". It was also noted that the association is ready to study the experience of using AI in training and exchange advice, given that this issue continues to develop (Artificial Intelligence, 2024). One of the main thoughts about the introduction of AI in

learning is the need to adapt education by developing a new concept of human thinking, and changing the very essence of human-machine interaction to prevent a gap between the concepts of human knowledge and human understanding. Ultimately, the latest technology not only disseminates human thought, but is also able to achieve its understanding and education, albeit indirectly (Lebid, 2023).

The use of this technology in education also has many advantages. For example, using the analytical capabilities of artificial intelligence, it is possible to create or edit educational programmes according to the individual needs of students. Such an adaptive educational platform was developed by the American organisation Enlearn. Using technology developed by the Centre for Game Science at the University of Washington, the programme breaks down the learning process for each educational applicant into many small components to analyse them and suggest what exactly hinders the student's effectiveness. Director of the Centre for Game Science and founder of Enlearn Z. Popovits argues: "Artificial intelligence can promote a personalised approach, it is able to provide the curriculum that the student needs at the moment." AI can also be used to improve the security of educational applicants by providing a more flexible system for filtering sites based on their content. This technology is successfully used by the American company GoGuardian. The principle of operation of the programme is to notify the administrator (teacher) about the student's search for unacceptable or suspicious things on the Internet (How artificial intelligence..., 2024).

Artificial intelligence technology, however, has its drawbacks. AI works most effectively in the presence of a huge amount of information and, in particular, examples. It is also important that the information provided must be accurate and verified to prevent errors or erroneous results. Another problem, but rather the task of educational institutions that use such technology, is to ensure the protection of personal data of educational applicants (Antonov, 2023).

The use of artificial intelligence in dual education includes certain disadvantages. First, AI requires large amounts of data for effective learning, which can be a limiting factor in dual education programmes where practical data may not be as widely available. Second, the accuracy of the information provided is critical, as errors in the data can lead to inaccuracies in the results of training, which is especially important in professional training. In addition, there is a significant risk from the standpoint of privacy: educational institutions that use AI must ensure reliable protection of students' personal data to avoid their misuse or leakage.

Additional disadvantages of using artificial intelligence in dual education in conditions of forced displacement (due to the fact that Russian troops captured the city of Berdyansk on 28.02.2022) of Berdyansk State Pedagogical University in Zaporizhzhia include:

1. Limited access to equipment and resources – in the context of displacement, it is difficult to provide the necessary technical equipment to fully utilise the potential of AI, especially in the practical aspects of dual education;

2. Interruption of communication with industrial partners – the relocation of the university has made it difficult to interact with existing industrial partners, which is important for dual education, since most of the practical training is carried out in production or in companies;

3. Difficulties with adapting courses – AI used to personalise the learning process requires considerable effort to adapt courses to new conditions, especially if the needs and availability of resources change;

4. Problems with the integration of new students – in the context of moving and changing locations, it is difficult to orient new students in the changed educational space, especially when the use of AI requires specific knowledge and skills to work effectively with systems.

These factors require additional planning and resources for the effective implementation and use of artificial intelligence in the context of a displaced university, which can complicate the implementation of a dual educational programme. Considering the conducted research, it is possible to confirm the significant potential of integrating artificial intelligence and digital technologies into the dual methodology of teaching bachelors of professional education. The results point to the positive impact of such integration on increasing student motivation, improving academic performance and developing professional skills, which is especially important in the context of globalisation and constant changes in market requirements. However, the study also identified a number of challenges associated with the use of AI in education, in particular, the need to provide high-quality data for training models, protect personal data of participants in the educational process, and adapt educational materials to the needs of students.

CONCLUSIONS

Thus, there is an indisputable significant potential for integrating artificial intelligence and digital technologies into the dual teaching methodology of bachelors of professional education. The use of AI in education opens up cutting-edge opportunities for improving the learning process, including ensuring students' safety in the online space and improving their academic performance through the development of personalised curricula. These technologies promise revolutionary changes in learning tools, creating more flexible, adaptive, and effective educational environments. However, it is important to recognise that the development and implementation of AI in education is accompanied by certain challenges and limitations, especially given the risks associated with education and upbringing. Data security issues, ethical considerations, the need for adequate teacher training, and ensuring equal access to technology for all educational applicants are among the main aspects that require attention. Thus, the future of dual education using AI and digital technologies looks encouraging, offering innovative approaches to learning. However, the success of this area depends on the ability of the educational community to solve problems, ensuring high quality and accessibility of education for

each student, and maintaining ethical standards in the use of the latest technologies.

In addition, based on the analysis of the integration of digital technologies and artificial intelligence into the dual methodology of teaching bachelors of professional education, it is possible to draw key conclusions about the significant potential of these innovations in improving the efficiency of the educational process. Individualised approaches, virtual discussions, gamification, and the use of VR and AR contribute to more active student participation in learning and improve their learning outcomes. However, challenges related to access to technology and the Internet can create obstacles to ensuring equal access to digital educational resources. Ethical issues, in particular, data privacy and security issues, require additional attention and regulation. Flexible and distance learning, supported by digital technologies, is becoming an important component of modern education, offering the latest ways for immersive and interactive mastering of the material. The integration of digital technologies and AI into dual education opens up broad prospects for rethinking and transforming approaches to learning. Achieving the full potential of digital innovation requires proactively addressing challenges related to access, ethics and security. Effective management of these aspects is key to ensuring equal opportunities for all students and ensuring effective learning. Given the growing importance of the ethical and legal aspects of AI use in education, it is necessary to develop clear guidelines for addressing them to ensure the protection of personal data and avoid abuse. In addition, it is necessary to explore methods for ensuring equal access to educational technologies for students from different socio-economic groups. Further study of these aspects will ensure the effective and inclusive use of AI in dual education.

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CONFLICT OF INTEREST

None.

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Інтеграція цифрових технологій і штучного інтелекту в дуальну методику навчання бакалаврів професійної освіти

Анотація. Особлива актуальність інтеграції штучного інтелекту в освітній процес виникає у зв'язку з стрімким розвитком цифрових технологій у XXI столітті, що відкриває нові можливості для педагогічної практики та водночас ставить перед нею нові виклики, особливо в контексті дуальної освіти, де поєднання академічного навчання з практичним досвідом може значно підвищити ефективність підготовки фахівців. Метою роботи було визначити найефективніші шляхи інтеграції цифрових технологій та штучного інтелекту, щоб відповісти на сучасні виклики в освіті та підготувати студентів до вимог сучасного ринку праці. Для досягнення мети дослідження використовувалися огляд літератури, статистичний аналіз даних, а також розробка рекомендацій для оптимізації використання цифрових технологій у дуальній освіті. В роботі виявлено інноваційні підходи, які можуть значно підвищити якість освіти, забезпечуючи індивідуалізацію навчального процесу та оптимізацію освітніх методик за допомогою сучасних технологій. Стаття пропонує комплексний погляд на теоретичні та практичні аспекти впровадження цифрових інновацій в освіту, надаючи методичні рекомендації для викладачів з метою оптимізації процесу навчання. Авторами розглянуто проблему впровадження новітньої технології штучного інтелекту в освітній процес з прикладами використання штучного інтелекту для підвищення ефективності навчального процесу та підвищення безпеки здобувачів освіти. Висловлено думку про необхідність реформування сучасної освітньої системи задля більш ефективного впровадження новітніх технологій у процес навчання. Проаналізовано вплив цифрових технологій на ефективність дуальної освіти, підкреслюючи основні переваги та виклики інтеграції цих технологій у сучасне освітнє середовище. Практичне значення даного дослідження полягає в тому, що його результати можуть бути використані викладачами та розробниками освітніх програм для бакалаврів професійної освіти щодо інтеграції штучного інтелекту і цифрових технологій в дуальну освіту, забезпечуючи ефективніше поєднання теоретичного навчання з практичним досвідом

Ключові слова: освітня програма; академічні студії; професійна практика; сучасні інформаційні системи; алгоритми; інтелектуальна обробка даних; індивідуалізація навчання; ефективність освітнього процесу

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Innovative teaching methods of tactical disciplines for students studying in the programme of training of reserve officers for air defence of the Army

Abstract. The study aimed to reveal modern methods of training reserve officers for air defence of the Army. The study analysed the current state of teaching tactical disciplines to students enrolled in the reserve officer training programme and the existing problems in the context of military education. The requirements for professional qualities, knowledge and skills of military personnel were described. The essence and importance of tactical disciplines are revealed. A study was conducted among 95 students of Ivan Kozhedub Kharkiv National Air Force University and the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute", which demonstrated the lack of innovative technologies in the educational process, as well as the need to develop practical skills of future military personnel using modern approaches. The study identified problems that students face during the educational process, in particular: fear of making mistakes (45% of respondents), lack of confidence in their knowledge and abilities (40% of respondents), and lack of practical skills (35% of respondents). The results of the study necessitated the development of new approaches to the training of military specialists and the improvement of existing curricula. The study proposed innovative methods of teaching tactical disciplines and provided recommendations for their introduction into the educational process. Among the proposed methods are: the creation of a simulation environment using augmented and virtual reality, air defence simulators, the use of artificial intelligence, and the creation of special training laboratories. The study suggested improving the skills of teachers to work more effectively with innovative technologies, regularly monitoring the effectiveness of innovations, and exchanging experience with international partners. The results obtained will improve the training of future military specialists, which may affect the effectiveness of countering armed aggression against Ukraine

Keywords: modern approaches; information technology; specialised education; virtual environment; simulation modelling

INTRODUCTION

In modern society is actively undergoing digitalisation processes that determine the need for innovative approaches and new educational methods in the educational environment to meet modern requirements. The use of innovative methods in the educational process can improve the training of future professionals, influence their knowledge acquisition and facilitate the effective development of practical skills, which will have an impact on the quality of their future professional activities, the development of their industry and the state as a whole. Due to the armed aggression against Ukraine, the use of innovative methods in the training of future military personnel has become increasingly important.

The use of the latest approaches in the military sphere, as well as in the educational process at military faculties and departments, was studied by V. Humeniuk *et al.* (2023), who also studied the use of innovative technologies at the Department of Military Medicine, D. Chopa *et al.* (2020),

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who analysed the peculiarities of using mobile applications in the study of military and technical disciplines, and M.L. Rusu (2023), who studied the culture of innovation in the military sphere. The researchers concluded that the modernisation of the educational process in today's realities is an important stage in the development of the state, which will allow the training of highly qualified specialists who will be competitive in the modern labour market and whose training will meet international standards. In the training of military specialists, the use of innovative methods can ensure a balance between theoretical knowledge and practical skills and influence the acquisition of the experience necessary for military service, which is especially important due to the special conditions in the country and the impact on the educational process. The military sphere requires regular design of innovative technologies and their application, as this allows to increase the accuracy and efficiency of military operations and respond quickly to the challenges of modern society.

Modern approaches to the training of future military specialists were revealed by J. Kosonen *et al.* (2023) in a study of the features of the use of modern educational resources in the educational process of future military personnel, as well as G. Wang (2024), who analysed the state of scientific research on military training and its prospects. The scientists noted that modern approaches to training military specialists can include flipped classrooms and expanded distributed learning, and that to modernise the educational process, it is necessary to develop the knowledge and skills of the teaching staff, improve the material and technical base and increase students' motivation to learn. However, no specific innovative methods of teaching disciplines to future military professionals were provided. In addition, the researchers concluded that the training of military specialists is currently based on outdated approaches, and the researchers identified the following problems that affect the decrease in the effectiveness of training future military personnel: outdated material and technical facilities, lack of motivation for students to study, lack of training models, including simulators that could be used to develop practical skills, which can reduce the quality of the educational process and contribute to a lack of practical skills.

The way to improve the training of future military personnel may be to introduce innovative approaches and methods into the educational process, but this process may also be accompanied by problems, as discussed by V. Chmyr & N. Bhinder (2023), who explored the challenges and prospects of using artificial intelligence in military training. R.P. Woźniak (2021) studied distance learning in the training of military specialists, and at the same time, I.S. Mert & C. Şen (2021), studied the features of professional military education. The researchers noted that the creation of an innovative educational environment for military professionals is important and necessary for them to acquire the necessary knowledge and counter armed aggression, but in the process of introducing innovations into the educational process, problems may arise, such as lack of material resources to modernise the educational process; lack of skills to apply innovations, both among teachers and students; teachers' commitment to traditional teaching methods; data confidentiality issues and the possibility of leakage of confidential proprietary information. The availability of modern equipment may not be enough for effective digitalisation and modernisation of the educational process, as it requires special skills to use them, which requires teachers and students to adapt to new technologies and changes in the organisation of the educational process.

The main problems that exist in the current content of educational programmes for the training of military specialists are also identified in the Resolution of the Cabinet of Ministers of Ukraine No. 1490-2022-p (2022). The document states that the current system of military education does not meet the current needs and does not meet the challenges currently faced by the Armed Forces of Ukraine, and identifies the reasons for this situation: use of outdated methods of training military personnel; lack of innovative educational technologies, methods and approaches; low level of readiness of academic staff to use innovative technologies and teach modern educational programmes; ineffective system of responsibility for the quality of training of military specialists; lack of material and technical support (in particular, simulators, training systems, complexes, laboratories and modelling centres); lack of exchange of experience with other educational institutions.

The modernisation and digitalisation of the educational process at military faculties and departments is an important stage in the quality training of servicemen for future duties, which will ensure a balance between their knowledge and skills. However, innovative teaching methods in the analysed studies are not sufficiently disclosed, and there are problems both in the existing educational process (outdated material and technical base, lack of opportunities to develop practical skills) and in the possible innovative educational environment (lack of material resources for the implementation of innovative approaches, lack of skills to apply them). The study aimed to provide effective innovative approaches to teaching disciplines to future military personnel. The objectives of the study was to analyse the current state of training of reserve officers, as well as to provide recommendations for the introduction of innovative methods in the educational process to improve their effectiveness.

MATERIALS AND METHODS

This study involved 95 students. Among them are 50 students from Ivan Kozhedub Kharkiv National Air Force University, as well as 45 students at the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute". The sample was formed randomly among students of military faculties and departments. For instance, among the participants of the study, 25 people from Ivan Kozhedub Kharkiv National Air Force University studied at the Faculty of Air Defence of the Army, and 25 people at the Faculty of Reserve Officers. Among the participants of the study from

the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute", all 45 people received their education at the military training department. The subjects were 22-25 years old, all male. All the subjects have different academic achievements, social status and different attitudes towards the research topic. Each of the subjects was trained in tactical disciplines. The survey was completely anonymous, and all the provisions of the The Declaration of Helsinki (2013) were followed. The information obtained was used exclusively for this study. A survey was conducted to identify the problems faced by students in the educational process (in particular, when studying tactical disciplines), analyse their attitudes towards innovative technologies and the possibilities of their use in preparation for performing their duties. The study was conducted using the author's questionnaire, which included 13 questions with the need to choose an answer that corresponds to the personal experience of the respondents ("Yes" or "No") and two questions with the need to provide an open answer (Table 1). Due to the introduction of martial law in Ukraine and for security reasons, the survey was conducted online using information and communication technologies (Google Forms).

Table 1. The author's questionnaire form for determining students' readiness to apply innovations in their professional training

No.	Question	Yes	No
1	Have you had any experience in tactical training?		
2	Have teachers used innovative technologies/methods/approaches in teaching tactical disciplines?		
3	Do you have experience with innovative technologies/methods/approaches (in any area of your life)?		
4	Was this experience useful for you?		
5	Are you getting the knowledge you need for your future military career?		
6	Are you getting the skills you need for your future military career?		
7	Is there enough practical application of the acquired knowledge in your educational process?		
8	Do you think it is advisable to introduce innovative technologies/methods/approaches in tactical training?		
9	Do you think that the introduction of innovative technologies/methods/approaches in tactical training can improve your preparation for military activities?		
10	Are you ready for future military activities?		
11	Are you confident in your knowledge and abilities?		
12	Do you believe that your knowledge and abilities are sufficient to perform your future duties?		
13	Do you have a fear of making mistakes in the course of your future duties?		
14	Please indicate what problems you face in the educational process, and which could be solved by introducing innovative technologies/methods/approaches into the educational process.		
15	Indicate which innovative technologies/methods/approaches could be useful in solving the problems described.		

Source: compiled by the authors

The results of this questionnaire helped to analyse the state of the educational process and identify the problems that exist in the current training of reserve officers for air defence of the Army. Given the presence of open-ended questions, the problems faced by students in the educational process were revealed and innovative technologies/methods/approaches that could be effective in solving these problems were identified. The synthesis of the data obtained was carried out, which became the basis for providing recommendations for the implementation of the proposed innovative methods of teaching tactical disciplines in the educational training of reserve officers. Based on the synthesis of the data obtained, the author also draws general conclusions and identifies prospects for further research in this area. This study analysed the following regulatory documents: Law of Ukraine No. 1556-VII (2014); Resolution of the Cabinet of Ministers of Ukraine No. 48-2012-p (2012); Resolution of the Cabinet of Ministers of Ukraine No. z1678-15 (2015); Resolution of the Cabinet of Ministers of Ukraine No. 1490-2022-p (2022).

The analysis of these regulatory documents:

- revealed the legislative framework for the training of reserve officers for air defence of the Armed Forces and identified problems that need to be addressed;
- defined the concept of "military higher education institution" and its differences from civilian educational institutions;
- determined the role of quality training of military personnel based on the list of their state duties;
- defined the concept of "tactical disciplines" and their role in the training of reserve officers for the Air Defence of the Armed Forces.

RESULTS

The educational process in Ukraine is being transformed in line with the changes taking place in the international labour market to prepare competitive specialists in various fields. Training specialists capable of effective professional activity is a priority for higher education. Particular attention currently is devoted to the training of military

specialists in connection with the armed aggression against Ukraine. Therefore, the educational process in higher military education institutions, as well as at military faculties and military departments of civilian higher education institutions, has certain peculiarities and should be subordinated to the existing needs of the state. According to the Law of Ukraine No. 1556-VII (2014), a military educational institution is defined as a higher education institution that trains cadets (students) for further service as officers to meet the needs of the Armed Forces of Ukraine. This indicates that the training of military specialists should meet the current needs of the state and is currently important for the protection of Ukraine's sovereignty, territorial integrity and inviolability.

To ensure the state sovereignty, territorial integrity and inviolability of Ukraine, it is necessary to staff the Armed Forces and other components of the defence forces with motivated, educated and qualified military personnel, which can be achieved through a high-quality educational process and the use of modern technologies, in particular: samples of weapons and military equipment, simulators, training systems, complexes, laboratories and modelling systems for future specialists to acquire the necessary practical skills (Resolution of the Cabinet..., 2022). Practical skills are important for all military specialities, including air defence officers of the Armed Forces. The servicemen of this branch ensure the protection of civilians, and military and civilian objects from air attacks by cruise and ballistic missiles, and unmanned aerial vehicles, and contribute to the effective execution of ground operations, creating the necessary conditions for their high-quality and unhindered conduct. The performance of these duties requires not only in-depth knowledge but also high-quality practical skills that should be acquired as part of training in higher education institutions, because on the battlefield there must be a specialist capable of performing duties accurately, clearly and responsibly.

The basis for acquiring practical skills in higher military educational institutions and military departments is tactical (tactical specialist) disciplines, which are conducted in a certain area (training grounds, airfields, training centres) or special classes/laboratories and within which the skills necessary for performing official duties are formed and improved (Resolution of the Cabinet..., 2015). Tactical disciplines provide not only practical training for future military personnel but also strategic and psychological training. During the teaching of tactical disciplines, students develop an understanding of how their actions affect real-life situations, as well as psychological readiness for the responsibility they face and the possible consequences of their decisions and actions. This makes tactical disciplines important in the comprehensive preparation of future military professionals for their duties. However, given the problems that exist in the current content of educational programmes for the training of military specialists (Resolution of the Cabinet..., 2022), there is a need to find new approaches and innovative methods to teaching tactical disciplines and changes in the training programmes for reserve officers for the Air Defence Forces.

To more specifically identify the problems that exist in the educational process during the practical training of future military personnel, which is necessary to provide effective innovative approaches to teaching tactical disciplines, a study was conducted among students of Ivan Kozhedub Kharkiv National Air Force University and the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute" Among those surveyed, 85% (81 people) stated that they had experience with innovative technologies/methods/approaches in various areas of their lives, and 74% (70 people) considered this experience to be useful. This demonstrated the high role of innovative methods in modern society and their benefits in various spheres of life, which confirmed the need for their application in the educational process. While 98% of respondents (93 people) had experience in teaching tactical disciplines, only 56% of respondents (53 people) stated that teachers used innovative technologies/methods/approaches in the process of teaching tactical disciplines. This proved the need to revise approaches to teaching tactical disciplines and the need to improve training programmes for reserve officers for the Air Defence Forces. Regarding the acquisition of knowledge and skills necessary for future military activities, 93% of respondents (88 people) believed that they were acquiring the knowledge necessary for their duties, but only 66% of respondents (63 people) said they were acquiring the skills necessary for their duties. Overall, 47% of respondents (45 people) noted a lack of practical application of the acquired knowledge in the educational process. These results pointed to the need to introduce tools into the educational process that would allow students to apply the knowledge gained in practice and acquire the necessary practical skills to perform future duties. Such tools may include previously identified samples of weapons and military equipment, special simulators, training systems, complexes, laboratories and modelling systems.

The findings were confirmed by the fact that 91% of respondents (86 people) indicated that they consider it appropriate to introduce innovative technologies/methods/approaches to tactical training, and 80% (76 people) said that this could improve the teaching of tactical disciplines and, as a result, their preparation for future military activities. However, only 60% of respondents (57 people) said they were ready for future military activities. Only 63% of respondents (60 people) were confident in their knowledge and abilities, and 36% (34 people) said that they believed their knowledge and skills were not sufficient to perform their future duties. And 33% of respondents (31 people) said they were afraid of making mistakes in their future careers. This demonstrated low readiness for future professional activities and the need to change approaches to the educational process, including the practical application of acquired skills. The respondents were asked to indicate what problems they face in the educational process, and which could be solved by introducing innovative technologies/

methods/approaches into the educational process. Among the most frequently mentioned problems are fear of making mistakes, lack of confidence in their strengths and abilities, and lack of practical skills (Fig. 1).

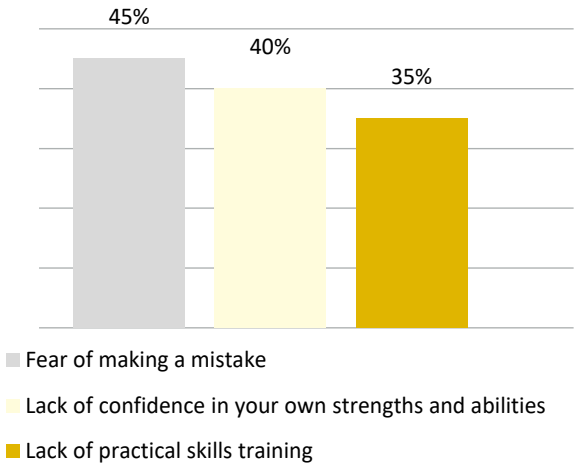

Figure 1. Problems faced by students during the educational process
Source: compiled by the authors

Less frequently, students reported fear for their health and life (20% of respondents) and fear of responsibility (12% of respondents), as their job duties involve a high level of risk and responsibility for the lives of others and their safety. Such results may demonstrate the need for psychological preparation of students for future military activities, which may be the prospect of further research. The respondents were also asked to indicate which innovative technologies they believe would be useful in solving the problems they face in the educational process. Innovative technologies are among the most frequently mentioned: artificial intelligence, virtual reality, special laboratories, and mobile applications (Fig. 2). Less often, students mentioned the need to use such methods as case-based learning (15% of respondents) and project-based learning (10% of respondents). Thus, the results of the survey demonstrated the expediency of changes in the existing military training programmes, as well as the need to introduce innovative methods into the educational process, as the surveyed students lack practical skills, lack of self-confidence, and are not ready for service, which can reduce its quality and effectiveness. To provide effective methods of teaching tactical disciplines, it is advisable to consider the basic requirements for the professional qualities, knowledge and skills of future reserve officers, as well as the competencies they should acquire in the course of their training for effective future professional activity since it is to implement these requirements that the content of the educational process, methods and approaches used are determined (Resolution of the Cabinet..., 2012).

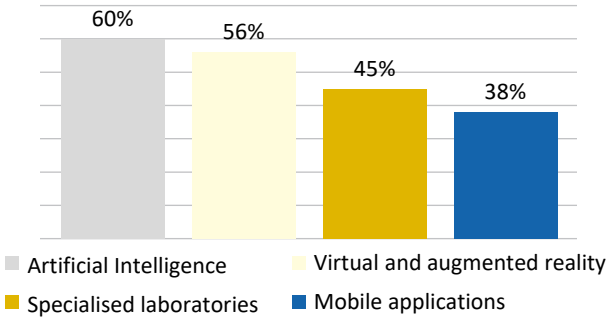

Figure 2. Innovative technologies that can be used to solve problems arising in the educational process
Source: compiled by the authors

Military competence in modern research is defined as a set of qualities that affect professional activity, ability and willingness to solve problems and tasks arising within it, using the acquired knowledge, skills, abilities, as well as values and culture (Benkovska, 2022). Military competence is also seen as a set of different knowledge and skills used in the performance of official duties (Fig. 3).

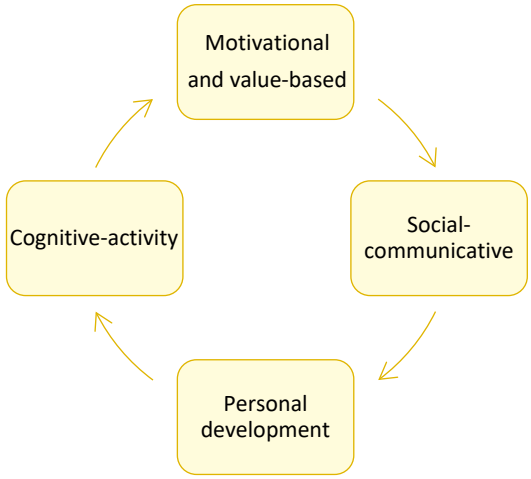

Figure 3. Blocks of knowledge, skills and qualities necessary for servicemen to perform their duties
Source: compiled by the authors based on O. Marchenko (2011)

The cognitive-activity block may include in-depth knowledge of the military sector and the ability to apply it in practice; cognitive skills necessary for effective performance (attention, analytical/critical/logical thinking, memory); flexibility, as the ability to adapt and quickly adapt to different conditions and situations. The motivational and value block may include motivation to perform official duties and to develop oneself as a professional throughout life; personal attitude to work and understanding of its importance; and personal values. The social-communicative block may include the ability to work in a team, the ability to understand requests, requirements and orders;

the ability to communicate effectively with others, and effectively resolve problems and conflicts that may arise while performing official duties. The personal development block may include the ability to self-development and professional improvement; unlocking one's potential; the ability to reflect; and the ability to take responsibility for actions.

Based on the requirements for the professional qualities, knowledge and skills of servicemen, innovative methods of teaching tactical disciplines for reserve air defence officers of the Armed Forces should develop the ability to quickly adapt to rapidly changing conditions on the battlefield, develop cognitive skills, motivate to perform official duties, form the ability to work in teams, motivate to continuous self-improvement and improve professional skills, provide opportunities to analyse their actions, their results and further adjust the strategy. Based on the information obtained during the study, the following innovative methods of teaching tactical disciplines to reserve officers are proposed: the creation of a simulation environment using augmented and virtual reality, air defence simulators, and artificial intelligence, and the creation of special training laboratories.

Artificial intelligence, which is a computer machine that can perform tasks, searching for information, generating ideas and performing other activities that normally require human intelligence, can be used to train reserve officers for the Air Force. The possibilities of its application in the training of military personnel are quite wide, in particular (Chmyr & Bhinder, 2023):

- the ability to simulate military missions and generate their results depending on the chosen options;
- the ability to plan operations and generate their results depending on the factors selected during planning;
- analysis and execution of various scenarios that may arise on the battlefield;
- designing plans;
- data analysis (e.g., analysis of the terrain features where the operation will be carried out, the approximate area of the territory where the operation will be carried out, and calculation of the results of the operation based on the selected factors);
- tracking of equipment health sensors or soldiers' health sensors.

In addition, artificial intelligence can be used by students in the process of self-education and improvement of their knowledge and skills to search for the necessary theoretical information, develop an individual study plan, learn foreign languages to interact with international partners, generate ideas. The introduction of artificial intelligence in the teaching of tactical disciplines can contribute primarily to the development of cognitive skills of military personnel because, despite its ease of use, artificial intelligence requires the input of accurate, consistent and logical data to perform tasks effectively and to search for the necessary information in a targeted manner (Baird *et al.*, 2024). In addition, artificial intelligence can be useful for analysing certain actions and decisions, tracking their consequences and, if necessary, correcting them. Among the problems that may arise in the process of introducing artificial intelligence into the educational process is the lack of necessary competencies for both teachers and students to use them correctly and effectively.

Air defence simulators are trainers that mimic the operation of military equipment to recreate real situations in artificial environments (Kulik *et al.*, 2023). Modern simulators have different degrees of realism and can be used in different conditions. There are such simulators as live simulators, virtual simulators, and constructive modelling (Bhattacharjya *et al.*, 2023). Live simulations can be implemented at training grounds using real equipment but without its practical application. The advantages of live simulations can be the conditions in which they are implemented (for example, at training grounds, conditions can be as close to real ones as possible) and the ability to interact with real equipment that will be used during professional activities. The disadvantages of live simulators may be the impossibility of practical use of the equipment, as well as its accidental damage, which will cause material damage. In this regard, virtual simulators and the creation of simulation environments based on them can be safer and more effective. The creation of a simulation environment using augmented and virtual reality can be an effective method of practical training for future military personnel, which will help them practice their knowledge in situations and conditions close to real life.

Virtual reality is software that can be used to interact with a three-dimensional simulated environment in real time (Pallavicini *et al.*, 2016). Virtual reality can enable students to experience real-life situations on the battlefield, but without endangering their lives and health, without endangering others, and without material losses that may occur in the event of damage to real equipment and real means of warfare. By introducing a simulation environment using virtual and augmented reality into the educational process, students will be able to develop flexibility – the ability to quickly adapt to situations that may arise and change rapidly on the battlefield, and can also clearly see the results of their correct or incorrect actions, understand the consequences of their decisions and high responsibility and adjust their strategy to get the best result in real professional situations (Almer *et al.*, 2021). The simulation environment using virtual and augmented reality can be implemented in the form of a specially equipped place in the classroom or at a training ground, which will look as close as possible to real conditions, and special virtual reality devices (glasses and sensors) will create the effect of being on a real battlefield. Another method of implementing a simulation environment is to create special software or use existing software (for instance, Joint Conflict and Tactical Simulation or Battle Command) that would allow simulating real situations on the battlefield at different levels and of varying complexity.

Among the factors that can influence the effectiveness of student training within the simulation environment using virtual and augmented reality are the following: availability of the necessary material and technical support based on a higher education institution, the quality of the simulation environment and the availability of the necessary competencies of teachers who will train future military personnel in a simulation environment (Gawlik-Kobylińska *et al.*, 2020). If at least one of these factors does not meet the requirements, the effectiveness of teaching tactical disciplines using a simulation environment may be reduced, as the lack of material and technical support, its quality, and the readiness of teachers to use it in the educational process are important aspects of quality and effective training.

The study by T. Kulik *et al.* (2023) describes such air defence simulators as OSA, TR-23 simulator, UST-1 GROM Training, NEWA SC simulator, TR-GROM MANPADS (Table 2). The use of these simulators is typical for the training of Polish military personnel, but since the Republic of Poland is a partner state of Ukraine, it allows for the exchange of experience between military educational institutions of both countries and in the future these simulators can be used in the training of Ukrainian military personnel, and therefore it is advisable to analyse the identified simulators and determine their advantages.

Table 2. Comparative characteristics of air defence simulators

Simulator	Description	Advantages
OSA	An air defence simulator that generates and practices specific scenarios that may arise in real-life situations on the battlefield with the ability to select conditions (day, night, weather conditions) and simulate a laser rangefinder.	The ability to choose the level of training of the student for comfortable and gradual development of practical skills; the ability to choose scenarios; and the possibility of team interaction.
TR-23	An air defence simulator is a mobile simulator using a monitor that displays a simulated image of a tactical situation, within which exercises are performed to detect, recognise, track and destroy air targets.	Possibility of team interaction; accessibility of the simulator; possibility of simultaneous training of a large number of people.
UST-1 GROM Training	A simulator designed for training in firing from a man-portable air defence system with the ability to evaluate the tasks performed according to selected criteria.	Ability to assess practical skills and correctness of tasks.
NEWA SC	A simulator based on real and augmented reality that simulates air raid scenarios with full simulation of objects, the environment, as well as the technical means used in real combat operations (for example, a copy of the missile system operator's consoles).	The ability to create combat scenarios according to selected criteria; the ability to analyse actions; accurate reproduction of real-world equipment.
TR-GROM MAN-PORTABLE AIR DEFENCE SYSTEM	A simulator designed to develop skills in interacting with man-portable air defence systems, allowing one to learn the features of their use in various virtual environmental conditions with simulated terrain, weather, atmospheric conditions and even sound effects. The simulator offers a large database of aircraft for practising skills in operating man-portable air defence systems and a wide range of scenarios with the ability to set own parameters.	Creating the most realistic environment possible; a wide base of scenarios with the ability to customise parameters and a wide base of aircraft

Source: compiled by the authors based on T. Kulik *et al.* (2023)

Thus, the advantages of virtual air defence simulators are the creation of the most realistic environment (simulating terrain, weather conditions, day or night, and even sounds), the ability to practice practical skills according to specified parameters (depending on the student's prior training, existing knowledge and skills, and field of study), the ability to select certain scenarios and practice them further, and the possibility of team interaction, which is an important factor in success on the battlefield, as well as the availability of equipment that can verify the correctness of the actions taken and exercises performed. However, such air defence simulators are expensive and may not be available to all higher education institutions, especially under martial law. In the context of limited resources, the most effective methods of improving the training of reserve officers for the Air Defence of the Armed Forces may be constructive modelling and the creation of special laboratories at a higher education institution that will combine all the necessary methodological and possible technical means to gain in-depth knowledge of military activities and practice practical skills.

Constructive modelling includes the use of various computer programs without the use of virtual and augmented reality and without the need to visit training grounds. In this software, it is possible to train on certain scenarios based on the input of the necessary data, for example: speed and type of aircraft, their weapons, and weather conditions. The advantages of this method are accessibility and ease of use, while the disadvantages are the lack of a realistic environment and the inability to simulate the use of aircraft destruction tools. Establishing special laboratories in higher education institutions is also an affordable method of improving the teaching of tactical disciplines. These laboratories can have a mixed format and be partly presented

in an offline environment (classrooms, testing grounds) and partly in an online environment. In an online environment, such as an online repository, the teaching materials necessary for professional training can be stored: manuals, recommendations, and author's developments by university professors and leading experts in the military field. The offline environment may include available models of military equipment, computers with the necessary software (e.g., constructive modelling software) to practice practical skills, and, if available and feasible, additional virtual reality devices (glasses and sensors). In addition, teamwork can take place within these laboratories: brainstorming on military operations, discussion and analysis of military operations already conducted, development of communication skills, exchange of experience and moral support.

The combination of in-depth knowledge of their speciality and its practical application can improve the training of military specialists, and make it more effective, which can lead to better results on the battlefield. Based on the results of the survey and analysis of scientific sources, it was found that each of the proposed methods during their implementation in the educational process may have its shortcomings that should be eliminated to improve their effectiveness and increase the efficiency of professional training of future military personnel. Among the most common problems that may arise while introducing the proposed innovative methods into the educational process are the lack of special competencies of teachers to implement innovations and use them in the teaching process and the lack of experience of students in working with innovations in the educational process. To solve these problems, the study proposed regular professional development of teachers, exchange of experience with international partners, and regular monitoring of the effectiveness of innovations. Many teachers may be adherents of traditional teaching methods, and when innovative methods are introduced into the educational process, they may have problems with their use and, as a result, with the practical training of future military personnel. In addition, modern technologies are changing rapidly, as are their functionality and approaches to their application. Therefore, for the effective implementation of the proposed innovative methods, it is advisable to conduct regular professional development among teachers, in the field of modern technologies. Professional development can take place through attending specialised courses, seminars, and workshops, as well as listening to various lectures, taking online courses, and listening to webinars. In addition, an effective way to improve the qualifications of teachers and develop the knowledge and skills of future servicemen and women is to exchange experience with international partners, as the experience of European servicemen and women can be valuable in improving interaction with innovative technologies, as well as in improving them and increasing the effectiveness of military training.

Given that innovative methods are rapidly evolving and require constant improvement, regular monitoring of the effectiveness of innovations is recommended. This not only tracks their effectiveness in teaching tactical disciplines, but also analyses their impact on military training, and improves them based on the needs of the educational process and students. The effectiveness of the proposed innovative methods can be monitored through regular surveys among students, selecting several exercises or tasks, the effectiveness, speed and accuracy of which will be compared over time, which will help assess how well the implemented modern approaches meet the purpose of the educational process and how effectively they develop the practical skills of future military personnel. To control the effectiveness of the implemented innovative methods, it may be advisable to conduct an experimental study of their effectiveness. Thus, to ensure the state sovereignty, territorial integrity and inviolability of Ukraine, military personnel must acquire certain knowledge, and competencies and have highly developed practical skills. However, the results of the survey showed that students perceive a lack of practical skills and experience to start their professional careers. Respondents also noted a fear of making mistakes and being held accountable during their future professional activities. In the modern world, these problems can be most effectively addressed by introducing innovative methods into the educational process, in particular: simulation environment with the use of augmented and virtual reality, air defence simulators, artificial intelligence, and special training laboratories. For more effective implementation of the proposed methods, it is advisable to improve the current competencies of teachers, monitor the effectiveness of the implemented methods, and exchange experience in the use of innovative technologies in military training with international partners.

DISCUSSION

The study determined that in the modern world, the military forces must be well-trained for the performance of official duties and have in-depth knowledge and highly developed practical skills. However, there are currently problems in the process of training future servicemen, in particular in the process of training reserve officers for the Air Defence Forces. To address the problems identified in this study, innovative teaching methods for future military personnel that can improve the effectiveness of their preparation for future professional activities were provided, and additional recommendations were made for their effective implementation in the educational process.

After analysing the peculiarities of the use of virtual reality technologies in military training, H. Zhong (2022) concluded that military training strengthens the combat capability of the army and the ability to effectively perform official duties, but it should be based on modern approaches, which correlates with the results of this study. These conclusions were also reached by M. Miller-Kopyt & A. Witczak (2022), who studied an interactive air defence simulator. The researchers noted that the effective operation of the state's military forces is possible only as a result of the use of modern methods and approaches and a

properly organised military training process. High-quality training of military specialists for the performance of official duties is possible within a higher education institution, which is also noted in the study of special military training in higher medical education by. The researchers concluded that in modern military training, there is a need for changes in the existing curricula, which was also identified in this paper. The study identified the creation of a simulation environment using augmented and virtual reality, air defence simulators, the use of artificial intelligence, and the creation of special training laboratories as innovative methods of tactical training of reserve officers.

In their study of simulation technologies in military medicine education, V. Rice *et al.* (2011) noted that the use of simulations of various types is an effective method of training specialists for future professional activities, and the researchers identify computer modelling and the use of virtual reality as the most effective methods, which correlates with the results of this study. Among the methods not disclosed in this study, researchers propose static and dynamic holograms, but they may not be available to all higher education institutions. The simulator as a method of effective training of military personnel was also considered in the study of a military training simulator based on virtual reality by R. Patil (2024). The scientist analysed the learning environment that allows you to practice practical skills without using real technical equipment. Such learning environments help students perform a variety of tasks in different conditions and terrains, analyse the data and assess their skills in real-time. The use of such virtual environments, according to the researcher, in addition to practising practical skills, improves leadership skills makes important decisions on the battlefield, and minimises the danger that may arise during training-on-training grounds using real equipment, which correlates with the results of this study.

Studying virtual reality methods for military training, C.U. Hinojosa & D.R. Arispe García (2023) also concluded that the main advantage of using virtual reality is that it does not require travelling to real training grounds, which is safer and requires fewer material costs, and will contribute to more effective training of students. H. Cardona-Reyes *et al.* (2024), studying the design of tasks for military personnel in virtual reality environments, noted that practising practical skills in virtual reality increases students' motivation to learn and helps them analyse their skills that can be applied in real professional situations, which correlates with the results of this study. G. Telli Yamamoto & D. Altun (2021), studying the prospects of virtual reality technologies in military training, concluded that virtual reality improves the perception and speed of information retention and can replace practical training on training grounds, and A. Sudiarno *et al.* (2024), analysing the performance of specialists after training using virtual reality, noted that the accuracy of practical skills in real and virtual conditions is quite similar, which proves the effectiveness of virtual air defence simulators. However, this study has determined that virtual reality may not be available to all higher education institutions due to a lack of material resources. D. Maxwell *et al.* (2018), in their study of virtual reality entertainment devices in military training, also concluded that virtual reality technology may not be accessible to everyone. The researchers noted that there are currently affordable virtual reality systems, but their quality may be lower and, in some cases, provoke vision problems, which may affect further military activities and the quality of combat missions, which should be addressed but was not sufficiently disclosed in this study. Another disadvantage of virtual reality, which was not taken into account in this study, is that communication on the battlefield can be unstable, as noted in the study of military simulation training by J.J. Shen *et al.* (2009). While using virtual reality technologies, students are provided with high-quality mobile and Internet communications, and the opportunity to receive assistance and support from other military personnel without hindrance. In real-world conditions, such capabilities may be limited, which may reduce the effectiveness of military personnel on the battlefield, which should be taken into account when training military personnel using virtual reality.

Another innovative method of teaching tactical disciplines in this study is artificial intelligence. A. Khan *et al.* (2024), studying artificial intelligence in military training programmes, concluded that it is relevant in modern military training and facilitates data analysis and modelling, which helps to make more informed decisions about military operations and actions, which correlates with the results of this study. However, scientists note that the use of artificial intelligence for military purposes lacks an understanding of how this or that information is generated, which was not considered in this study. Military activities are responsible, and conditions during military operations can change rapidly, which is not always addressed by artificial intelligence. In addition, artificial intelligence is not capable of addressing all possible factors, which should be taken into account when using it to train future military personnel. Despite the large amount of information provided by artificial intelligence, it needs to be verified, and tools should be created to more transparently evaluate the information provided by artificial intelligence. M. Möbius *et al.* (2023), studying artificial intelligence for military decision-making, concluded that training with its use is an effective method of preparing military personnel for professional activities and can also be useful for decision-making, training in the use of equipment, planning of military operations and their optimisation, which correlates with the results of this study. The researchers also noted that for artificial intelligence to be more effective, it should be used in combination with other innovative methods, such as virtual and augmented reality or modelling. Among the possibilities of using artificial intelligence in military training that were not disclosed in this paper, the researchers noted the possibility of using it for cybersecurity and cyberattack resistance. This requires the development of a legislative framework for the use of artificial intelligence in the training of reserve officers, as well as verification of the safety of its use.

Speaking about computer modelling as an accessible method of training military personnel for professional activities, J.D. Fletcher & P. Chatelier (2000), analysing the possibilities of military training, noted that simulation is characteristic of military training, therefore, the use of software for this purpose is appropriate, which correlates with the results of this study. The researchers concluded that computer modelling makes the training process more realistic by creating different events and reproducing different scenarios under different conditions, which was also noted in this paper. Among the innovative methods of teaching tactical disciplines not disclosed in this study, A.F.A. Fadzlah *et al.* (2023), in their study of mobile games for military training, highlight mobile applications. The researchers concluded that gaming mobile applications and mobile applications specially designed for military training may be the most accessible and one of the most effective methods for military personnel to acquire the necessary knowledge and skills. To improve the effectiveness of the implementation of the proposed methods in the educational process, it was suggested that teachers should be trained, and experience exchanged with international partners. Both professional development for teachers and the exchange of experience for future military personnel can take place through cooperation with other educational institutions, with educational institutions of partner countries. In their study of public relations as a method of improving the competencies of military personnel, C.J. Gbaden & K. Kwapsoni (2022) noted that communication is the basis of any activity, including military, which proves the need to share experiences with other professionals. S. Barr *et al.* (2019) noted in their study of academic-practical partnerships in the training of military doctors that experience exchange, exchange programmes, and foreign internship programmes can be effective in acquiring practical skills, which correlates with the results of this study.

Military training is an important aspect of the development of a modern state, as well as a guarantor of the protection of its territorial integrity, which determines the need to change approaches to training future military personnel. Modern technologies such as virtual and augmented reality and the creation of simulation environments with their help, artificial intelligence, and computer modelling can be effective methods of teaching tactical disciplines, but they can also have certain disadvantages. Disadvantages: the inaccessibility of some modern technologies due to limited resources, inaccurate data, lack of realistic training, and privacy issues, which should be analysed and addressed. By improving the qualifications of educators and facilitating the exchange of experience with international partners, the implementation of the proposed methods can be made more effective and the training of reserve officers for air defence of the Armed Forces more efficient.

CONCLUSIONS

This study reveals innovative methods of training reserve air defence officers of the Armed Forces. The study determined that the use of innovative methods is an important part of the educational process in military specialities since the processes of digitalisation combined with armed aggression against Ukraine require new approaches to the training of military personnel. Traditional methods and approaches to military training, including practical skills training, are currently insufficient, which requires finding ways to improve the educational process. The study also identified that some students believe they lack the knowledge and abilities to perform their future job duties. In addition, some respondents concluded that they have fears about their future professional activities, in particular: fear of making mistakes, lack of practical skills, and difficulties in understanding how to use the knowledge gained in real-life situations, rather than in the educational process. This pointed to the need for changes in the educational process and the importance of improving curricula and training methods. The respondents noted that effective approaches that can be used to improve the educational process could be: the use of artificial intelligence, virtual and augmented reality, the creation of special laboratories and the use of mobile applications.

Based on the information obtained during the study, the following innovative methods of teaching tactical disciplines were proposed: the creation of a simulation environment using virtual reality, air defence simulators, use of artificial intelligence, as well as the creation of special training laboratories, which will collect all theoretical information and will also preserve the possibility of its practical development. However, both teachers and students may have problems in the early stages of working with the proposed innovative approaches. Based on this, recommendations were made for their introduction into the educational process, in particular: professional development among teachers, which can ensure more efficient work with modern technologies and a better teaching process; regular monitoring of the effectiveness of the innovations applied to track their effectiveness and, if necessary, adapt them to specific conditions; exchange of experience with international partners, which can help to work more effectively with innovative methods and use all their capabilities.

The limitations of this study include the possibility of inaccurate and dishonest answers from respondents, which may be due to fear of being judged or losing confidentiality, as well as the insufficient number of respondents in the sample. The results obtained can be improved by involving a larger number of respondents, and prospects for further research may include an analysis of the psychological readiness of students studying under the programme of training reserve officers for the Air Defence Forces for professional activity, disclosure of methods of psychological preparation for the performance of official duties, as well as experimental testing of the proposed methods of teaching tactical disciplines.

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CONFLICT OF INTEREST

None.

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Інноваційні методи викладання тактичних дисциплін для студентів, які навчаються за програмою підготовки офіцерів запасу для ППО Сухопутних військ

Анотація. Метою даного дослідження було розкрити сучасні методи підготовки офіцерів запасу для протиповітряної оборони Сухопутних військ (ППО СВ). В роботі було проаналізовано сучасний стан викладання тактичних дисциплін для студентів, які навчаються за програмою підготовки офіцерів запасу та існуючі проблеми в змісті військової освіти. Описано вимоги до професійних якостей, знань і умінь військовослужбовців. Розкрито сутність та важливість тактичних дисциплін. Проведено дослідження серед 95 студентів Харківського національного університету Повітряних Сил імені Івана Кожедуба, а також Національного технічного університету України «Київський політехнічний інститут імені Ігоря Сікорського», яке продемонструвало нестачу застосування інноваційних технологій в навчальному процесі, а також необхідність відпрацювання практичних навичок майбутніх військовослужбовців за допомогою сучасних підходів. За результатами дослідження було виявлено проблеми, з якими стикаються студенти в ході навчального процесу, зокрема: страх помилки (45 % опитаних), невпевненість у власних знаннях та здібностях (40 % опитаних), нестача відпрацювання практичних навичок (35 % опитаних). Результати дослідження обумовили необхідність розробки нових підходів до підготовки військових фахівців та удосконалення наявних навчальних програм. На основі проведеного дослідження було запропоновано інноваційні методи викладання тактичних дисциплін та надано рекомендації щодо їх введення в освітній процес. Серед запропонованих методів: створення імітаційного середовища з використанням доповненої та віртуальної реальності, симулятори ППО СВ, використання штучного інтелекту, а також створення спеціальних навчальних лабораторій. Рекомендовано підвищення кваліфікації серед викладачів для більш ефективної роботи з інноваційними технологіями, регулярний моніторинг ефективності інновацій, а також обмін досвідом з міжнародними партнерами. Отримані результати дозволять покращити підготовку майбутніх військових фахівців, що може вплинути на ефективність протидії збройній агресії проти України

Ключові слова: сучасні підходи; інформаційні технології; спеціалізована освіта; віртуальне середовище; імітаційне моделювання

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The female triad in the development of public preschool education: Pauline Kergomard, Sophia Rusova and Maria Montessori

Abstract. The relevance of the research is based on the retrospective analysis of the foundational aspects of the public preschool education development. The research problem concerns the determination of how views on teaching and education of preschool children evolved in public institutions across European countries since their establishment (late XIX – mid XX century) and the specification of the contributions made by those pioneers. The aim of the study was to provide a comprehensive historical and pedagogical analysis of the creative activities and conceptual frameworks concerning the preschool education systems established by three founders: the Frenchwoman Pauline Kergomard, the Ukrainian Sophia Rusova and the Italian Maria Montessori. To achieve the stated objective, a complex of methods was implemented: theoretical analysis and synthesis, historical-pedagogical methods (retrospective and chronological-structural), pedagogical historiography, specification, generalization, and systematization. The article studies the main stages of pedagogical activities of each pedagogue of the female triad in the development of public preschool education, as well as the leading principles characterizing their pedagogical concepts. It offers both identical and specific positions regarding the contributions represented by these figures. Key progressive ideas regarding the organization of educational processes for preschool children in the context of modern preschool education have been defined as relevant for implementation. It was clarified that these positions included principles concerning the organization of public preschool education considering national identity, natural inclinations, talents and interests of children, as well as their psychological capabilities while performing different activities. The core role of the female triad's contribution addressed the formation of personality during early childhood and the guidance of this process by the pedagogue. The scientific and practical value of the conducted research lies in deepening educational materials within the educational component

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"History of Preschool Pedagogy" for students majoring in Preschool Education (specialty 012). Additionally, it contributes to the course "Foreign Language for Professional Purposes" for students majoring in pedagogical specialties. This research enhances the understanding of historical developments and theoretical foundations in preschool pedagogy, providing valuable insights and knowledge for researchers and students specializing in pedagogy

Keywords: history of preschool pedagogy; France; Ukraine; Italy; the end of the XIX – middle of the XX century; children of preschool age; formation of preschool theory and practice

INTRODUCTION

To understand the development of preschool education and find effective ways to organize the educational process with preschool children, it is important to refer to historical origins in the context of this phenomenon continuity not in a single country, but in several. This approach will help to identify identical and specific trends in the development of preschool education systems, as well as clarify the main conceptual positions in the views of the founders of public preschool education. The peak of this historical-pedagogical phenomenon, which occurred in European countries, falls between the late XIX century – the mid of the XX century. Specifically, the development of public preschool education in France was inspired by the pedagogical activities and conceptual positions outlined in the works of Pauline Kergomard, in Ukraine by Sophia Rusova and in Italy by Maria Montessori. However, in the resources, these individuals' achievements are usually presented autonomously, which does not allow for an analysis of the similarities or differences in their views, despite the fact that they were engaged in the same endeavor – they were founders of institutions for preschool children and developed their educational systems. This highlights the necessity for scientific understanding of the historical origins of public preschool education development in three European countries from the perspective of contemporary requirements, explaining the relevance of the initiated research. The focus of the scientific inquiry is on conducting a retrospective study of the pedagogical activities and contributions of this unique triad of women in the development of public preschool education.

Considering the modern challenges in the preschool education system, related to the updating of both its content and methodological support, researchers from different countries have begun to actively study the history of pedagogy to uncover "gems" that may not have been previously studied for ideological reasons (Ivanova, 2019; Raimondo, 2021; Scaglia, 2021). As E. Scaglia (2021) rightly noted, it is important to understand the relation between the "historical genesis" and the current educational system to identify advanced ideas and innovative views and implement them in the education of preschool children. One aspect is the study of the foundation and development of public preschool education in France, a globally progressive country. This is primarily related to Marie Pape-Carpantier (1815-1878) and her successor in preschool education, Pauline Kergomard (1838-1925) (Mutuale & Weigand, 2019; Palluau, 2021). Significant achievements distinguish both the practical pedagogical activities and the scientific works of the renowned doctor and psychologist Maria Montessori (1870-1952), the founder of preschool institutions in Italy. The pedagogical system she developed holds a significant place in the global practice of preschool education (Hopta, 2020; Romano, 2020). Today, the methods of the Italian educator are used in the preschool education systems of various countries worldwide, including Ukraine.

Valuable for scientific understanding and implementation in the educational process of preschool institutions is the contribution of Sophia Rusova (1856-1940), the founder of public preschool education in Ukraine in the late XIX – early XX centuries. Her pedagogical activities and the formulated principles of preschool education span various periods and directions, including practical work with preschool children, teaching courses for students at the Froebel Women's Pedagogical Institute and administrative work in the government of the Ukrainian People's Republic (Dzhus, 2020). A significant part of Sophia Rusova's work focuses on the theoretical foundation of the Ukrainian national kindergarten, the development of a holistic educational process, and the implementation of comprehensive education tasks for preschool children (Lokhvytska & Konstantinova, 2019).

Thus, it can be asserted that during this historical period, there was a dissemination of pedagogical ideas concerning the need for the development of public preschool education. These ideas subsequently defined the scope of issues for both the theoretical foundations of preschool pedagogy and child psychology, as well as various aspects of practical work in preschool institutions. However, the results of such thematic studies are usually presented separately for each country or in terms of the pedagogical activities and legacies of their representatives. There are only a few studies that provide a comparative analysis highlighting key positions, such as the pedagogical views of Maria Montessori and Sophia Rusova, as conducted by N. Yakobchuk (2023).

Considering the above, the scientific interest lays in understanding the significance and role of the female triad (Pauline Kergomard, Sophia Rusova, and Maria Montessori) in the development of public preschool education in a holistic unity. This was based on identifying common elements in their pedagogical concepts and differences in their interpretations of the essence of preschool children's education, development and teaching. This shaped

the research question of the presented thematic study. The aim of the article was to conduct a historical-pedagogical analysis of the activities and views on preschool education of the Frenchwoman Pauline Kergomard, the Ukrainian Sophia Rusova, and the Italian Maria Montessori, within a single framework, recognizing them as founders of preschool institutions and pioneers of public preschool education.

The tasks were as follows:

1) To explore the main stages of pedagogical activity and carry out an overview of the leading provisions of the pedagogical concepts of the founders of public preschool education in the late XIX – mid XX centuries: in France – Pauline Kergomard, in Ukraine – Sophia Rusova, and in Italy – Maria Montessori;

2) To outline identical and specific positions in the pedagogical concepts of representatives of the female triad in the development of public preschool education;

3) To define progressive ideas in accordance with modern preschool education, formulate key positions that are appropriate for implementation in the content of the educational component "History of Preschool Pedagogy" for students of the first (bachelor's) level of education majoring 012 Preschool education and on the course "Foreign Language for Professional Purposes" for students majoring pedagogical specialties.

The scientific novelty can be met in the presentation of the results regarding the extrapolation of conclusions about the meaning and role of the female triad in the development of public preschool education through the comprehensive prism of consideration: the identical and specific positions of Pauline Kergomard, Sophia Rusova and Maria Montessori on the upbringing, development and education of preschool children.

MATERIALS AND METHODS

The scientific search was carried out in accordance with the following main stages. At the *first stage*, the issue of the research was specified in accordance with the scientific problem raised, the chronological boundaries (late of the XIX century – mid of the XX century) and territorial affiliation (France, Ukraine, Italy) were determined; the study of scientific and pedagogical sources (Table 1) from the outlined spectrum of issues and the primary analysis of the collected data was carried out, which made it possible to shape the goal and research tasks.

Table 1. Description of the ranking of the studied scientific and pedagogical sources

Territorial affiliation and personality	Source
Pauline Kergomard (France)	Cohen, S. (2006). Childhood at heart. Marie and Pauline: Two pioneers of nursery school. Georgieva-Hristozova, V., & Slavov, I. (2018). Pauline Kergomard as the founder of kindergartens and public pre-school education in France. Kabac, N. (2016). Pauline Kergomard pedagogue and writer: From the foundation of kindergartens to the writing of children's books. Kergomard, G., Kergomard, A., & Luc, J.-N. (2000). Pauline Kergomard creator of modern kindergarten, private correspondence, reports to ministers. Kergomard, P. (2009). The lesson of things. Chapter XV, excerpt from the book Kindergarten in School (reprint 1886). Kergomard, P. (1886). Nursery education in schools. Kergomard, P. (1928). The child from 2 to 6 years. Practical teaching notes. Moussy, B. (2007). Between Pauline Kergomard and Maria Montessori. Mutuale, A., & Weigand, G. (2019). The great figures of pedagogy. Palluau, N. (2021). The socio-educational destiny of the Kergomard heirs (1914-1983). Plaisance, E. (1996). Pauline Kergomard and nursery school. Plaisance, E. (2001). Pauline Kergomard. Terdjman, E. (1992). The preschool system according to Pauline Kergomard (1838-1925). Vincent-Nkoulou, M. (2007). The creation of the figures of two pedagogues in the history of education: Jean-Frédéric Oberlin and Pauline Kergomard.
Sophia Rusova (Ukraine)	Dzhus, O. (2020). Issues of inclusion and special education in the creative heritage of Sofia Rusova. Lokhvytska, L., & Konstantinova, K. (2019). Psychological and pedagogical principles of moral education of preschoolers in the views of S. Rusova. Melenets, L. (2015). Sophia Rusova about the organization of preschool education in rural areas. Rusova S. (1924). Theory and practice of preschool education. Rusova, S.F. (1927). New methods of preschool education. Rusova, S.F. (1996). Selected pedagogical works. Tarapaka, N., & Martin, A. (2015). Views of S.F. Rusova on the problems of moral education of preschool children. Ulyukaeva, I.G. (2016). Concept of preschool education of Sofia Rusova. Ulyukaeva, I.G. (2018). The world process of preschool education development and its influence on the formation of domestic theory and practice (XIX – early XX centuries). Yakobchuk, N. (2023). Pedagogical views of Maria Montessori in Sofia Rusova's scientific research.

Table 1. Continued

Territorial affiliation and personality	Source
Maria Montessori (Italy)	Frierson, P.R. (2022). The moral philosophy of Maria Montessori. Hopta, S.M. (2020). Pedagogical ideas of Maria Montessori in the context of modern educational space. 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. Absorbing mind. Moussy, B. (2007). Between Pauline Kergomard and Maria Montessori. Pironi, T. (2011). From Ellen Key to Maria Montessori: The design of new educational spaces for children. Raimondo, R. (2021). Maria Montessori and Anna Freud: Links and influences between pedagogy and psychoanalysis. Romano, A. (2020). Maria Montessori: A complex and multifaceted historiographical subject. Yakobchuk, N. (2023). Pedagogical views of Maria Montessori in Sofia Rusova's scientific research.

Source: developed by the authors

On the *second stage*, a general analysis of the selected historical-pedagogical sources was presented, together with a brief biographical description of the lives and an overview of the key principles of the pedagogical concepts of the public preschool education founders in France – Pauline Kergomard, in Ukraine – Sophia Rusova, and in Italy – Maria Montessori. On the *third stage*, identical and specific positions in the pedagogical concepts of the female triad in the development of public preschool education were identified, and conclusions were formulated based on the results of the study. These conclusions will contribute to a deeper understanding of the educational component "History of Preschool Pedagogy".

Justification of the applied research methods: *theoretical analysis and synthesis* were employed to study the scholarly sources concerning the research issue, which involves clarifying the historical roots of public preschool education in different countries (France, Ukraine, Italy); *historical-pedagogical methods* (retrospective and chronological-structural) were utilized to comprehend the prevailing views during the studied period regarding the development, upbringing, and education of preschool children; *pedagogical historiography method* was used to interpret the main perspectives of the female triad in the development of public preschool education and the principles outlined in their pedagogical works; *specification and generalization methods* were employed to delineate the fundamental conceptual positions of the pedagogical legacy of Pauline Kergomard, Sophia Rusova and Maria Montessori from the late XIX – to the mid XX century, *systematization method* – in determining the leading ideas of the pedagogical heritage of the mentioned pedagogues in accordance with modern trends in preschool education and formulating conclusions regarding the importance of their pedagogical activity and isolated conceptual provisions in the context of the public preschool education development and outlining the prospects for further scientific research in the aspect of deepening information on the history of preschool pedagogy.

RESULTS AND DISCUSSION

A brief biographical review of Pauline Kergomard's life (1838-1925) and an overview of the main points of her pedagogical concept

Pauline Kergomard (1838-1925) is a progressive activist in the field of public education in France, the founder and theoretician of public preschool education, the main figure in the evolution of the shelter for children. Pauline Recluse was born on April 24, 1838 in Bordeaux in a Protestant family. Her mother died early, so the girl was raised by her father, Jean Recluse, who took the position of inspector in French schools, and her uncle, Jacques Recluse, taught at one of the most prestigious colleges in France at that time in Saint-Foy-la-Grande. Pauline spent most of her childhood in Ortega with her aunt, Zéline Trigant-Markey, and later began her education in Gironde. After she got education, when she turned 18, she became a teacher at the same high school she graduated from (Georgieva-Hristozova & Slavov, 2018).

In 1861, she moves to Paris and marries Jules Duplessis-Kergomard, a penniless man of letters who was disliked by Pauline's family and had "no particular taste for his work" (Plaisance, 1996). In 1879, she became the chief inspector of the so-called asylums for children. Her pedagogical views were formed in the 1980s and 1990s, when the movement for public education of children intensified. She actively made speeches at various conferences, met with the public, put forward various initiatives to struggle with child poverty and improve the position of women. Pauline Kergomard sharply criticized the work of shelters for children at the time and demanded the foundation of a new type of institution for preschool children, which should be based on the principles of respect for the pupil's personality, the development of their independence, creativity, etc. Pauline Kergomad called on city municipalities to provide suitable premises for children, to allocate funds for the maintenance of nursery schools and to improve their quality. She independently supervised the work of nursery schools, conducted classes, organized preparatory courses for pedagogues, noting the importance of psychological support and pedagogical guidance from an adult in the process of development and formation of a child's personality.

Working in the Ministry of Education of France since 1879, thanks to the support of the chief of staff of the Ministry of Public Education, Ferdinand Buisson, the pedagogue for 20 years managed preschool education institutions, which were then called maternal schools. She headed

the commission for the preparation of the project for the reorganization of children's shelters into so-called maternal schools and the commission for development of new programs maternal schools functioning (Cohen, 2006; Mutuale & Weigand, 2019).

1881-1917 – Pauline Kergomard was the chief inspector of kindergartens (maternal schools). She traveled extensively throughout France, providing assistance to ensure their proper functioning.

1881-1886 – held the position of editor of the pedagogical journal "Friend of Childhood" ("*Ami de l'enfance*").

1886-1892 – elected as a member of the Higher Education Council of France, becoming the first woman to join this council. She was actively involved in reforming orphanages and establishing kindergartens under the new preschool education system.

1887 – Pauline Kergomard organized and patronized the French Union for the Rescue of Children until death, an organization that still exists today.

1897 – she founded a pedagogical union with the support of Ferdinand Buisson, Morris Boucher and other prominent French pedagogues.

1903 – cooperates with the publishing house of the journal for kindergarten teachers "Childhood Education" ("*L'Education enfantine*").

1911 – organizes the courses for training personnel to work with preschool children; actively participates in the making up of the "New Dictionary of Pedagogy and Primary Education" ("*Nouveau dictionnaire de pédagogie et d'instruction primaire*").

Pauline Kergomard's earthly journey ended on February 13, 1925, in Saint-Maurice at the age of 86 (Kabac, 2016). Due to her efforts, the French preschool education system gained worldwide recognition.

Figure 1. Pauline Kergomard's portrait
Source: Geneanet (n.d.)

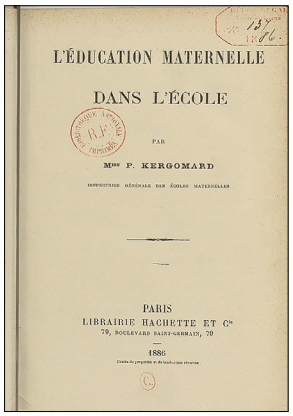
From 1886 to 1895, she actively worked on publishing her main work, "Preschool Education in Maternal Schools" ("*L'education Maternelle Dans L'école*"), in two volumes, which essentially became a teaching manual for pedagogues in French preschool institutions at that time. This work summarized numerous articles by Pauline Kergomard that had been published in pedagogical journals. For her active and fruitful pedagogical work, she was awarded the Officer of the Legion of Honor.

However, as noted in the study by E. Plaisance (2001), although Pauline Kergomard's name appears "on the facade of some kindergartens", her pedagogical works and their significance for the development of preschool education remain unresearched. Streets bearing her name exist in Bordeaux, Paris, Lyon, and Dijon, as well as in Ducos (Martinique) and Casablanca. Since 1927, the Pauline Kergomard Prize has been awarded in France to teachers of maternal schools. On March 8, 1985, a commemorative stamp featuring Pauline Kergomard, with a denomination of 1.70 francs, was issued as part of the International Women's Journey. She had a large family – children, two grandchildren, and great-grandchildren – who shared Pauline Kergomard's views and continued her work, popularizing her pedagogical ideas and republishing her works: R. Kergomard (2009), G. Kergomard *et al*. (2000). As emphasized in the scholarly work by N. Palluau (2021), her son Jean Kergomard (1870-1954), grandson Pierre Kergomard (1897-1981), and later great-grandson Jean-René Kergomard (1926-2020) – these three generations of men worked together on improving the state of education through active methods and striving for positive social changes in society.

In Pauline Kergomard's works "Preschool Education in Maternal Schools" *("L'education Maternelle Dans L'école"*, 1886) and "The Child from 2 to 6. Practical Teaching Notes" *("L'enfant de 2 à 6 ans. Notes de pédagogie pratique"*, 1928), she addresses both the organization of the educational process in maternal schools and the content and methods of working with preschool children. She developed significant theoretical principles regarding the implementation of multifaceted preschool education, suggested forms for its realization, and outlined the characteristics of structuring the educational process in maternal schools.

Under Pauline Kergomard's guidance, a program for the teaching children in kindergartens was developed (Vincent-Nkoulou, 2007). It was designed for two age groups: juniour (2-5 years) and seniour (5-7 years). The program provided comprehensive recommendations on organizing children's daily routine (daily schedule, meal planning, room setup, selection of equipment, etc.) and the fundamentals of preschool education (activities for language development, reading, writing, arithmetic, singing, crafts and environmental awareness). Pauline Kergomard developed the content of intellectual education, emphasizing sensory perception as its foundation. She paid particular attention to the development of children's cognitive processes (memory, thinking, attention, etc.), observant skills, and the ability to compare, reflect, and apply acquired knowledge in practice. In education, she considered the cultivation of moral habits and "the contemplation of goodness" to be paramount. She attached significant importance to children's free activities, especially play as a process reflecting their impressions, and manual work. Pauline

Kergomard was one of the first to address the necessity of continuity between the family, preschool institutions and primary schools (Moussy, 2007). She insisted on providing systematic pedagogical and psychological training for future teachers of maternal schools (Terdjman, 1992). In her book "Preschool Education in Maternal Schools" ("*L'education Maternelle Dans L'école*") (1886) (Fig. 2), Pauline Kergomard addressed various aspects of preschool education.


L'ÉDUCATION MATERNELLE

DANS L'ÉCOLE

PAR

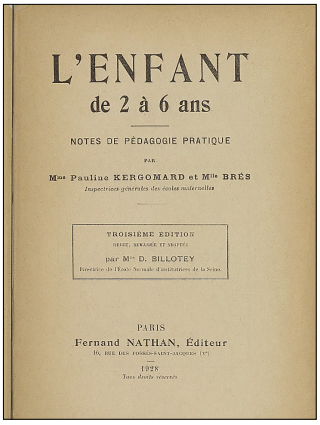
Mme P. KERGOMARD

PARIS
LIBRAIRIE HACHETTE ET Cie
79, BOULEVARD SAINT-GERMAIN, 79
1886

Figure 2. Front page of P. Kergomard's book (1886). *L'education Maternelle Dans L'école*.
Source: Gallica (n.d.)

This work by Pauline Kergomard effectively presents her pedagogical concept. She places primary emphasis on three aspects of preschool education: physical, intellectual, and moral (Kergomard, 1886). Regarding physical education, she emphasizes the importance of maintaining a child's daily routine in nursery school, conducting hardening procedures, special gymnastic exercises, and respiratory system development exercises, which are urgent tasks for this age group. In intellectual education, Pauline Kergomard prioritized acquainting children with the surrounding world and its understanding. The educator emphasized supporting children's mental activity, which stimulates the development of their curiosity and desire for learning. To achieve this, she proposed the use of "subject lessons", which were pioneered in pedagogical practice by her predecessor, Marie Pape-Carpantier (Cohen, 2006). According to Pauline Kergomard, such "subject lessons" should focus on developing language skills, sensory perceptions, introducing children to nature and the environment, and teaching mathematics, providing children with realistic knowledge. Importantly, she underscored that these "subject lessons" should be integrated. According to her pedagogical concept, such forms of teaching must be methodically organized to stimulate "mental work" in children, encouraging them to seek out new knowledge. Additionally, Pauline Kergomard provided methodological advice regarding the frequency of conducting "subject lessons" – scheduled once a week, with spontaneous sessions initiated by children aimed at satisfying their emerging interests and needs (for example, during walks, observations, etc.). In organizing "subject lessons", educators must thoroughly prepare, consider all stages of implementation, and provide didactic materials. The main requirement is to consider the psychological characteristics and capabilities of children during each "subject lesson" (Kergomard, 1886).

Regarding moral education, Pauline Kergomard placed special emphasis on fostering moral feelings and habits in children. She noted that this should primarily occur in maternal schools rather than within the family, as children have the opportunity to interact with peers and express feelings of trust, friendliness, and sincerity towards them. She emphasized the importance of instilling in children an awareness of adhering to societal rules and developing independence in decision-making. To achieve this, she recommended methods such as demonstrating and explaining the best moral examples. Pauline Kergomard emphasized that moral education would be successful only if children's life needs were fully met in maternal schools, which included considering their interests, needs and inquiries. According to the educator, every activity of the child should have a clear goal defined by the teacher, based on the children's interests and the support of their attention (Kergomard, 1886). Her pedagogical work "The child from 2 to 6 years old: Practical lesson outlines" ("*L'enfant de 2 à 6 ans. Notes de pédagogie pratique*"), which had its third edition in 1928 (Fig. 3), encapsulates Pauline Kergomard's views on organizing play activities in maternal schools.


L'ENFANT

de 2 à 6 ans

NOTES DE PÉDAGOGIE PRATIQUE

PAR

Mme Pauline KERGOMARD et Mlle BRÈS

TROISIÈME ÉDITION

par Mlle D. BILLOTEY

PARIS
Fernand NATHAN, Éditeur

1928

Figure 3. Front page of P. Kergomard's book (1928). *L'enfant de 2 à 6 ans. Notes de pédagogie pratique*.
Source: Gallica (n.d.)

Pauline Kergomard advised for engaging children in various types of games: creative, imitative, free play, as well as games with rules overseen by adults (Kergomard, 1928). The educator emphasized the importance of play activities in shaping the personality of preschoolers and preparing them for life in society. According to her, games develop social interests in children and contribute to their physical, intellectual, and moral development. She placed significant emphasis on cultivating sociability and communication skills during the play. Pauline Kergomard also highlighted the necessity of providing an appropriate play environment with a sufficient variety of toys that stimulate children's

imagination (Kergomard, 1928). In this regard, educators are encouraged to demonstrate creativity and inventiveness by either making toys themselves or providing children with materials that can inspire them to create their own versions, known as material toys. Pauline Kergomard's progressive stance on this matter involved integrating play activities as a mandatory component into the curriculum of maternal schools. She developed both the content and methodology for guiding children through various types of games. Pauline Kergomard's pedagogical ideas gained wide popularity not only in France but also internationally. For instance, Sophia Rusova, the founder of public preschool education in Ukraine, was deeply inspired by the French system of early childhood education, which included Kergomard's concepts.

A brief biographical review of the Sophia Rusova's life (1838-1925) and an overview of the main points of her pedagogical concept

Sophia Lindfors (maiden name) was born on February 18, 1856, in the village of Oleshnia in Chernihiv region, Ukraine, into an aristocratic family. Her father, Fedor Lindfors, was a Swedish officer who served as an adjutant to the governor of Omsk, and her mother, Hanna Jerve, was French. Sophia was the fifth child in the family. However, tragedy struck the Lindfors' family when their older children, Natalia and Volodymyr (Volodia), passed away, preceding Sophia. This deeply affected their mother, who soon died. Following these losses, Sophia and her siblings were raised by their father, Fedor Lindfors, with assistance from her older sister Maria and governesses. When Sophia Lindfors turned 9 years old, her family moved to Kyiv, where she was enrolled to the Fundukleevska Gymnasium and graduated with a gold medal. However, in the winter of 1871, tragedy struck again when her father, Fedor Lindfors, passed away from tuberculosis. This event made Sophia and her sister Maria make decisions about their future lives and occupations. The same year, in autumn (September), they opened one of the first private kindergartens in Kyiv, which accommodated 20 children from the Ukrainian intelligentsia. Despite Sophia Lindfors' dream of studying at the St. Petersburg Conservatory, she was unable to pursue this due to lack of opportunities. Instead, she engaged in self-education, reading pedagogical literature, and traveled to study the experience of organizing kindergartens in other cities. During this time, she met Alexander Rusov, whom she married in 1874, becoming Sophia Rusova.

Sophia became part of the Ukrainian intelligentsia group and, together with her husband, was involved in publishing an uncensored edition of Taras Shevchenko's "Kobzar". In 1877, she was one of the founders of the first public library in Chernihiv. She had to endure investigations, arrests and imprisonment in Lukyanivska Prison for defending the rights of the Ukrainian people during the national revival. Due to this persecution, the Rusov's family was forced to leave Ukraine, briefly settling in Prague. During this time, Sophia Rusova compiled a reader for children, which was later published by the Kyiv publisher Johanson. She also wrote stories for her three children: Mikhail Rusov, initiator and co-founder of the revolutionary Ukrainian party, co-editor of the foreign journals "Haslo" and "Selyanyn"; Lyubov Rusova-Lindfors, a pianist, doctor, and member of the Ukrainian Public Committee in Prague; and Yuri Rusov, a biologist and ichthyologist. In the 1890s, Sophia Rusova actively pursued literary activities, collaborating with the educational journal "Svitlo", and later with literacy societies in Kharkiv and Kyiv. After receiving permission to return to Ukraine in 1909, she taught in adult Sunday schools, which encouraged Sophia to engage actively in pedagogical work (Ulyukaeva, 2018).

Since 1910, while residing in Kyiv, Rusova became a member of the teaching staff at the private school and the Teachers' Association. During this period, she joined the Froebel Pedagogical Society and began teaching at the Froebel Pedagogical Institute, which started in Kyiv in 1911 and where she worked until 1919. The lectures given by Sophia Rusova to the students were published in the book "Preschool education", released in 1918 in Katerynoslav. This publication essentially presented her concept for establishing Ukrainian national kindergartens. In 1919, another of her books, "In the Kindergarten", was published in Poltava (Rusova, 1996). In 1917, Sophia Rusova became a member of the Central Rada, the first Ukrainian government. At the invitation of the Minister of Education of the Ukrainian People's Republic, Ivan Steshenko, she headed two departments: extracurricular education and preschool education, and became the chairperson of the All-Ukrainian Teachers' Association. During this time, she focused on developing a plan for the development of the preschool education system, including the creation and reorganization of kindergartens, and the establishment of institutions and courses for training educational professionals (Melenets, 2015).

Since 1919, after the establishment of Bolshevik rule, Sophia Rusova evacuated to Kamianets-Podilskyi. There, upon the initiative of Ivan Ohiyenko, the First Ukrainian University was opened, where Sophia Rusova worked as a professor, teaching pedagogy. The same year, she became the head of the cultural sector of the civic-political organization "Union of Ukrainian Women", which cared for orphanages and hospitals. In 1921, Sophia Rusova emigrated first to Lviv and then to Prague, where she continued her active civic work. She was elected as the chairperson of the Ukrainian Women's Council. In 1923, she initiated the establishment of the Ukrainian Higher Pedagogical Institute named after Mykhailo Drahomanov in Prague, which was opened later that year. In the institute, Sophia Rusova worked as a professor, teaching several courses. Her elder son and daughter were also involved in teaching activities there. She continued her work on preschool education, which was reflected in her works "Theory and practice of preschool education" (1924) and "New methods of preschool education" (1927), both published in Prague (Rusova, 1924; 1927). In 1929, Sophia Rusova was awarded a doctorate in sociology at the general assembly of the institute. While in emigration abroad, Rusova consistently

demonstrated active civic engagement. She initiated various campaigns, fundraised for Ukrainians in need, and supported the establishment of childcare facilities. She was a founder of the National Council of Ukrainian Women in Prague. Her portrait is depicted in Figure 4. Sophia Rusova passed away at the age of 83 on February 5, 1940, in Prague, where she was buried at the Olšany Cemetery.

Figure 4. Sophia Rusova's portrait
Source: Pedagogical ideas of Sofia Rusova (2015)

Tribute to Sophia Rusova:

In 1991, on the 135th anniversary of the birth of Sophia Rusova, a commemorative plaque was opened in the village of Oleshnya in the Chernihiv region.

In 2005, the Ministry of Education and Science of Ukraine introduced the "Sophia Rusova" badge, which is awarded to specialists in the field of pre-school and extra-curricular education.

In 2016, for the 160th anniversary of her birth, the National Bank of Ukraine issued jubilee coin.

In many cities of Ukraine – Kyiv, Poltava, Chernihiv, Rivne, Vinnytsia, Dnipro, etc. there are streets in honor of Sophia Rusova.

Preschool education institutions operating under the Sophia Rusova are named after her.

In 2009, a foundation named after Sophia Rusova was established, which takes care of the memorial complex opened in the village of Oleshnya in the Chernihiv region, to which her great-granddaughter Iryna Mykhaylevich-Tkachenko joined.

The foundations of Sophia Rusova's pedagogical concept are presented in her work "Preschool education", which is included in a collection of selected works (Rusova, 1996). These were lectures on pedagogy and psychology that she delivered to students at the Fröbel Pedagogical Institute. The scholar characterized the main principles of national upbringing for developing personalities: consideration of children's individual characteristics, adaptation to the nature of the pupil, reliance on the specificity of the country and nation, and conformity to the socio-cultural demands of the time. She emphasized the cultivation of mental traits and personal morality, and advocated for the unity of family and societal preschool education (Ulyukaeva, 2016). According to Sophia Rusova, the implementation of these principles should be ensured by specially trained educational professionals.

Sophia Rusova also drew upon the study of pedagogical and psychological works by renowned educators of the past and her contemporaries. She paid particular attention to the work of the Italian scholar Maria Montessori, positively evaluating the principles of her work with preschool children. Rusova appreciated Montessori's didactic materials and her recognition of the child as a unique and individual personality, emphasizing the importance of psychological and pedagogical support from educators in child development (Yakobchuk, 2023). In Sophia Rusova's writings, she also explored the history of the spread of kindergartens (maternal schools) in France. Thus, her reference to the progressive experience of establishing institutions for public preschool education in France as exemplary practices also influenced the early stages of developing Ukraine's own national preschool education system in the late XIX – early XX centuries. You can see the cover of Sophia Rusova's book "Theory and practice of preschool education" ("Теорія і практика дошкільного виховання") (Rusova, 1924) on Figure 5.

Figure 5. Front page of S. Rusova's book (1924). *Theory and Practice of Preschool Education.*
Source: S. Rusova (1924)

The book "Theory and practice of preschool education" ("Теорія і практика дошкільного виховання") (1924), published in Prague, is also a manual for the course students. It covers the aspects of their professional training for working with preschool children. It is noted that every kindergarten teacher should be familiar with the psychological principles of pupils' development, be able to conduct a psychological analysis of a child's development, determine temperament, systematize and summarize the results obtained during observation. She presents her views on the child as a personality developing in accordance with their natural talents, characterizes the mechanism of imitation typical of preschoolers, emphasizes the sensitivity of the development of cognitive mental processes (perception,

memory, imagination, speech, etc.) at this age; analyses the specifics of sensory development and insists on taking into account the typical and individual characteristics of children. At the same time, the scientist emphasized that the main thing in organizing the educational process with preschoolers should be a manifestation of love for them, care and concern for the growth and education of decent citizens of their country (Rusova, 1924).

Sophia Rusova's work includes a description of the program of work with children, the forms, methods, and means of its implementation. She suggested organizing various types of activities with children, including play. It is the leading activity of preschool age that is closely connected with others and has the greatest impact on mental development. In addition to play as a means of education, she insisted on the use of manual labour, nature (including the seasons), and "technology" in the process of physical and mental education. She advised teaching children to read and write from the age of 6, and to count from the age of 5. The specifics of working with gifted, unbalanced, or backward children were not ignored (Dzhus, 2020). A prominent place in Sophia Rusova's conception is given to such types of work with children as conducting observations in nature and excursions, using the literature, retelling and reading, communicating in kindergarten in children's native language, and engaging in children's creativity (drawing, modelling, singing, dramatizing, etc.). This formed the basis for familiarizing preschoolers with the environment and using "subject lectures" (classes) for this purpose, which are described in the book "New methods of preschool education" ("Нові методи дошкільного виховання") published in Prague in 1927 (Rusova, 1927). The cover of the first edition is shown in Figure 6.

Figure 6. Front page of the S.F. Rusova's book (1927). *New methods of preschool education*.
Source: S. Rusova (1927)

In this work, she considered the education processes (physical, mental, moral, aesthetic, and labour), training, and development of children in an integrated manner. Sophia Rusova provided methodological recommendations for organizing each direction of education. She especially emphasized on the fostering of preschoolers' "virtues and cultural habits" (Rusova, 1927). The means of their education included Ukrainian folk culture, which contributes to the development of a sense of belonging to their nation and high morality, the development of freedom of self-expression (Tarapaka & Martin, 2015). In preschool age, a person's moral character and moral qualities develop, which influence other aspects of development. The family environment and the environment where the child lives have a significant impact on the process of child's socialization (Lokhvytska & Konstantinova, 2019). Thus, Sophia Rusova's work outlines the content of kindergarten work and, above all, the content of the educational process with preschool children. She emphasized the development of children's interest and curiosity for new knowledge, the desire to develop skills in understanding the surrounding reality.

A brief biographical review of Maria Montessori's life (1870-1952) and an overview of the main points of her pedagogical concept

Maria Montessori was born on August 31, 1870, in the small Italian town of Chiaravalle and was the only child in the family. Her father, Alessandro Montessori, was a high-ranking government official, and her mother, Renilda Stoppani, descended from one of the oldest families in Italy, distinguished for its literacy and learnedness. On her mother's side, Maria was the niece of Antonio Stoppani, a well-known Italian geologist, paleontologist, and naturalist whose works are still being studied nowadays. Unlike her father, a Catholic who was against women getting educated, Maria's mother supported her desire to study and helped her in this.

In 1876, Maria began studying at the municipal elementary school of Rio Ponte and immediately showed great academic ability and interest in the educational process. She had an aptitude for the natural and mathematical sciences, which determined the choice of an educational institution for her further education. In 1884, at the age of 14, Maria studied in Rome at the public school for women, Regia Scuola Tecnica Michelangelo Buonarroti (now Regio Istituto Tecnico Leonardo da Vinci). There, she studied Italian, history, geography, natural sciences, as well as accounting, arithmetic, algebra, and geometry. She was one of the best students. Two years later (in 1886), at the age of 16, after graduating from this educational institution, Maria continued her studies at the Regio Istituto Tecnico Leonardo da Vinci with the intention of becoming an engineer, although only young men could be accepted to study there. She also did well at this institute, especially excelling in mathematics. She graduated in 1890 at the age of 20, and got a certificate from the Faculty of Physics and Mathematics.

In 1890, Maria decided to enter the University of Rome to study medicine. At the time, this was almost unachievable aim, as only men were allowed to pursue higher education, especially medical studies. At first, she got enrolled in a course of studying natural sciences, then, in 1892, Maria entered the medical faculty. To do this, she sought permission from Pope Leo XII, justifying her desire to become a student of the medical faculty and later work as a doctor. She proved this by her significant academic success and

persistent laboratory research, which she conducted even at night, as attending classes with men was perceived aggressively by both students and the exclusively male faculty.

Maria was particularly interested in the experimental hygiene classes conducted by Angelo Celli, which later allowed her to conclude that epidemics among children were caused not only by a lack of medical care, but primarily by their social conditions. In 1895, she was able to gain clinical experience as a physician's assistant and was granted the right to join the Lancisian Society, which united doctors and professors of Rome's hospitals. From that time on, she actively studied psychiatry and paediatrics, working in a paediatric consultation and emergency service, and became a specialist in paediatric medicine. In 1896, Maria Montessori successfully passed her final exams and became the third Italian woman to graduate from the Faculty of Medicine with a degree in neuropsychiatry and the first woman in Italy to receive a doctorate in medicine. During her studies, she attended courses in experimental engineering and conducted experimental research in the laboratory, as well as observations in the asylum rooms of the Santa Maria della Pieta Hospital in Monte Mario (Rome). In 1897, Maria Montessori's thesis "*Sulle Cosidette Allucinazioni Antagonistiche*" was published in the journal Policlinico. This is when her professional career began.

At first she worked as an assistant at a university psychiatric hospital and later started a private practice because she was too concerned about the development of children with disabilities. To this end, she studied in depth the works of French psychiatrists Jean Marc Itard and Edouard Seguin and developed her own method of developing the senses in children with mental retardation. Maria Montessori travelled extensively at this time, speaking and publishing both nationally and internationally. She became known as a champion for women's rights and an advocate for the rights of children with disabilities and healthy children, taking care of their education. In 1898, she presented the results of her first research at a pedagogical congress in Turin. On March 31, 1898, Maria Montessori gave birth to her only son, Mario Montessori (1898-1982). He was the child of her love to Giuseppe Ferruccio Montesano, with whom she began working together at the University Psychiatric Hospital of Rome and who later became one of the directors of the Rome Orthophrenic School. Maria Montessori did not marry because it would have prevented her from pursuing a professional career. Therefore, she gave birth to her son in secret and entrusted him to the Vicovaro family, Vittoria Pasquali, who lived in a small town in Lazio. Later, when the boy was in his teens, Maria reconnected with him.

Due to family pressure, Giuseppe Montesano married another woman, and their personal and professional paths diverged. When Mario Montessori grew up, he joined his mother's research activities. The way of Maria Montessori as an educator began in 1898-1900, as her interests shifted towards education and she completed a philosophy course to deepen her knowledge of education and the development of a person's worldview. In 1900, Maria Montessori became co-director of the Roman State Orthophrenic School for Children with Special Educational Needs with an attached laboratory, which was opened in Rome by the League of Women of Italy. In just 3 months of the school's operation, significant results were obtained in the developmental indicators of children who passed the exams for admission to a city school. This prompted a study of the factors of low development and healthy children, which led to the conclusion that a special methodology needed to be developed, which would later be called the Montessori "method-scientific pedagogy".

In 1903, Maria Montessori was appointed assistant second class physician at the Executive Headquarters of the Italian Red Cross (Croce Rossa Italiana – C.R.I.), with a military rank similar to that of junior lieutenant of the C.R.I. Territorial Hospitals. In 1904, she was qualified as a teacher and began lecturing on educational anthropology at the University of Rome. She also took up the position of head of the Department of Hygiene at the Royal Women's Teachers' College. She worked until 1908 and had the opportunity to conduct various studies in the field of education and to study methods of working with healthy children, which she would later present as an educational program for kindergartens. In 1910, the lectures given by Maria Montessori were published in a book called Pedagogical Anthropology.

In 1906, Montessori was invited to observe the education of a group of children in a new residential building for low-income families in the San Lorenzo district of Rome. And on January 6, 1907, a new type of institution, the *Casa dei Bambini*, was opened for children aged two or three to six or seven (with the support of Italian millionaire Eduardo Talamo). Up to 60 children from poor families with normal development were admitted to the center, with whom Maria Montessori worked according to the method she developed. The second such institution for preschool children was opened on April 7, 1907. Three more similar institutions ("*Case dei Bambini*") were founded in 1908. Thus, the method of education developed by the German teacher Friedrich Froebel was replaced by that of Montessori, used in orphanages and kindergartens.

In 1909, Maria Montessori published the book "The method of scientific pedagogy applied to the education of children in orphanages" ("*Il metodo della pedagogia scientifica applicato all'educazione infantile nelle case dei bambini*"), in which she described her own observations and methods of working with preschoolers. This book was translated into 20 languages, which contributed to the global spread of her pedagogical views. In the same year, she launched the first teacher training courses based on the method she developed. Such courses were organised in 1910 and 1911 for representatives of different countries. In fact, it can be assumed that at that time she left medical practice to devote herself to educational work, including the development of methods of working with children and teacher training. Thus, in 1915, at the International Exposition held in San Francisco, she triumphantly demonstrated her own method to the American community in a

specially designed classroom "behind glass" that was placed in the exhibition pavilion.

After returning from the United States in 1915, Montessori continued her teaching work in Barcelona, Spain. In 1919, Maria Montessori resigned from her position at the University of Rome to devote herself entirely to the educational work that was of great interest to her. In Barcelona, she implemented an educational programme (the Montessori School) for children aged three to ten, sponsored by the Catalan government. However, in 1924, the new military dictatorship in Barcelona closed the Montessori school and its pedagogy in Spain declined, although Maria stayed there with her son until 1936. Together with him, in 1929, she organised the International Montessori Association (IMA) in Denmark, and set up a special school and college. Due to a difference in political views, the Italian government closed down Montessori institutions in the country in 1936. After the establishment of the Fascist regime, Maria Montessori and her son had to emigrate, first to England and the Netherlands, and then in 1939 to India, where they stayed for seven years. During this time, Maria Montessori's teaching method was further developed. While in India, Maria Montessori studied the peculiarities of development and early childhood education. In 1944, she gave a series of 30 lectures on early childhood, which were published in 1949 in the book "What you should know about your child".

In 1946, at the age of 76, Maria Montessori returned to Europe and settled in Amsterdam (the Netherlands) with her son. In 1949, she attended the 8th International Montessori Congress in San Remo, Italy, where she demonstrated a model classroom based on her method. In the same year, she founded the first educational course for children from birth to three years, called the Montessori School for Childhood Assistants (*"Scuola assistenti all'infanzia"*). In 1950, she was awarded an honorary doctorate, a professor at the University of Amsterdam. In 1951, she took part in the 9th International Montessori Congress in London. In the same year, Maria Montessori was directly involved in the development and foundation of the UNESCO Institute of Education in Hamburg, which she was entrusted to head. She held her last teaching course at the age of 81 in 1951 in Innsbruck, Austria. Maria Montessori passed away on 6 May 1952. She was buried in the small town of Noordwijk near Amsterdam (Netherlands). A portrait of Maria Montessori is n in Figure 7.

Figure 7. Portrait of Maria Montessori
Source: Maria Montessori (2015)

Maria Montessori is recognized around the world. She, like Pauline Kergomard, was awarded the French Legion of Honor and Officer of the Dutch Order of Orange Nassau (Moussy, 2007). She was nominated for the Nobel Peace Prize three times (in 1949, 1950, and 1951) and received six nominations in total. Montessori schools (kindergartens) function in different countries of the world and Montessori societies have been founded and are active (Denmark, USA, Great Britain, the Netherlands, France, Germany, Switzerland, Belgium, Ukraine, Serbia, Canada, India, China, Japan, Indonesia, Australia, New Zealand, etc.). Her books are still being published and are popular today: "Self-education in teaching schools" (2016); "The mind of the child. Absorbing mind" (2017).

Since 1952, the International Montessori Association (AMI) was headed by her son Mario, who made an extremely important contribution to the popularization of Montessori pedagogy. After his death (1982), Renilde Montessori, the prominent pedagogue's granddaughter, became the AMI president. Honoring Maria Montessori: In Italy, a postage stamp was issued in 1970 to celebrate the centenary of Maria Montessori, depicting her in a garden with children playing. In 1990, Maria Montessori's portrait was depicted on a 1000 Italian lira banknote that was in circulation before the introduction of the euro (and she was the first and only Italian woman to have a banknote dedicated to her). In 2007, Italy reissued a commemorative postage stamp with a portrait of the world-famous educator in the foreground. The pedagogical views of Maria Montessori are presented in her numerous works, including: M. Montessori, (1950). "The discovery of the child" ("*La scoperta del bambino*"); M. Montessori, (1957). "The child in the family" ("*Il bambino in famiglia*") (reprint).

Thus, in the work "The discovery of the child" ("*La scoperta del bambino*") (1950) (Fig. 8), Maria Montessori advises providing children with as many materials as possible for examination and discovery of their properties

Figure 8. Title page of the book by M. Montessori (1950). *La scoperta del bambiNo*.
Source: M. Montessori (1950)

In her opinion, children will develop their senses more effectively when they are involved in a variety of activities,

first modeled and then independent, leading to self-development. This can be caring for their surroundings, such as dusting and sweeping, watering flowers, caring for animals, and taking care of the garden (Montessori, 1950). Maria Montessori's development of the teaching method was preceded by long-term observation of children's behavior. She noted that children are able to concentrate on objects and phenomena around them, can repeat activities many times, and show their sensitivity to tidiness in their surroundings. The scientist stated that when children are provided with a free choice of activities, they are more interested in performing practical exercises and using the materials offered to them (Pironi, 2011). In turn, this stimulates the development of self-discipline, which occurs spontaneously at the appropriate stages of personality development. She emphasized that by working independently, children achieve a level of freedom that encourages them to become self-motivated in achieving new levels of awareness of their own activities. Montessori was convinced that recognizing children as individuals and treating them accordingly leads to the realization of the natural potential inherent in each child.

Based on her own observations of children, Maria Montessori introduced a number of practical exercises (such as walking, marching, greetings, polite and gentle movements to attract attention, etc.) that formed the basis of her "scientific method" (Maria Montessori, n.d.). Foremost, she insisted on arranging the educational and developmental environment for children to move around easily; children's tables and chairs should be light enough to be moved. In addition, it is important to place materials on low shelves that are accessible to children so that they can use them whenever they are interested and willing. All materials, toys and tools in autodidactic classrooms should be grouped into different zones (sections), creating a so-called open educational space in which children can move freely, thus ensuring their self-education (Montessori, 2016).

As for the content of the time spent by children in public institutions (baby homes), Maria Montessori established a clear daily routine and defined the types of activities. These include exercises that practice practical life skills: self-care – dressing, undressing, washing hands, cleaning, etc.; conducting an educational process with children aimed at developing speech: conversations, stories, discussions; intellectual tasks that develop children's visual, auditory and tactile perceptions and sensations and develop the ability to assemble, compare, sort objects; planned games that are held outdoors whenever possible; manual labour: clay modelling, children's design, etc. physical development activities: gymnastics, which can be done outdoors, movements with musical accompaniment (songs); observation of wildlife, etc. The teacher's role is to observe the children's independent free activity and guide their innate psychological development at an individual pace and taking into account their individual characteristics. According to Maria Montessori, this is the goal of education – the development of a free and independent personality, as the child "has to create themselves" (Montessori, 2016). Montessori created didactic material for the development of sensory and speech skills, for teaching children mathematics, writing and reading, and for "space education" (Montessori, 2017). In total, it comprises more than 200 titles in various fields. For example, there were letters cut out of sandpaper and fixed on boards, moving cut-out letters, and cards with pictures and inscriptions. Four- to five-year-olds spontaneously engaged with these materials and quickly learned to write and read. Sometimes it happened even very fast, which was not typical for their age (Raimondo, 2021). Particular attention was paid to the sensory material created by her, which is still used nowadays in preschool education. It includes: a pink tower, a brown ladder, red bars, noise boxes, wooden bars, "golde" beads, metal pots, frames, a series of cards (made of paper, cardboard, fabric), geometric sets, stencils and contours, etc. Maria Montessori promoted the use of "pure categories of perception", avoiding the provision of knowledge about colours, shapes, sizes, spatial arrangement on the examples of natural objects (flowers, fruits, vegetables, etc.) (Romano, 2020).

The work "The child in the family" ("*Il bambino in famiglia*") (Fig. 9) describes the Montessori method, which was one of her numerous contributions.

Figure 9. Title page of the book by M. Montessori (1957). *Il bambino in famiglia*.
Source: M. Montessori (1957)

The method of teaching preschool children introduced by Maria Montessori focuses on the development of their own initiative and natural abilities, mainly through practical activities – play, which is enjoyable and stimulates the expression of a wide range of emotions (Montessori, 1957). The implementation of this method allowed children to develop at their own pace, and teachers gained new knowledge and experience based on understanding the special characteristics of child development. Thus, the education system, according to her approach, is intended for children aged 1.5 to 12 years. However, the main emphasis was placed on the age of 3 to 7 years (Hopta, 2020). Teachers following the Montessori method started creating special educational environments to meet the psychological needs of children in three developmentally important age

groups: from 1.5 to 2.5 (3) years old, from 2.5 (3) to 6 years old, and from 6 to 12 years old. Children learn about the environment through activities that involve different types of actions: manipulation, exploration, repetition, arranging in a certain order, repetition, concretisation, abstraction, accompanied by communication. In the process of interacting with others, children develop moral behavioural skills and a desire to give help if needed (Frierson, 2022). Teachers had to encourage children in the first two age groups by using playful techniques to use their senses to explore and manipulate materials in their immediate environment. Children of the older (last) age group were already capable of mastering abstract concepts based on their developed ability to reflect, imagine and create. Thus, Maria Montessori's pedagogical provisions describe the following aspects of childhood education: physical, mental, moral, labour and aesthetic.

Comparative analysis of the main principles of the pedagogical heritage of the preschool education founders in France, Ukraine and Italy: Pauline Kergomard, Sophia Rusova, Maria Montessori

The next objectives of the study were to identify the identical and specific provisions in the pedagogical concepts of the public preschool education founders, as presented in Table 2, and to identify progressive ideas regarding the modern development of the preschool education system.

Table 2. Provisions in the pedagogical concepts of the female triad in the development of public preschool education

Founders of public preschool education	Identical provisions	Specific provisions
Pauline Kergomard	➥ respect for the child's personality; ➥ recognition of the child's individuality; ➥ free upbringing and giving children freedom; ➥ development of children's independence; ➥ taking into account the essence of the child's development and psychological peculiarities; ➥ development of the child's feelings and perceptions; ➥ creation of a developmental and didactic environment; ➥ substantiation of the comprehensive upbringing of children; ➥ socialisation of children; ➥ management and support of the educational process in the preschool education institution; ➥ psychological and pedagogical training of teachers to work with preschoolers	➥ Paulina Kergomard developed a programme for children aged 2 to 6 and insisted on including reading, writing, and mathematics into it;
Sophia Rusova		➥ Sophia Rusova considered the main task of education to be the development of children's national consciousness and the foundations of universal morality; the development of a creative personality capable of making a conscious choice and enriching various aspects of the national potential; ➥ the educational ideal, according to Sophia Rusova's concept, is the upbringing of a harmonious personality based on love and respect for the best examples of national traditions; ➥ developed a programme of work with children based on the principle of seasonality
Maria Montessori		➥ Maria Montessori introduced the method of sensory education for preschool children and developed special teaching materials for this purpose; ➥ - focused on the sensory development, which is the basis of all mental functions; ➥ described the purpose of "space education" of children; ➥ outlined the tasks of work and pedagogy of early childhood (methodological support for the development, education and upbringing of children from birth to three years old)

Source: developed by the authors

According to the description given in Table 2, it can be argued that despite the presence of many provisions that were the same in the concepts of Pauline Kergomard, Sophia Rusova and Maria Montessori, there are also differences distinguishing their originality and originality. We can state that there are few studies on the comparative analysis of the achievements of these prominent personalities in the development of public preschool education: B. Moussy (2007), N. Yakobchuk (2023). It seems relevant to formulate the main points that should be implemented in the content of the educational component "History of preschool pedagogy" for first (bachelor's) level students of speciality 012 Preschool Education and in the discipline "Foreign Language for Professional Purposes" for students majoring in pedagogy. In particular, the female triad in the development of public preschool education is united by practical pedagogical work at the national level, participation in the movement for the protection of women's and children's rights, involvement in the creation of institutions for organising the educational process with preschoolers, supporting the ideas of the theory of free education; it is based on the natural development of the child, personal characteristics, respect for children, their early socialisation and development as personalities, and the use of play as a form, method and means of children's activity.

However, the following differences in their ideas are noted: Pauline Kergomard focused on working with children from the age of 2; Sophia Rusova insisted on the mandatory

implementation of the principles of nationality, humanism, cultural relevance and the principles of human values; the peculiarities of Montessori's pedagogy are that the didactic material she presented was developed and experimentally tested, which allowed it to be improved; there are elements of "space education" and methodological recommendations for working with children from their birth. In addition, the views of Sophia Rusova and Maria Montessori contain a number of requirements for psychological training of preschool teachers, as well as pedagogical principles for organising public preschool education institutions.

Thus, it is possible to make summary generalisations about the contribution of each of the founders of preschool education in their country. Pauline Kergomard is considered in the context of the establishment of public education in France in the late XIX – early XX centuries. She promoted the ideas of public preschool education, emphasised the creation of maternal schools and developed programmes for working with preschool children there (Palluau, 2021). As rightly noted in the study by A. Mutuale & G. Weigand (2019), only a woman with a big heart could love children so much and care about their protection and upbringing; this is what makes her pedagogical heritage valuable.

The prominent role of Sophia Rusova, the founder of the Ukrainian preschool education system, involves both her direct pedagogical engagement with preschool children in pre-school institutions and her management actions to expand public institutional facilities and train professionals to work there (Dzhus, 2020). The fundamentals of the theory of preschool education developed by Sophia Rusova are the basis of modern conceptual provisions in the development of the Ukrainian preschool system, and her methodological guidelines are used to organise the educational process with preschool children (Lokhvytska & Konstantinova, 2019). The contribution of the Italian scientist Maria Montessori convincingly proves the efficiency of the methodology of upbringing children in the orphanages, which was based on a clear organisation of the daily routine, considering the age sensitivity in the implementation of sensory education tasks and teaching children moral behavioural skills, as confirmed by the studies of P. Frierson (2022), R. Raimondo (2021).

In particular, special attention was paid to the development of the senses, training children's fine hand muscles, responding to the touch of various objects, and practicing visual reactions using didactic material specially created by Montessori (Yakobchuk, 2023). The contribution of the female triad – Pauline Kergomard, Sophia Rusova and Maria Montessori – to the development of public preschool education is invaluable both in terms of defining the scientific foundations of preschool pedagogy and in the practical work of preschool education institutions. Due to their pedagogical activity and publication activity, the fundamental basis of the preschool education system was founded, which was recognised not only in their country of origin, but also in the international educational space.

CONCLUSIONS

Thus, the conducted historical and pedagogical research contributed to the specification of the problem of the development of public preschool education since its inception in some European countries (France, Italy) and Ukraine in the late XIX – mid XX centuries. In accordance with the objective of the research, the article presents brief biographical information and describes the main provisions of the pedagogical concepts of the founders of public preschool education: in France – Pauline Kergomard, in Ukraine – Sophia Rusova and in Italy – Maria Montessori through a single prism of consideration. Based on the results of the analysis of the studied sources, by means of generalisation and systematisation of the material, it was possible to identify identical and different provisions in their pedagogical concepts; due to this, it was possible to determine those progressive ideas in the context of modern preschool education that should be added to the content of the educational component "History of preschool pedagogy" for first (bachelor's) level students of speciality 012 Preschool Education and in the discipline "Foreign language for professional purposes" for students majoring in pedagogical specialities.

Scientific and practice-oriented findings of represented female triad in the development of public preschool education should be revealed in accordance with the interpretation of the current fundamental and regulatory framework, outlining the areas of preschool education, psychological characteristics of children's development and methodological recommendations for teachers of preschool education institutions. The research initiates the idea of a comparative study of the history of preschool pedagogy and partially of child psychology (preschool psychology) for a holistic understanding of the fundamental views of European preschool professionals in order to prepare new information materials for specialists in this field. Prospects for further thematic work are to clarify the provisions of the pedagogical concepts of the founders of public preschool education in other European countries in the late XIX – early XX centuries and to conduct a comparative analysis to identify common trends and specific features that were typical of each educational system.

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CONFLICT OF INTEREST

None.

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Жіноча тріада в розвитку суспільної дошкільної освіти: Поліна Кергомар, Софія Русова і Марія Монтессорі

Анотація. Актуальність презентованого дослідження ґрунтується на ретроспективному аналізі засадничих аспектів становлення суспільної дошкільної освіти. Дослідницька проблема стосується визначення, як розвивалися погляди на навчання і виховання дітей дошкільного віку в суспільних інституціях країн Європи з часу їх заснування (кінець XIX – середина XX століття) та конкретизації внеску тих постатей, якими це започатковано. Метою наукового пошуку було висвітлення в єдиній (цілісній) площині історико-педагогічного аналізу творчої діяльності і концептуальних положень щодо системи дошкільної освіти трьох її фундаторок: француженки Поліни Кергомар, українки Софії Русової та італійки Марії Монтессорі. Для реалізації поставленої мети використано комплекс методів: теоретичний аналіз і синтез, історико-педагогічні методи (ретроспективний і хронологічно-структурний), педагогічної історіографії, конкретизація, узагальнення та систематизація. У статті розкриваються основні етапи педагогічної діяльності кожної із педагогинь, які належать до жіночої тріади в розвитку суспільної дошкільної освіти, та провідні положення схарактеризованих ними педагогічних концепцій; окреслені як тотожні, так і відмінні позиції щодо репрезентованого цими постатями внеску. Виокремлено ключові прогресивні ідеї щодо організації освітнього процесу з дітьми дошкільного віку в контексті сучасної дошкільної освіти, які є доречними для імплементування. З'ясовано, що такими були положення стосовно організації суспільної дошкільної освіти із врахуванням національної приналежності, врахування природних нахилів, задатків та інтересів дітей, їхніх психологічних можливостей під час різних форм активності. Чільне місце в доробку жіночої тріади займали питання становлення особистості в період дошкільного дитинства і керівництво цим процесом з боку педагога. Наукова і практична цінність проведеного дослідження полягає в поглибленні навчального матеріалу з освітнього компонента «Історія дошкільної педагогіки» для здобувачів освіти спеціальності 012 Дошкільна освіта та з дисципліни «Іноземна мова за професійним спрямуванням» для студентів педагогічних спеціальностей

Ключові слова: історія дошкільної педагогіки; Франція; Україна; Італія; кінець XXI ст. – середина XX ст.; діти дошкільного віку; становлення теорії і практики дошкілля

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Development of digital competence of teachers in vocational education institutions

Abstract. Teachers' digital competence is key to preparing students for the digital age. It is not only computer skills, but also the creation of interactive learning, assessment and collaboration. The aim of the study was to assess the level of information and communication competence of vocational teachers. A comparative analysis of tools for assessing teachers' media literacy is made. An overview of global and national trends in the development of digital competence of teachers, as well as the development and implementation of digital literacy programmes, is provided. Attention is paid to the role of the teacher as a facilitator, the problems of network security and the use of artificial intelligence (AI) in education. According to the results, the level of digital competence among teachers varied: 43.3% have a high level, 50% have an average level, and 6.7% have a low level. The main problems identified were insufficient knowledge of specialized software, lack of systematic training and technical support, and low motivation due to workload and stress. As part of the development of a programme to improve digital competence, the need to introduce compulsory courses in digital literacy, provide the necessary equipment and technical support, reduce the workload of teachers, and monitor successful international experience, such as regular courses and trainings, online courses, practical classes, project work, technical support and mentoring programmes; create communities for sharing experiences and a reward system to motivate teachers; organize effective feedback; and develop a system of teacher training and mentoring. The implementation of these recommendations is intended to help improve digital literacy and enhance the quality of education. The findings of the study can be used by the management of educational institutions to develop and implement programmes to improve the digital competence of teachers, which will improve the quality of the educational process and prepare students for the requirements of the modern digital society. These results may also be useful for state educational authorities in developing national standards and policies on digital literacy of teachers

Keywords: information and communication technologies; skills updating; facilitator; learning effectiveness; teacher reflection

INTRODUCTION

Technological advances, changing student needs for interactivity and personalization of education, and the COVID-19 pandemic have led to an increase in the importance of teachers' digital skills. This process has become rapid, driving educational transformations. Educational institutions have been forced to adapt to new realities, focusing on developing not only knowledge but also the flexible skills necessary for successful life in a dynamic society. Critical thinking, strategic planning, flexibility – these are the qualities that distinguish a modern, competitive and successful teacher. Teachers who want to be successful must have not only in-depth knowledge, but also strong skills in the use of information and communication technologies (ICT) and be able to implement innovative practices in the educational process using modern learning models.

Given these trends, digital training of teachers is an urgent necessity. The development of teachers' digital competence in vocational education depends on several

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key factors: professional development and training, availability of modern technical infrastructure, access to fast internet, administrative support, and motivation. Training should be based on modern legal documents that define standards and requirements for digital competence. In Ukraine, the guiding documents are Resolution of the Cabinet of Ministers of Ukraine No. 184 (2024) and Order of the Cabinet of Ministers of Ukraine No. 167-r (2021). The issue of digital experience has been actively studied in the scientific and educational environment, contributing to a better understanding of the opportunities and challenges of introducing digital technologies into the educational process.

In the work by A. Goncharenko *et al*. (2024), the authors identify and summarize the types of online resources for educational purposes, providing a comparative description of their functionality, advantages, and disadvantages. The work aims to provide teachers with information to select the best online resources, help develop effective strategies for integrating them into curricula, and promote the informed use of technology in education. The article by M.N. Perumal *et al*. (2022) is devoted to the search for ways to integrate digital technologies into the practice of educational institutions. The authors of the study showed that e-content provides a favourable environment for blended learning, simplifying the work of teachers and improving student outcomes compared to traditional methods. In the work of S. Iovchev *et al*. (2024), the authors provide an overview of distance learning tools: platforms for creating courses, communication, and assessment Moodle, Zoom, Edmodo, Canvas; virtual and augmented reality, which provide immersive experience and promote knowledge acquisition; cloud technologies for hosting materials, flexibility of learning. In the work by L. Ovsiienko (2023), the author analysed the advantages and disadvantages of introducing smart technologies in teaching philological disciplines, emphasizing the importance of their competent and purposeful use.

The authors S. Kharytska & A. Kolisnychenko (2023) investigated the search and information competences of future biomedical engineers and economists by developing a method for assessing these skills and a training programme using electronic dictionaries. The programme focused on developing strategies for finding information in electronic dictionaries and understanding their functions. This programme significantly increased the number of students who reached the desired level of search and information competence. The study by M. Nyathi & E. Sibanda (2023) found that the teacher has become not just a translator of knowledge, but a facilitator of learning, helping a group of people to work effectively together, achieve common goals and make decisions. Researchers have focused on the impact of different interactions on student satisfaction in e-learning environments. They concluded that learners do not evaluate all interactions equally: both learner-learner interaction (LLI) and learner-facilitator interaction (LFI) contribute to satisfaction, but LFI has a stronger impact. It is emphasized that these interactions are not interchangeable, and that learners benefit more from collaborating with instructors than with other learners in e-learning.

In the work of K. Riabets (2024), the author theoretically substantiated the definition of information and digital competence of a vocational teacher, exploring the impact of modern technologies on the quality of educational services and providing recommendations for their implementation. The author S.V. Tolochko (2021) studied the directions of digitalization in different types of educational institutions, identifying ways, methods, and conditions for the formation of teachers' digital competence in the system of postgraduate teacher education. The article points out that information technology in education is usually used as an auxiliary tool, but for better effectiveness, it should be used as an independent product. In the work of D. Dzvinchuk & I. Ozminska (2020), the authors analysed the development of education in relation to global development trends, noting that innovation will be a key feature of the education of the future, and personal and interpersonal skills will be valued more than knowledge, curricula will be adapted to the needs of each student, and teachers will become mentors and facilitators.

In view of the above, it is stated that an important problem in the process of maintaining the level of digital skills of vocational teachers is the lack of structured feedback and its systematic analysis. This is due, among other things, to the dynamic development of digital technologies, which makes it difficult to constantly update the knowledge and skills of teachers, creates the need to constantly inform educators about the news, to upgrade digital skills, that is, to create an infrastructure for mastering innovations. The aim of the study was to assess the level of information and communication competence of vocational teachers. The study solved the following tasks: a comparative analysis of tools for assessing teachers' media literacy; global and national trends in the development of digital competence of teachers; surveys and interviews among teachers on the use of digital technologies in teaching; analysis of the results and development of recommendations on ways to improve the level of digital training of teachers.

MATERIALS AND METHODS

To find effective tools for developing digital competences, the article reviews and analyses modern digital platforms for assessing and researching the state of teachers' media literacy and the experience of their use in the educational process. In particular, such methodological approaches as the Digital Competence Framework for Educators (DigCompEdu), the Technological Pedagogical Content Knowledge Framework (TPACK), the Substitution, Augmentation, Modification, Redefinition Model (SAMR) and the International Computer and Information Literacy Study (ICILS) were considered.

Taking into account the available resources and restrictions of martial law, the heavy workload of teachers, and unequal access to technical resources, the study was

divided into several stages. At the first stage, to obtain quantitative and qualitative results of assessing the state of digital skills in the educational institution, a survey of teachers of vocational education institutions using Google Forms and paper questionnaires was proposed, covering the following areas: basic information about the teacher – teaching experience and subject taught; level of digital technology proficiency – use of a computer, the Internet, e-mail, search engines, digital educational resources, online learning platforms; awareness of artificial intelligence (AI), experience in using AI tools in the educational process; knowledge of online security rules, ability to protect oneself and one's students from online threats; experience in conducting online lessons, using interactive teaching methods.

The target population of the sample was teachers of vocational education institutions, and 30 respondents took part in the survey. The questionnaire contained 25 questions designed to obtain data on the level of pedagogical use of technology: integration of ICT in the educational process, use of online resources, creation of digital content, communication and collaboration, problems and ways to solve them. The survey included 2 open-ended questions, 11 closed-ended questions with a single choice, 11 closed-ended questions with multiple choice, and 1 ranking question. The survey was distributed among teachers via email and messengers, and they were asked to fill out paper questionnaires. The survey data was collected and processed using Google Forms. The combination of online surveys using Google Forms and paper questionnaires minimized the impact of technical problems, although it increased the labour intensity and time of the survey. In order to obtain more accurate and reliable results, the questionnaire was distributed using the snowball method, when the respondents who had already been interviewed sent invitations with a link to their colleagues, following cybersecurity rules. In other words, a non-random accessible sample of respondents who agreed to participate in the survey was used.

The survey was conducted in compliance with all the provisions of the Declaration of Helsinki (2013). All participants were informed in advance about where and how the information they provided would be used. This included a detailed explanation of the research objectives, data collection methods, potential risks and benefits, and measures to ensure confidentiality and protection of personal information. Using the Google Forms platform, a statistical analysis of the closed questions was made to identify general trends (percentage of respondents supporting a particular point of view) to identify the main issues that require further research. The analysis of the survey results was aimed at identifying key trends and issues, as well as topics for further interviews with respondents to understand in detail the answers of respondents and the context of their opinions. Subsequently, the respondents were interviewed based on the list of questions generated from the survey analysis. The respondents were offered the following interview formats to choose from: a personal meeting with the respondent in a place convenient for them, an interview via mobile phone, communication with the respondent via text messages in a messenger, video conferencing, online calls to communicate with the respondent. List of interview questions:

1. In your questionnaire, you mentioned that the problem of lack of motivation is important to you. Could you tell us in more detail how this problem affects your professional activities?

2. What, in your opinion, is the main reason for the problem of lack of motivation? Are there any specific factors or events that you think contributed to its development?

3. Have you had any personal experience with students being distracted during class? If so, could you share this story and tell us how you dealt with the situation?

4. What steps do you think could be taken to address the problem of cyber addiction? What measures do you think would be most effective?

5. What role do you think the educational institution should play in addressing the issue of personal data protection? Are there specific examples of successful initiatives that you have heard about or participated in?

6. What sources of information do you usually use to learn more about AI capabilities? Do you think these sources provide sufficiently objective and complete information?

7. How do you feel when you think or talk about the issue of lack of motivation? Do you experience any emotional difficulties or stress related to this issue?

The interviews were designed to create a more holistic picture, to identify key themes and issues raised by respondents. During the interviews, the anonymity, and confidentiality of the information provided by the respondents was ensured. The data obtained during the survey was processed and analysed using statistical methods. Charts, graphs, and tables were used to visualize the results. The interview data were analysed using thematic analysis, which allowed determining key themes and patterns in the respondents' answers.

RESULTS

Digital competence is a set of knowledge, skills, and attitudes required to use digital technologies effectively and critically in different areas of life, including the ability to understand, use and integrate digital means of communication and everyday tasks. Digital competence includes both technical skills and socio-ethical aspects of ICT use. The components of digital competence are the ability to effectively search for, evaluate and use information from digital sources, the ability to critically analyse it and distinguish reliable sources from unreliable ones; use of digital tools for communication and cooperation in compliance with network etiquette and rules of conduct in the digital environment; ability to create and edit digital materials in compliance with copyright and licences for digital content; knowledge of the basic principles of cybersecurity, personal data protection and privacy, the ability to recognize and prevent threats on the Internet; search

for and implement new digital solutions to improve professional activities. For teachers of vocational education institutions, information literacy is critically important, as it directly affects the quality of the educational process and the preparation of students for professional activities in the digital economy.

A high level of digital competence of teachers cannot be achieved without continuous professional development and updating of knowledge in the digital sphere, which will allow maintaining the skills of using e-learning platforms, interactive learning tools and virtual laboratories, developing and implementing digital learning materials and resources at the appropriate level. An important component of information literacy is the ability to use digital tools to assess students' knowledge and skills, use analytical systems to monitor and identify needs for correction of the learning process. The list of requirements for digital competence cannot ignore the social and ethical aspects: fostering a responsible attitude to the use of digital technologies, ensuring the security and confidentiality of the information they process. Demonstrating their own positive attitude towards the latest technologies and motivating students to develop their digital skills through their own example and support, i.e. personal example, also plays an important role among the social aspects. Taking these components and requirements into account ensures a high level of media literacy among teachers, which contributes to effective teaching and preparing students for the modern labour market. Modern digital platforms help to assess and develop the information and communication competence of teachers, taking into account various aspects of their work and improving the quality of teaching and learning.

The European Commission has created the DigCompEdu tool, which is a structured system consisting of six main areas, including: professional engagement, digital resources, teaching and learning, assessment, support and learning, and student empowerment. Each of the pillars contains specific competences that teachers develop. The model describes what it means to be a competent teacher and provides a common reference framework to support the development of teachers' digital competences in Europe. DigCompEdu is used in different contexts across Europe to design teacher training, assessment and professional development programmes; and education policies to support the development of teachers' and students' digital competencies. Implementing DigCompEdu-based programmes can be resource-intensive and involves a culture change in schools, so support from school leadership and other stakeholders is essential for success (Fig. 1).

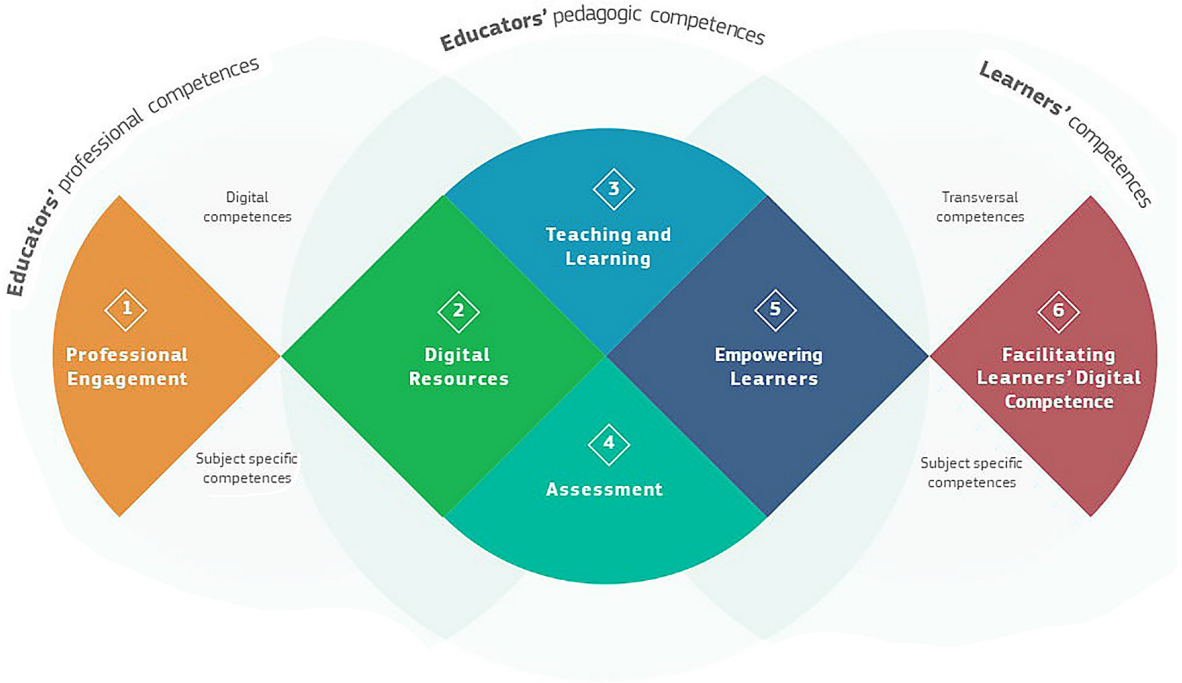

Figure 1. Structure of the DigCompEdu digital competence framework
Source: compiled by the author

The next tool, TPACK, integrates technological knowledge with pedagogical and content knowledge to help assess the use of technology in learning (Koehler & Punya, 2013; 2016). TPACK is a complex concept that can be difficult to understand and apply, and implementing TPACK-based programmes can require significant resources (Fig. 2). The SAMR tool describes four levels of technology integration into learning to create a bank of digital tasks to replace existing ones and is used for teacher training and professional development and educational research.

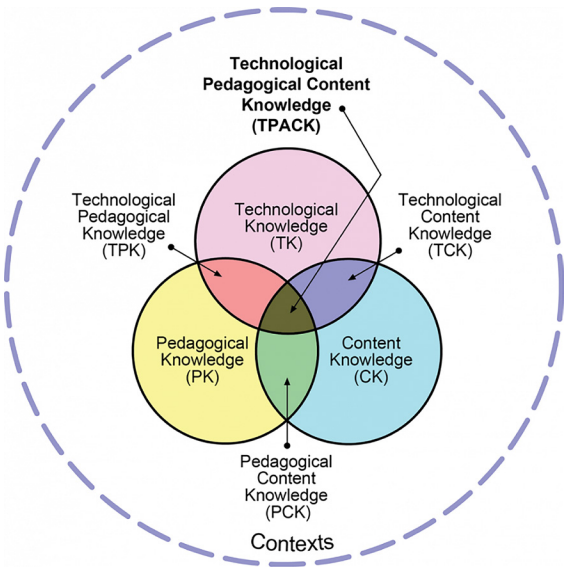

Figure 2. Structure of the TPACK digital competence framework
Source: compiled by the author

ICILS is an international study of computer and information literacy of students and teachers conducted by the International Association for the Evaluation of Educational Achievement since 2011 (Fraillon *et al.*, 2019). ICILS assesses knowledge and skills in areas such as the ability to use a computer to perform tasks such as information retrieval, communication and content creation, and understanding of the ethical and social aspects of using computers and information. ICILS has been conducted in 42 countries, including Ukraine. This tool helps to identify the strengths and weaknesses of education systems in different countries and helps to develop policies and programmes aimed at improving computer and information literacy. This framework is a rather complex study that requires significant resources to conduct. The results are difficult to compare across countries, as education systems and cultural contexts vary considerably. The results show that the level of computer and information literacy of students in different countries varies significantly: students in developed economies tend to have higher levels of computer and information literacy than students in less developed economies (International Computer and..., 2023). All these methods are aimed at assessing and developing teachers' information and communication competence, taking into account various aspects of their activities, including professional knowledge, pedagogical methods, technological skills, and focus on improving teaching and learning. Each of the methods is internationally recognized and used in different countries to assess and develop teachers' digital competences. Although all these methods have a common goal – to assess and develop teachers' digital competences – they differ in their assessment approaches, structure, data collection methodology, and result orientation. Their comparative characteristics are presented in Table 1. Ukraine regularly monitors the level of digital skills of educators and implements training programmes. The Ministry of Education and Science of Ukraine, with the support of Google Ukraine, organized free training under the Google Digital Tools for Education programme to improve the effectiveness of distance learning in the 2022/2023 academic year. The training was conducted by the Academy of Digital Development. To assess digital competence, the programme included surveys, questionnaires, performance evaluations, and classroom observations. The assessment criteria depended on the context and purpose. The identification of additional training needs for vocational teachers was carried out through a comparative analysis.

Table 1. Comparative characteristics of methods for assessing teachers' digital competence

	DigCompEdu	TPACK	SAMR	ICILS
Approach to the assessment	Uses a framework of six digital competency areas, each of which contains specific competencies	It focuses on the integration of technological knowledge with pedagogical and content knowledge, evaluating how this knowledge is combined	Evaluates the use of technology at four levels (replacement, supplementation, modification, transformation), determining the depth of their integration	Uses testing and questionnaires to assess the digital competence of teachers and students internationally
Structure and components	It has a clearly structured system of six main areas of competence	It consists of three main components (technological, pedagogical and content knowledge) and their intersections	A simple four-level model that assesses the depth of technology integration	More focused on international comparison and includes an assessment of the competencies of both teachers and students
Data collection methodology	Uses self-reported tools and interviews	Often uses questionnaires and surveys to collect data	It is usually assessed through observation and analysis of learning materials	Uses standardized testing and questionnaires to collect data internationally

Table 1. Continued

	DigCompEdu	TPACK	SAMR	ICILS
Focus on results	Focuses on the professional development of teachers through the improvement of specific competencies	Aimed at integrating technology into the learning process through a combination of knowledge	Assesses progress in the use of technology from the basic to the transformational level	Assesses the overall level of digital competence of teachers and students for international comparison

Source: compiled by the author

For the assessment and development of teachers' digital competences in Ukraine, the above-mentioned DigCompEdu in the DigComp 2.1 version was chosen as a basis (Carretero *et al.*, 2017). The Digigram platform, created by Ukrainian experts on the basis of the European conceptual and reference Framework of Digital Competences for EU citizens, is based on standardized methods, which guarantees the objectivity and comparability of the results. Knowledge and skills are measured based on clearly defined criteria. The testing procedure is regulated, instructions are unified, and results are recorded, processed and stored in accordance with established standards. Thanks to this tool, teachers can assess their level, reflect on the results, receive a certificate and use it both to confirm their competencies and to find a job. The experience of using the Digigram self-testing platform for teachers is being studied in order to increase the digital literacy of teachers and improve the quality of education. This process includes the following key steps. To determine the current level of knowledge, the platform allows teachers to take tests that assess their skills in various aspects of digital competence. Once the test results are received, the data collected is analysed to identify general trends and problem areas in teachers' digital literacy, which allows educational authorities to develop targeted professional development programmes. The platform also provides access to self-study resources, webinars, online courses and other materials to help teachers and adjustments through retesting to assess progress. This allows identifying the effectiveness of learning and making the necessary adjustments.

Studying successful cases of using the Digigram platform helps to identify best practices and models that can be implemented at different levels. Within a particular educational institution, it is considered appropriate to introduce a survey using the DigComp 2.1 criteria. For this purpose, a list of questions for both the questionnaire and the follow-up interview is proposed to obtain not only quantitative but also qualitative results. The survey was aimed at determining the attitudes and opinions of respondents regarding the state of digital competence in a vocational education institution. The proposed questionnaire covered such topics as general information about the respondents, their assessment of their digital competence level according to criteria including: the ability to use digital tools and technologies in the learning process, understanding of digital security and data protection, the ability to create and adapt digital educational resources, and skills of interaction and communication in the digital environment. According to the results, teachers of both general education subjects (30%) and vocational subjects (36.7%) and technologies (33.3%) took part in the survey. Their teaching experience ranged from 5 to 30 years and was evenly distributed among the sample. The distribution of the self-assessment results indicates a sufficient level of competence, but they should be interpreted with caution (Fig. 3). They can be useful for getting a general idea of the level of digital skills of respondents, but they are not a substitute for an independent assessment, which provides a more objective and reliable picture.

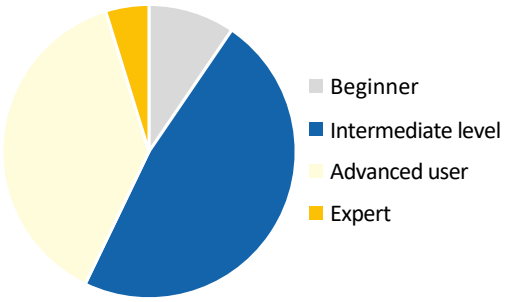

Figure 3. Respondents' self-assessment
Source: compiled by the author

The most used presentation tools were PowerPoint and Prezi, which demonstrates the convenience of this method of presenting information in a clear and concise manner for teachers. Video and audio materials and online learning platforms (Moodle, Google Classroom) are in second place, followed by social media and interactive learning materials (Fig. 4).

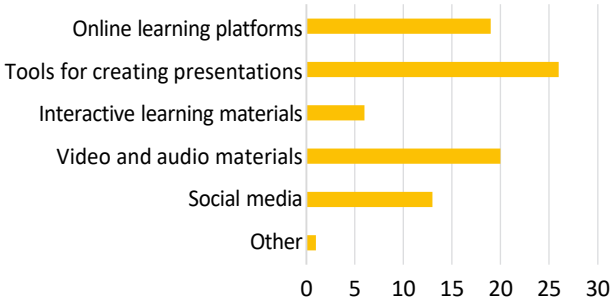

Figure 4. Respondents' use of digital technologies
Source: compiled by the author

The answers to the next question showed a strong desire of respondents to master the latest tools such as Kahoot!, Mentimeter and others to create and use interactive content, which showed that teachers are aware of the effectiveness of interactive teaching methods (Fig. 5). The results also indicated a significant need for teachers to master automatic assessment platforms (Google Forms, Edmodo), which indicated the existence of a problem with the workload of this task. At the same time, teachers expressed interest in personalization and feedback tools (Duolingo, Adaptive Learning).

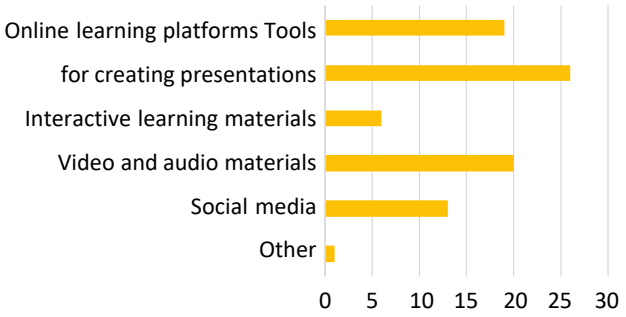

Figure 5. Teachers' needs for mastering new digital tools
Source: compiled by the author

The question about challenges in using media tools indicated a lack of motivation and technical difficulties as the dominant factors (Fig. 6). Also, noteworthy are the difficulties in integrating digital technologies into the curriculum and the lack of support.

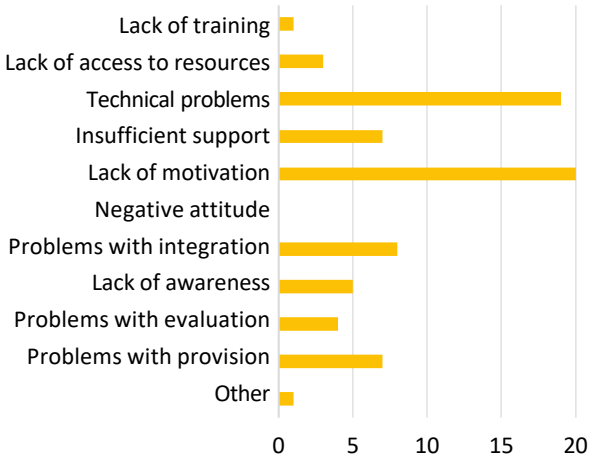

Figure 6. Factors hindering the use of digital technologies in education
Source: compiled by the author

A valuable result is the absence of negative attitudes towards digital technologies in the sample, which indicates that respondents are open to change, willing to take risks and try new teaching methods, adapt to new pedagogical approaches, and cooperate with colleagues and administrators to improve the educational system. At the same time, the result confirmed the view that there is no sustainable-structured system for learning technologies. The overwhelming majority of respondents (86.7%) are not sure whether their educational institution provides sufficient support for digital learning, or have not experienced it at all (Fig. 7). The next step was to explore how teachers develop their digital skills. Self-study was the most popular option. Considerable attention was paid to online courses (Fig. 8).

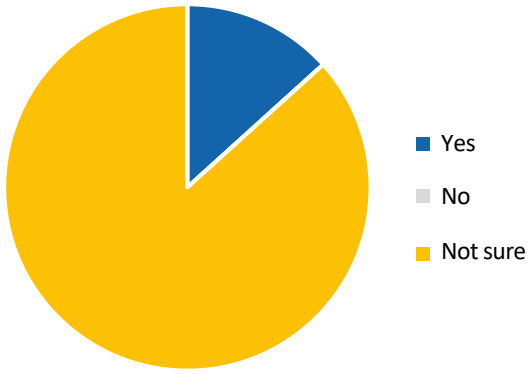

Figure 7. Responses to the level of support for the educational institution
Source: compiled by the author

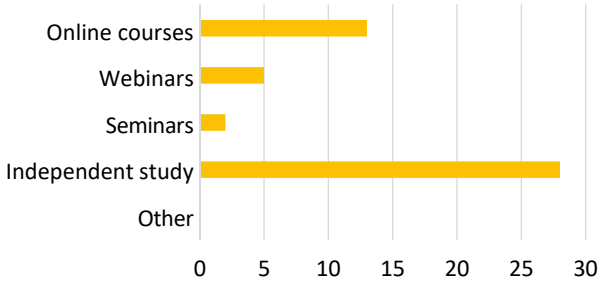

Figure 8. Ways to develop teachers' digital skills
Source: compiled by the author

The respondents expressed interest in receiving regular updates on news and tips for using digital tools in teaching (67.7% of the total number of respondents), agreeing to receive regular newsletters. The question about what additional resources or support the respondents would like to receive to develop their digital skills allowed them to choose from several answers, the result is presented in the form of a frequency table. The answer "Training with a mentor" was given by 4 respondents (13.3%), the option "Training with a mentor + Professional organizations" was chosen by 6 respondents (20%) and 5 choices (16.7%) were made for the option that also includes resources from the educational institution. This shows that the majority of respondents prefer learning with a mentor as opposed to self-study, webinars, seminars and conferences, or choose a comprehensive approach to this issue (Table 2).

Table 2. Frequencies of respondents' choices of ways to improve digital skills

Answer	Number of elections	Percentage
A. Online courses	-	-
B. Webinars	1	3.3%
C. Seminars and conferences	-	-
D. Professional organizations	1	3.3%
E. School/institutional resources	-	-
F. Independent study	-	-
G. Learning with a mentor	4	13.3%
B+E	2	6.7%
A+B	1	3.3%
A+B+C	1	3.3%
A+G	1	3.3%
A+D+G	1	3.3%
A+E	1	3.3%
A+C+E	1	3.3%
D+G	6	20%
D+E	4	13.3%
D+E+G	5	16.7%
E+G	3	10%

Source: compiled by the author

Questions 11-15 concerned the respondents' attitudes towards the use of AI in educational activities. The results indicate awareness and interest in this tool, as well as the desire of teachers to master the use of AI algorithms to automate assessment and as a tool for creating educational content. Opinions on possible threats to the use of AI are divided between the problems of data security, bias of AI algorithms, dependence on technology, and the cost of application. The most significant benefits of using AI in education were the improved accessibility and automation of tasks, with individualized learning also mentioned. Their expectations for the future use of AI in education are positive: all respondents noted the impact of AI on the learning process, as well as its future impact on teachers' research (Table 3).

Table 3. Results of the survey on the use of AI in education, %

Do you use AI in your teaching?		What do you think is the most important advantage of using AI in teaching?		Which of the challenges do you see as the most threatening in the use of AI in teaching?		What are your expectations for the use of AI in teaching in the future?		Would you like to receive more information and support on the use of AI in teaching?	
Automaton. Evaluation of tasks	76.7	Improving access to education	50	Bias in AI algorithms	33.3	New innovative tools based on AI will appear	63.3	Yes	76.7
Tools for creating learning content based on AI	23.3	Automation of tasks	30	Data privacy and security issues	30	AI will become more integrated into educational processes	36.7	No	23.3
Chatbots for interacting with students	10	Individualization of learning	13.3	Dependence on technology	23.3	AI will be used to research teaching and learning	26.7		
Other	6.7	Personalization of training	3.3	Cost	13.3	I have no expectations on this issue	-		
		Support for students	3.3	Unpreparedness of teachers	-				
		I don't see any advantages	-	Other	-				

Note: questions marked with * offered multiple choice answers, so the sum of the percentages for such questions may not add up to 100%
Source: compiled by the author

Questions 16-20 dealt with online safety in the use of digital technologies in education: a significant proportion of respondents noted that their educational institution did not provide training on this issue. They showed interest in this issue, dividing their attention between the problems of personal data protection, cyber addiction and online fraud. Respondents also acquire new knowledge on online security mainly on their own and through online courses such as Coursera and Khan Academy, while not being confident in the sufficiency of the activities organized by the educational institution on this issue. Respondents see education and training as the main way to master safe technologies (Table 4).

Table 4. Results of the survey of respondents on online security in education, %

Have you or your school/institution conducted online safety training for teachers and students?		Which of the following online security topics do you consider a priority for study?		What resources do you use for online safety training?		What additional resources or support would you like to receive for online safety training?		Do you think your school/institution provides you with sufficient opportunities to learn about online safety?	
Yes	33.3	Protection of personal data	43.3	Independent study	80	Education and training	86.7	Not sure	80
No	66.7	Cyber addiction	33.3	Online courses	50	Protective technologies	23.3	Yes	10
		Fraud on the Internet	13.3	Webinars	10	Online resources	6.7	No	10
		Information literacy	6.7	Seminars	6.7	Offline resources: school libraries; local child and youth support centres; cyberbullying hotlines	-		
		Cyberbullying	3.3	Other	-				
		Other	-						

Note: questions marked with * offered multiple choice answers, so the sum of the percentages for such questions may not add up to 100%
Source: compiled by the author

The next set of questions concerned the experience of conducting online lessons. The most used platforms for this purpose were Zoom and Google Meet (Fig. 9). The results for other platforms showed a possible lack of awareness of their capabilities.

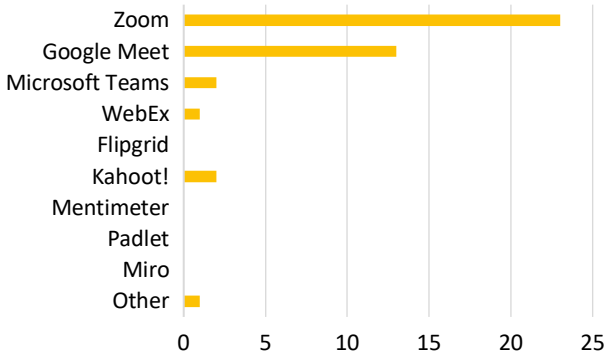

Figure 9. Platforms and tools for online learning
Source: compiled by the author

The next question was about pedagogical methods and strategies in online classes: the survey showed that teachers use a combination of modern methods in the same way as in the usual format (Fig. 10). It is noted that the experience of using such methods as discussions, surveys, quizzes, voting, group work, brainstorming, role-playing and co-creation of content has organically fit into the format of online classes. Next, we investigated the respondents' opinions on the greatest advantages and challenges of conducting interactive online lessons. The greatest advantage was the increased accessibility of education, and the greatest challenge was the loss of attention when students are distracted by other things during interactive online lessons. Technical issues, such as internet connection problems or malfunctions, and lack of student motivation and engagement are also of concern to teachers (Fig. 11).

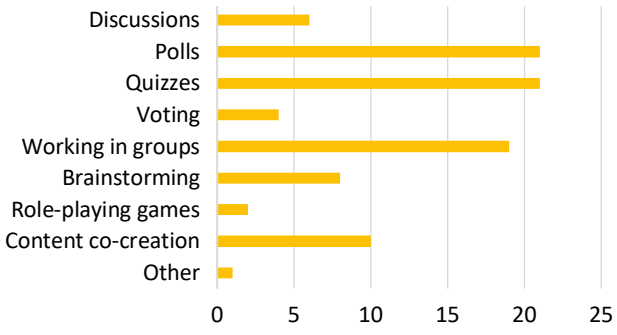

Figure 10. Methods and strategies used in online classes
Source: compiled by the author

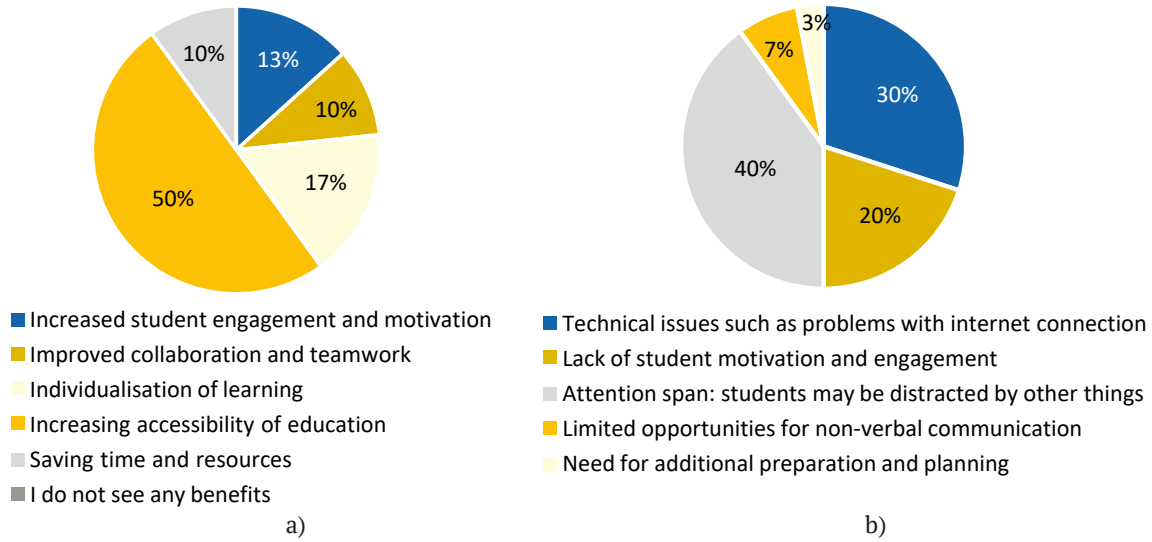

Figure 11. Respondents' answers to: a) the benefits of online classes; b) the challenges of online classes
Source: compiled by the author

The next question was designed to find out which of the tips offered by the teachers to each other the respondents considered the most useful, i.e. it encouraged the exchange of experience. It is important to note that the highest priority was given to clearly setting goals and expectations for each interactive online lesson, as well as to ensure that students understand them. Next on the list are tips on how to collect feedback from students and use it to improve one's methods of delivering interactive online lessons, encourage students to discuss and collaborate, and thus overcome the loss of attention during an online class. The interview questions were formed on the basis of the survey results to delve into topics that required more detailed consideration and thematic analysis to identify common themes and categories, and to compare interview data with the survey results. According to the results of the interviews, the respondents recognized the significant impact of lack of motivation on their professional activities, feeling frustrated and stressed, as they realize that lack of motivation has negative consequences: reduced productivity, procrastination, job dissatisfaction, and in some cases, mistakes or negligence in their work. Lack of motivation made it difficult for respondents to focus on tasks and follow through on what they started. This had a negative impact on relationships with colleagues and management. Among the reasons for the lack of motivation mentioned by the respondents were the following factors: heavy workload and the resulting lack of time, lack of self-organization skills, burnout, and routine duties. The respondents also mentioned the lack of full-time technical staff to maintain computer and office equipment and multimedia in proper technical condition as an important factor that leads to an increase in workload, respondents expressed their readiness for individual psychological assistance and discussion of this issue in communities.

All respondents had personal experience with student distractions and admitted that it was frustrating. The main reason for this was the lack of interest of students in learning in general or in the subject in particular. They were able to partially solve this problem by combining short motivational speeches and improvisations during the class. To address the problem of cyber addiction, respondents suggested the introduction of comprehensive assistance that combines preventive conversations aimed at raising awareness of the problem of cyber addiction, developing self-control skills with individual psychological support. The respondents considered it necessary for the institution to develop and implement data protection policies and procedures, as well as to provide training for staff and students on their rights and responsibilities. Respondents were aware that some sources provide fairly objective and complete information on AI, while others may be biased or have a commercial interest. Trusted sources include information from AI algorithm developers and scientific articles, although only four respondents said they had time to follow events.

DISCUSSION

The study examined the level of digital skills and attitudes of teachers towards the use of digital technologies in education and showed that teachers have sufficient but not optimal digital skills. The main challenges are lack of motivation, technical difficulties, and integration into the curriculum. Based on the results of surveys and interviews, respondents acknowledged that lack of motivation negatively affects their professional activities, leading to lower productivity, procrastination and job dissatisfaction, and, as a result, less engagement. S. Fan *et al.* (2023) also found that teachers with high digital skills are more engaged in their work and emphasized the importance of supporting their mental and emotional health. The authors emphasized

the importance of creating favourable conditions for online and blended education, highlighting the role of digital literacy in teacher engagement.

The surveys and interviews did not focus on identifying gender differences in perceptions and readiness to use digital technologies. The authors C. Zhang & L. Villanueva (2023) investigated the relationship between AI readiness and technological competence and found that there is a gender difference in the perception and readiness to use AI. This aspect should be considered in future research. The analysis of the respondents' survey showed that the development of digital skills of the respondents is mainly due to self-study and online courses, and there is no systemic support. The problem has been studied in the works of S. Schmidt *et al*. (2020) and L. Mohandas *et al.* (2020). The researchers studied teachers' perceptions of online courses and identified factors that influence the effectiveness of online learning. They identified best practices to equip teachers with the necessary skills, emphasizing the adaptation of curriculum and pedagogy, and highlighted the need for effective professional development programmes for teachers adopting online learning. The recommendations provided focus on the design and delivery of online courses.

The results obtained in this study on the use of AI in education showed that this tool is not actively implemented in the process. They also reflected concerns about the bias of AI algorithms. Such findings are confirmed by the study by J. Robert (2024). It indicated that most educational institutions are developing AI-related strategies to better prepare students for work, explore new teaching methods, and improve vocational education. At the same time, despite the optimism of educational leaders about the potential of AI, they need additional support to create new positions related to this technology and perform tasks such as personalized student support, learning assistance, research, administrative work, learning analysis, and digital literacy support. In the interviews, teachers emphasized the need for age- and education-level-appropriate educational programmes to help them understand AI and its impact on life. Similar recommendations are made in the works by I.A. Chounta *et al*. (2022) and A. Bewersdorff *et al*. (2023). The authors identified widespread misconceptions about AI, such as limited understanding of the technology, attribution of human traits, and unclear perceptions of risks and opportunities. This leads to uncertainty about the impact of AI on society, bias, and distrust.

Given the interest of respondents in the role of AI in education, it seems appropriate to monitor the current trends in order to alleviate uncertainty and concerns about this new technology: to plan similar studies with more teachers to explore how AI can be integrated into classrooms with equity, accountability, transparency, and ethics in mind. The work of S. Polak *et al*. (2022) noted that collaboration between humans and AI is a more powerful approach than relying solely on technology, as it combines human creativity and intuition with the power and speed of AI data processing. In this context, the Will, Skill, and Tool (WST) model is worthy of attention, which considers the following factors: will (teachers' attitudes towards technology), skills (level of digital competence) and tools (availability of technology), and their impact on the effectiveness of technology implementation in education.

An analysis of the digital tools used by respondents revealed that presentations, video and audio resources, and social media are the most common. Zoom and Google Meet were the most popular online communication platforms, and there is interest in learning and using Kahoot!, Mentimeter and automatic assessment platforms. Respondents emphasized the existence of a digital divide in the use of technology by teachers and students. It would be useful to study its impact on Ukrainian vocational education. The topic of introducing digital tools into vocational education is actively discussed in the scientific discourse. In the article by J. Mohanraj *et al*. (2019), the authors noted that teachers prefer scientific sources, while students use YouTube and Wikipedia, and students spend more time online learning, but teachers are concerned about their self-discipline. The work of K.O. Lewis *et al*. (2024) explored the potential of the metaverse to revolutionize medical education by offering interactive learning environments for personalization and risk-free hands-on experience. It is noted that the metaverse can adapt teaching methods, new assessment methods and promote collaboration without geographical barriers. At the same time, challenges such as technical limitations, content quality, resistance to change, and data security are identified. In the work by F. Azam *et al*. (2021), the authors analysed the impact of dynamic learning methods on medical education, in particular, the evolution from static web pages to simulation learning in the meta-universe.

Given the respondents' awareness of the needs of the Ukrainian education system to adapt to the digital age and implement modern standards for training specialists, it is appropriate to discuss and implement the results of the work of M. Maghiar & C. Brown (2022). They investigated the technological competencies required for college graduates in the south-eastern US by interviewing employers in various industries about key functions and dimensions of competence. The authors used an interdisciplinary approach and found that the level of complexity of the skills varies significantly. The study provided information for improving curricula and pedagogical strategies to develop graduates' technological skills. The results obtained in this paper on online security issues indicate that the respondents are aware of this problem and that ways to solve it require specific knowledge and training programmes. According to scientists D. Bendler & M. Felderer (2023), existing models do not provide a complete picture of the information security sector. The researchers investigated the skills required to work in cybersecurity and developed a more comprehensive model. This model covers five classes of skills, including personal, interpersonal, technical, cognitive and professional. The researchers plan to

further study this model to see how it works in real-world settings. Authors J. Marquardson & A. Noshokaty (2019) proposed a practical approach to methods of studying cybersecurity requirements for future workers: analysing entry-level cybersecurity jobs on Dice.com to determine the required and desired qualifications. The issue of cybersecurity competencies is also discussed in the article by M. Armstrong *et al*. (2020). These conclusions and proposed models can be used to develop curricula, evaluate personnel, and make personnel decisions as a basis for new competency models or as a supplement to existing ones. The direct connection of research with the current state of the labour market is considered useful, and should be implemented for regular monitoring.

The experience of digital exams and personalized learning using AI is still perceived ambiguously, according to the results of interviews. A study conducted by the Organization for Economic Co-operation and Development (OECD) in Estonia and Norway found that most VET teachers and students are satisfied with the use of technologies such as online courses, virtual meetings, robots, and school information systems (OECD, 2023). However, the high cost, lack of awareness, and lack of digital skills of teachers hinder the wider use of these technologies. Recommendations to overcome these barriers include reducing the cost of digital tools, raising awareness of available technologies, supporting the development of new and existing digital tools, and training teachers in digital skills.

In the interviews, respondents emphasized the importance of comprehensive support for teachers, including an attentive attitude to their needs, accessible support systems, clear communication, priority study of pedagogical aspects of online learning, cooperation and exchange of experience. Comprehensiveness and differentiated approach are also recommended in the study by K. Murray-Johnson *et al*. (2021). The authors separately studied a group of teachers who remained silent about their problems during the COVID-19 pandemic due to resistance to change, problems with Internet access or lack of skills, and a group that successfully coped with the difficulties. The researchers emphasized that this differentiated approach is useful and should be incorporated into recommendations and future research. Awareness of such experiences is the key to improving educational resources for teacher professional development. A similar experience of Emergency Transition to Remote Instruction (ETRI) is discussed in C. Mazur *et al*. (2021). The authors investigated the strategies used in the context of limited interaction and resources. The study showed that ETRI can increase inequalities among students, but also led to more flexible learning opportunities. The authors' recommendations for supporting teachers and students included synchronous lectures, feedback channels, open source materials, and DIY labs.

The study found that most VET teachers and students are satisfied with the use of modern technology, but are hampered by high costs, low awareness and lack of digital skills. Similar conclusions were drawn in a report by the OECD (2023). The authors noted that technology can play an important role in improving the quality of VET education, but that targeted policy measures are needed to ensure its effective use. As noted in the latest project report by Quality Matters and Eduventures, hybrid learning models combining face-to-face and online experiences are becoming increasingly common (CHLOE-7: Tracking online..., 2022). This is a vision of the future of higher education, where students will learn through a combination of traditional and digital methods. The report highlights that over 99% of institutions expect online learning to be part of the typical student experience by 2025. Institutional support and restructuring are highlighted as crucial to this integration.

CONCLUSIONS

The study showed that teachers are actively using digital tools, but need better support from educational institutions. They are interested in regular information about new tools, mentoring, and cooperation with professional organizations to improve their digital competence. The study also identified the main difficulties and challenges: lack of motivation, technical difficulties, integration into the curriculum, and students' loss of attention during online classes. The current monitoring of the level of digital skills has identified insufficient knowledge of specialized software, lack of systematic training and technical support, and low motivation due to workload and stress as the main problems. An acceptable and desirable solution is continuous monitoring to obtain a comprehensive picture of teachers' digital competence, which should result in the creation of effective programmes to improve digital competence. The proposed measures are aimed at reducing the digital divide between teachers. The study was based on a limited sample and self-reported data, which may affect the accuracy of the data.

To increase motivation, it is recommended to introduce an award system for teachers who successfully integrate digital technologies into their work. An important aspect is to provide access to modern equipment and software, as well as to organize ongoing technical support and consultations on the integration of digital technologies into the educational process. The process of improving teachers' digital skills should be continuous and comprehensive, requiring cooperation between teachers, school administrators, authorities, and employers. In order to facilitate cooperation between teachers and experts, it is recommended to create an online community and forum to maintain an atmosphere of mutual assistance and cooperation, organize mentoring programmes, and invite digital technology experts to conduct master classes and consultations. For future research, it is suggested to conduct a study with a more representative sample, to examine the impact of teachers' digital skills on student learning, and to monitor the ethical implications of AI in education.

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CONFLICT OF INTEREST

None.

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Розвиток цифрової компетентності викладачів закладів професійної освіти

Анотація. Цифрова компетентність викладачів є ключем до підготовки студентів у цифрову епоху. Це не лише комп'ютерні навички, але й створення інтерактивного навчання, оцінювання та співпраці. Метою дослідження була оцінка рівня інформаційно-комунікаційної компетентності викладачів професійного навчання. Зроблено порівняльний аналіз інструментів оцінювання медіаграмотності викладачів. Надано огляд світових і національних тенденцій розвитку цифрової компетенції педагогічних робітників, а також розробки та впровадження програм підвищення цифрової грамотності. Приділено увагу ролі викладача як фасилітатора, проблемам мережевої безпеки та використання штучного інтелекту (ШІ) в освіті. Згідно з результатами, рівень цифрової компетентності серед викладачів варіював: 43,3 % мають високий рівень, 50 % – середній, і 6,7 % – низький. Виявлено основні проблеми: недостатні знання спеціалізованого програмного забезпечення, відсутність систематичного навчання та технічної підтримки, а також низьку мотивацію через завантаженість та стрес. У рамках розробки програми підвищення цифрової компетентності наголошено необхідність впровадження обов'язкових курсів з цифрової грамотності, забезпечення необхідним обладнанням та технічною підтримкою, зниження навантаження викладачів, рекомендовано відстеження успішного міжнародного досвіду, такого як регулярні курси та тренінги, онлайн-курси, практичні заняття, проектна робота, технічна підтримка та менторські програми; створення спільнот для обміну досвідом та системи заохочень для мотивування викладачів; організація ефективного зворотного зв'язку. Реалізація цих рекомендацій покликана сприяти покращенню цифрової грамотності та підвищенню якості освіти. Отримані результати дослідження можуть бути використані керівництвом навчальних закладів для розробки та впровадження програм підвищення цифрової компетентності викладачів, що дозволить покращити якість навчального процесу та підготувати студентів до вимог сучасного цифрового суспільства. Також ці результати можуть стати в нагоді державним освітнім органам при розробці національних стандартів та політик щодо цифрової грамотності педагогічних працівників

Ключові слова: інформаційно-комунікаційні технології; оновлення навичок; фасилітатор; ефективність навчання; рефлексія педагогів

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The influence of the integration of neuropedagogy, trend-watching, gamification, robotics, and immersive technologies on the development of pedagogical skills

Abstract. The real value of the topic lies in the need to improve the educational process in the conditions of constant technological changes in society. The integration of new teaching methods and technologies is a key factor in improving the quality of education and developing the professional skills of teachers. The aim of the study was to determine the synergistic effect of integrating innovative pedagogical methods into the educational process and to determine their impact on the development of teachers' professional skills. The methods of problem analysis included theoretical analysis of scientific literature, generalisation of pedagogical experience, application of statistical methods of analysis and examination of the practise of applying innovative teaching methods. The main results of the research are evidence of the synergistic effect of integrating advanced pedagogical approaches in the context of promoting the development of teachers' professional competencies. It was found that neuropedagogy helps to understand students' brain activity and personalise the learning process for each of them. Trendwatching enables teachers to react to new trends in time and adapt their practise. Gamification creates a motivating learning environment, and robotics helps complete routine tasks, allowing more time for individualised attention to each learner. Immersive technologies allow students to immerse themselves in the learning process and explore it in practise. It has been noted that the integration of advanced pedagogical approaches is an important step for the development of teachers' professional skills and the improvement of the quality of education. The synergy effect and personalisation of education allow for greater success in the educational process and provide an individual approach to each student. The value of the results obtained lies in the development of recommendations that can be applied in practise to improve the educational process and develop pedagogical practise in the digital age

Keywords: innovative approaches in education; synergy effect; modernisation; personalisation; learning process

INTRODUCTION

The relevance of the research is determined by the fact that in wartime conditions pedagogical skills become much more important than in peacetime. The recovery and reconstruction of Ukraine require the training of a new generation of professionals who can effectively use modern innovative educational methods. The COVID-19 pandemic and the war in Ukraine have become catalysts for the acceleration of progress in education, forcing

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educational institutions to actively use the latest technologies and approaches.

The literature review has shown that there is a considerable amount of research dealing with individual innovative teaching methods. According to L. Lysiak (2020), neuropedagogy, based on knowledge of brain activity, helps teachers to optimise the educational process, taking into account the individual characteristics of students. Research by A. Hamdan (2020) also confirms the effectiveness of using neuropedagogy to improve educational outcomes. O. Bilier *et al*. (2023) state that the use of neuropedagogical methods contributes to the development of critical thinking and increasing the motivation of those seeking education. E. Anisimova (2021) emphasises that trendwatching allows teachers to keep abreast of current trends in educational programme development and apply current teaching methods. Trendwatching helps to determine the strategic directions of educational program development. Trendwatching is important for adapting the educational process to rapidly changing conditions.

Gamification makes learning more exciting and motivating for students and thus contributes to better acquisition of knowledge and skills. The use of gamification increases student engagement and motivation to learn. I. Star *et al*. (2021) emphasise that gamification promotes the development of critical thinking and creativity. Gamification improves learning outcomes and overall satisfaction with the learning process. O. Bazelyuk (2023) emphasised the role of digital culture in the professional activities of teachers, noting that digital skills are becoming an integral part of modern education. N.E. Bilonozhko (2021) considered the pedagogical aspects of the quality of teaching technological English in the process of internationalisation and identified the key factors that influence the effectiveness of teaching.

Robotics frees up teachers' time for more creative and productive work and provides students with more individual attention. H. Wojtaszek *et al*. (2023) argue that robotics contributes to the development of learners' technical skills and increases their interest in learning. Ya. Slupska & O. Shkurenko (2022) also note the positive impact of robotics on the development of teachers' professional competences. Immersive technologies create artificial environments that allow learners to explore and learn experientially. According to T. Kramarenko & O.S. Kochina (2023), such technologies contribute to a better understanding of complex concepts in education. K.V. Zavalko (2022) points out that immersive technologies develop learners' practical skills, which is important for their future professional development. G. McDermott *et al*. (2023) also add that the use of immersive technologies enhances the overall learning experience and promotes deeper immersion in the subject matter.

Although each of these methods has been sufficiently researched on its own, the question of the effectiveness of their integrated use in pedagogical practise is still insufficiently investigated. It is particularly important to investigate how these methods can interact and reinforce each other, creating a synergistic effect that contributes to improving the quality of education and developing pedagogical skills. Therefore, this study aimed to analyse the impact of a complex of innovative teaching methods (neuropedagogy, trendwatching, gamification, robotics, immersive technologies) on the pedagogical skills of teachers and to determine how their integration contributes to the improvement of pedagogical competences.

MATERIALS AND METHODS

Researching the impact of the integration of neuro-pedagogy, trend monitoring, gamification, robotics and immersive technologies on the development of pedagogical skills requires a comprehensive approach and the use of different methods to obtain objective results. The research methodology is based on a synergetic combination of several scientific and practical approaches. Analysis of literary sources and scientific publications. A systematic literature review was conducted to assess the current state of research in selected topics - neuropedagogy, trendwatching, gamification, robotics and immersive technologies. Expert surveys and interviews. Interviews were conducted with researchers and practitioners in the fields of neuropedagogy, trendwatching, gamification, robotics and immersive technologies to gather opinions and impressions about their impact on pedagogy. Questionnaires and surveys. A questionnaire has been developed to determine the opinions, preferences and attitudes of pedagogical professionals regarding the use of new pedagogical approaches and technologies. Experimental study. An experimental study was conducted using interactive technologies and game methods in the educational process to determine their impact on the development of pedagogical skills. Observation and analysis of field tests. The implementation of new pedagogical methods and technologies in different educational institutions was monitored to evaluate their efficiency and effectiveness. Statistical data analysis. Statistical analysis of the data obtained was carried out to identify statistically significant differences and correlations between variables.

The methods used made it possible to obtain a detailed picture of the influence of neuropedagogy, trend-watching, gamification, robotics, and immersive technologies on the development of pedagogical skills, and also provided the opportunity to repeat the study to verify its results. The research methods chosen are key to obtaining objective and complete results within the given topic. The analysis of literary sources and scientific publications played a key role in determining the current state of research on the selected topics. This method made it possible to obtain an overview of scientific research, theoretical concepts, and practical experience in the fields of neuropedagogy, trend monitoring, gamification, robotics, and immersive technologies. In this way, a theoretical basis for further research phases could be created. Expert surveys and interviews played a strategically important role in gathering opinions and impressions from experts and practitioners

in the respective fields. This feedback helped to establish links between theory and practise and to identify the most important aspects of the impact of the selected technologies on pedagogical quality.

Questionnaires and surveys were used to gather the opinions, preferences and attitudes of pedagogical professionals towards the use of new pedagogical approaches and technologies. This data helped to understand the practical aspects of introducing innovations into the educational process. An experimental study was conducted using interactive technologies and game methods in the educational process to determine their impact on the development of pedagogical skills. This method made it possible to test hypotheses and determine the practical effectiveness of the use of innovative pedagogical approaches. Observations and analysis of field tests were carried out to evaluate the effectiveness and efficiency of the introduction of new pedagogical methods and technologies in different educational institutions. Statistical data analysis was conducted to determine statistically significant differences and correlations between variables, which made it possible to obtain objective research results.

Respondents for the survey and interviews were selected using a stratified random component. This made it possible to capture a representative group of teachers from different age groups, with different professional experience, with different qualification levels and from different types of educational institutions. Sampling criteria: 1) age: 25-60 years; 2) professional experience: at least 3 years; 3) qualification category: not lower than the second; 4) type of educational institution; 5) experience in the use of innovative pedagogical approaches and technologies; 6) the degree of interest in the use of neuropedagogy, trend watching, gamification, robotics and immersive technologies.

The survey was conducted from January to March 2024 in educational institutions in Kyiv, Pereiaslav, Boryspil, Yagotyn and Berezan. 313 teachers took part. The survey was a group survey, personal and anonymous. Participants were informed about how their responses would be used and that all data collected would be used solely for scientific purposes and would remain confidential. The ethical norms of research were adhered to in accordance with the documents "Ethical principles and rules for conducting research with human participation" (Ukrainian Educational Research Association, 2015). A questionnaire was developed to capture the opinions, preferences and attitudes of educational professionals regarding the use of new pedagogical approaches and technologies. The questionnaire consisted of several questions (Table 1).The survey (Table 2) was conducted on the basis of statements that respondents were asked to answer on a Likert scale (from "strongly disagree" to "strongly agree"). 217 teachers took part in the survey. A questionnaire with 20 statements was developed to capture teachers' opinions, preferences, and attitudes regarding the use of new pedagogical approaches and technologies.

Table 1. Questionnaire

Questions
1. How would you rate your level of knowledge in the field of neuropedagogy?
2. How often do you familiarize yourself with new trends in pedagogy?
3. Do you use gamification in your educational practice?
4. Which game methods do you use in education?
5. Do you have experience with the use of robotics in the educational process?
6. Do you use interactive technologies in your work?
7. How do you evaluate the effectiveness of the use of interactive technologies in the educational process?
8. Do innovative pedagogical approaches have an impact on your professional activity?
9. How do you rate your pedagogical skills?
10. Which technologies do you consider particularly promising for use in the educational process?
11. Does the use of innovative methods influence your professional satisfaction?
12. How do you assess the possibilities of using immersive technologies in the educational process?
13. Do you have sufficient resources to implement new pedagogical approaches?
14. Do you feel supported by the administration in implementing innovative changes?
15. Do you notice differences in students' academic performance after implementing new methods?
16. What obstacles do you encounter when implementing innovative approaches?
17. How would you rate student response to new teaching methods?
18. Has your approach to learning changed after the introduction of new technologies?
19. How would you rate your ability to adapt to new pedagogical technologies?
20. What opportunities do you see for increasing the efficiency of the educational process by implementing innovative approaches?

Source: developed by the authors

Table 2. Questionnaire

№	Statements
1	I am familiar with the term "Neuropedagogy".
2	I believe that neuropedagogical methods can help me to improve my teaching skills.
3	I am willing to use neuropaedagogical methods in my work.
4	I am familiar with trend monitoring in education.
5	I believe that trendwatching can help me keep up with the latest trends in education.
6	I am willing to use trendwatching in my work.
7	I am familiar with the term "Gamification".
8	I believe that gamification can make learning more interesting and exciting for students.
9	I am willing to use gamification in my work.
10	I am familiar with robotics in education.
11	I believe that robotics can help me to automate some routine tasks so that I can focus more on the creative and interactive aspects of learning.
12	I am willing to use robotic systems in my work.
13	I am familiar with the term "immersive technologies".
14	I believe that immersive technologies can create a more engaging and interactive learning environment for students.
15	I am willing to use immersive technologies in my work.
16	I believe that integrating neuropedagogy, trendwatching, gamification, robotics, and immersive technologies can help me develop my pedagogical skills.
17	I am willing to use innovative methods to develop pedagogical skills in my work.
18	I believe that my management supports the use of innovative methods for developing pedagogical skills.
19	My educational institution provides the conditions for the use of innovative methods to develop pedagogical skills.
20	I believe that using innovative methods to develop pedagogical skills can improve the learning outcomes of my students.

Source: developed by the authors

The research methods chosen are scientifically sound and provide the opportunity to re-do the research to verify its findings. They provide a complete picture of the progress of the research and allow other scientists to repeat the research using the same methods and materials.

RESULTS AND DISCUSSION

The results of the survey show that the majority of teachers (70%) are positive about the impact of innovative teaching methods on their professional activities. They believe that these methods make learning more interesting and effective for students (about 60% and 50% respectively). However, not all teachers have sufficient resources (around 55%) and administrative support (around 45%) to implement innovative approaches. This is one of the biggest obstacles they face (around 40%). It is important to mention that the majority of teachers (about 75%) are willing to adapt to new pedagogical technologies and believe that this is an opportunity to increase the effectiveness of the educational process (about 40%, 35% and 20% respectively).The results of the survey show that the majority of pedagogical professionals (approx. 70%) positively assess the impact of innovative methods of developing pedagogical skills on their work. They believe that these methods can help them to improve their skills (approx. 65%) and make learning more interesting and effective for students (approx. 60%). However, not all teachers have sufficient support from management (about 50%) and conditions in educational institutions (about 45%) to apply innovative methods. It is important to mention that the majority of teachers (about 65%) are willing to use innovative methods to develop pedagogical skills in their work.

The study results demonstrate the importance of integrating neuropedagogy, trend observation, gamification, robotics, and immersive technologies for developing pedagogical skills. The implementation of these methods showed a significant positive impact on various aspects of teachers' professional activities. In particular, the study found that these innovative methods not only improve the learning/educational process but also increase learners' motivation and interest, as well as develop critical thinking and creativity.

The data analysis showed that teachers who actively use modern pedagogical approaches have a higher level of professional competence. They can adapt their teaching methods more effectively to the needs of learners, integrate new technologies more quickly into the educational process and maintain a high level of interest among learners. The use of neuropedagogy helps teachers to optimise the educational/educational process, taking into account the individual characteristics of those seeking education, and trendwatching allows you to keep up with modern trends in the development of education. Gamification makes learning more engaging and motivating, while robotics and immersive technologies promote practical skills and technical knowledge. The results obtained are presented in the form of tables, charts, and graphs that help to visualise the data and make their analysis more understandable and accessible. The presentation of changes in the level of knowledge and skills of teachers "before" and "after" the implementation of the innovative methods (Table 3) allows you to see the effectiveness of the implemented methods and their impact on the professional development of teachers.

Table 3. Comparison of the level of knowledge and skills "before" and "after" the implementation of innovative pedagogical approaches, %

Evaluation criteria	Before implementation	After implementation	Change
Awareness of pedagogical theory	3.5	4.2	+0.7
Mastery of teaching methods	3.8	4.5	+0.7
Ability to use ICT	3.2	4.0	+0.8
The level of pedagogical skill	3.7	4.4	+0.7

Source: developed by the authors

The distribution of responses by category in the questionnaires and surveys was also analysed to obtain additional information on the perception of innovation and its impact on different aspects of pedagogical activity. In particular, the analysis of these responses made it possible to find out which innovative methods are most frequently used by teachers, which of them are considered the most effective, and what difficulties are encountered in their implementation. The detailed distribution of responses by category (Table 4) enabled a deeper understanding of teachers' attitudes toward innovative methods and their impact on professional activity. This data is valuable for identifying the most successful practises and recommendations for further use of the latest approaches in pedagogical activity.

Table 4. Distribution of responses by category in questionnaires and surveys, %

Answer category	Neuropedagogy	Trendwatching	Gamification	Robotization	Immersive technologies
Not familiar	10	15	20	25	30
Aware, but I don't use it	20	25	30	35	40
I use it from time to time	30	35	40	45	50
I use it regularly	40	30	30	25	20

Source: developed by the authors

The analysis of the distribution of responses by category in the questionnaires and surveys has shown that innovative pedagogical approaches such as neuropedagogy, trendwatching, gamification, robotics, and immersive technologies are becoming increasingly important among teachers. According to the results of the survey, the majority of teachers are already familiar with these approaches, but a fairly large proportion do not yet use them in practise. Nevertheless, a significant number of teachers already use innovative pedagogical methods from time to time or regularly, which indicates a certain level of acceptance and use of innovation in the educational process.

This multi-level approach makes it possible to better understand which methods are the most effective and in demand among teachers. Determining the levels of innovative implementation methods is just the first step to fully understanding their impact. The next important stage is the study of correlations between the use of these technologies and pedagogical skills. The analysis of these connections is particularly interesting, as it allowed us to discover how different levels of implementation of innovative approaches affect the professional development of teachers and which of them contribute to the improvement of their skills the most. This analysis (Table 5) helps to understand which specific innovative technologies provide the greatest effect and how their integration can optimise the learning and educational process and improve the quality of education as a whole.

Table 5. Correlations between the use of innovative technologies and pedagogical skills, %

Correlation	Correlation coefficient
The use of neuropedagogical methods	0.78
The use of trendwatching	0.65
The use of gamification	0.72
The use of robotics	0.68
The use of immersive technologies	0.74

Source: developed by the authors

The obtained results of correlations between the use of innovative pedagogical technologies and pedagogical skills indicate the presence of a significant positive relationship between these indicators. In particular, the use of neuropedagogical methods, trend-watching, gamification, robotics, and immersive technologies has a high degree of correlation with the development of pedagogical skills. This analysis made it possible not only to determine the relationship but also to understand its direction, to identify the most effective methods, to optimise pedagogical practise, and to develop strategies for the development of pedagogical skills at the system level. This shows that the introduction of innovative pedagogical approaches significantly impacts the improvement of teachers' professional

competencies and the quality of their work. After analysing the questionnaire and survey results answered by 217 and 313 educators, respectively, we formulated concrete and metaphorically integrated recommendations. These recommendations are aimed at improving the quality of education and creating a stimulating environment for the implementation of innovative approaches in pedagogical practise. The authors' approach considers the needs of the modern educational process and innovative ideas implementation to improve the effectiveness of the future generation's education and training.

The author's contribution in this part of the study consists of the detailed analysis of the collected data and the development of practical recommendations for the optimisation of pedagogical practise. Based on the obtained results, the key factors contributing to the development of pedagogical skills were identified, as well as strategies for improving the quality of education through the implementation of innovative methods were developed. In addition, the authors developed and applied a stratified random selection of respondents, which ensured the representativeness of the sample and the correctness of the data obtained. The authors also developed a two-factor questionnaire that included key questions and statements that allowed a comprehensive assessment of the perception and use of innovative pedagogical methods.

Observing the introduction of robotics to the educational process confirms the importance of this direction as another means of improving pedagogical skills. The use of assistant robots in the educational process opens up new opportunities for personalisation of learning and provides access to more interactive and interesting learning methods. This approach becomes an important factor in the formation of teachers' professional competencies in the conditions of the modern educational environment when in the light of rapid technological changes, the use of robot teachers in the educational process becomes an integral synergistic component. This innovative approach transforms not only the technical side but also affects the formation of the relevant competencies of those seeking education. This allows us to understand how the paradigm of education is changing – from primary school to professional corporate training – and how these changes are reflected in the training of a new generation of Ukrainians in the conditions of the XXI century challenges.

Teacher robots are a new reality that opens up many educational opportunities. Personalisation of learning, increasing motivation, accessibility of education, and development of new skills are just some of them. At the same time, there are challenges: cost, preparation, and ethical issues. In today's educational landscape, the use of robot teachers has become not only a fantastic possibility but also a reality. Some innovative developments allow you to see how digital technologies are integrated into the educational processes of the New Ukrainian school (n.d.) and the Scientific and pedagogical project "Intellect of Ukraine" (n.d.), changing the way we interact with the management process. The focus is on the companion robot Buddy (Fig. 1), which has a special purpose to help children (including those with autism) in their learning and development. Thanks to its friendly and accessible form, Buddy promotes the development of social skills, the perception of information, and the understanding of emotions. His interaction with students leads to the creation of an open and friendly educational environment that promotes effective learning and social development of each participant in the educational process.

Figure 1. The appearance of Buddy the robot
Source: Robot Buddy (n.d.)

Another exciting robot mentor in this series is Robo Wunderkind. Its interactive game format promotes learning the basic principles of programming from an early age and the development of creative abilities in children. Worthy of attention is the Ubtech Jimu Robot (Fig. 2). This designer robot opens up endless opportunities for students in science, technology, engineering, and mathematics (STEM) disciplines. It allows learners to create and programme their works while developing creativity, logical thinking, and emotional intelligence.

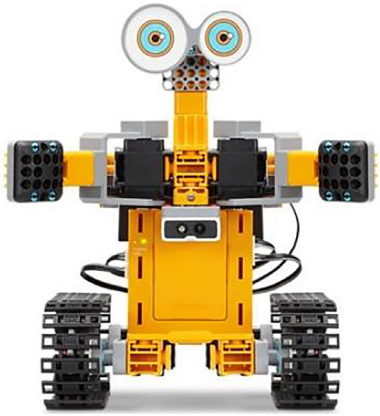

Figure 2. Appearance of the Ubtech Jimu robot
Source: UBTECH MeeBot 2.0 (n.d.)

These examples show that teacher robots are increasingly becoming an integral part of the modern educational process as companions, mentors, and designers, opening

up new opportunities for the development of students from different countries. The introduction of robot teachers into the educational process in the role of a friend, assistant, or partner is a characteristic feature of the European Union countries, which is declared in European standards. Another virtual assistant that helps to learn language and mathematics is Nao Robot (Fig. 3), developed by SoftBank Robotics (n.d.). Not only does it provide instructions and explanations but also tests knowledge, motivates, and supports. It has several functions designed to educate, entertain, and interact with users. Nao has an interactive interface capable of recognising voice commands, faces, and gestures, making it an ideal candidate for use in educational institutions and training programmes. Not only can it help with language and math tasks, but it also helps develop creative skills and engage in social interactions, helping educators and learners in the learning process.

Figure 3. The appearance of Nao the robot
Source: NAO V6 programmable humanoid robot (n.d.)

Pepper Robot (Fig. 4) is an equally useful and interesting robot that can interact with people. His social skills and ability to recognise emotions allow him to effectively communicate and interact with people in various situations. It understands language, shows empathy, and adapts to the needs of users, making it an ideal assistant for developing communication skills. With its unique features, Pepper helps people develop communication skills and emotional intelligence. He can play the role of a trainer, an interlocutor, or even a student, depending on the needs of the user. When interacting with Pepper, people get the opportunity to improve their skills in articulating, emoting, and connecting with others. Skills that can be developed with Pepper include not only communication and empathy but also collaboration, conflict resolution, and interpersonal culture. Interaction with robots helps people better understand themselves and others, which is especially useful in today's world of education, where communication skills and emotional intelligence are increasingly important for successful social and professional adaptation.

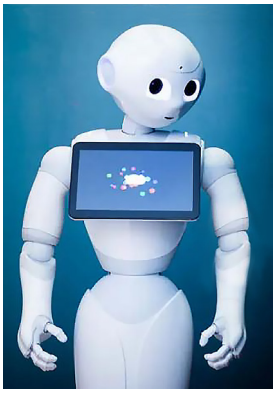

Figure 4. Appearance of Pepper the robot
Source: Pepper (n.d)

Emotional partner Probo the Robot (Fig. 5) is a robot assistant who is always ready to listen and support. It helps to overcome fear, insecurity, and other emotions that interfere with learning and development.

Figure 5. Probo, an intelligent huggable robot for HRI training with children
Source: H.-L. Cao *et al.*

Interaction with a robot teacher is not just learning, but a real adventure. The robot can provide instructions and explanations of new material; cheque the students' knowledge and skills; assign tasks and evaluate their performance; and provide emotional support and motivation. The impact of teacher robots on learning is impressive in terms of increasing motivation when robots make learning more interesting and interactive; personalisation, when robots adapt training to the needs of each student; improving results, as learning with robots leads to better results (Prasad Bhatt, 2021; Mihai & Returns, 2024); development of new skills when robots help develop the 21st-century skills: critical thinking, creativity, and emotional intelligence.

Robot teachers have significant potential to improve education. They do not replace human teachers but become their valuable assistants as companions, mentors, designers/instructors, assistants, partners, etc. European society not only recognises but also actively develops standards for

the use of robot teachers, based on ethical principles and pedagogical recommendations. With the deepening of digital transformation in the field of education, there is a need for effective management of digital processes. To achieve success in this dynamic area, we have considered new tools and methods that will truly revolutionise the educational process, as the role of digital education in ensuring efficiency and security increases.

The introduction of robot teachers is only one aspect of the dynamic transformation taking place in modern education. This process leads to the evolution of education, opening up new horizons for the development and improvement of a holistic system through data analytics systems, namely the collection and analysis of data on the success of learners, which allows the teacher to get a clear idaea of their strengths and weaknesses, as well as the dynamics their development, which makes it possible to personalise education and adapt it to the needs of each student; online learning platforms make education more accessible and flexible because students get the opportunity to study anywhere and at any time, having access to educational materials and interactive tasks; artificial intelligence systems used to personalise learning, adapt content, and automate routine tasks, allowing educators to focus on more important aspects of their work.

At the same time, the role of the head of the educational institution is also evolving through management of the process of robotisation of education, when the teacher is responsible for the implementation and use of digital technologies in the educational process (coordination of the work of teachers, administration and IT specialists, as well as ensuring the effective and safe use of teacher robots); mastering digital technologies by teachers, when the teacher organises training and seminars to help specialists in the educational field master new tools and work methods; ensuring the ethical and safe use of teacher robots, when the teacher develops and implements regulating rules and procedures.

The introduction of robot teachers opens up many opportunities for improving education at all levels. Primary school (development of basic reading, writing, and mathematics skills; study of STEM disciplines in game and interactive forms; development of social and emotional skills). Secondary education (study of languages, mathematics, natural sciences, and other disciplines with the help of robot teachers; personalisation of education and its adaptation to the needs of each student; preparation for final exams and admission to a higher educational institution. Higher education (conducting interactive lectures and seminars on the use of teaching robots; the use of teaching robots in research work; the training of highly qualified specialists who meet the needs of the labour market; professional training and development of flexible skills of employees; training of new employees in the Code of Ethics; support for continuous development and self-learning throughout life (Resolution of the general meeting of the National Academy, 2009).

The author's recommendations: 1) to provide teaching staff with the necessary resources for the implementation of innovative teaching methods; 2) provide teachers with more support from the administration in implementing innovative changes; 3) conduct additional studies and training for teaching staff on the use of innovative teaching methods; 4) develop methodological recommendations for the use of innovative teaching methods in various subject areas. The implementation of these recommendations will help create conditions for more effective use of innovative teaching methods in Ukrainian schools, which, in turn, will contribute to improving the quality of education.

Also, based on the results of the questionnaire, the authors proposed recommendations: 1) support pedagogical workers from the management in using innovative methods of developing pedagogical skills; 2) create conditions in educational institutions for the use of innovative methods of developing pedagogical skills; 3) conduct additional studies and training for pedagogical workers on the use of innovative methods of developing pedagogical skills; 4) to develop methodical recommendations regarding the use of innovative methods for the development of pedagogical skills in various subject areas. The implementation of these recommendations will help create conditions for more effective use of innovative methods of developing pedagogical skills in Ukrainian educational institutions, which, in turn, will contribute to improving the quality of education.

Thus, the impact of integrating neuropedagogy, trend-watching, gamification, robotics, and immersive technologies on the development of pedagogical expertise is that these innovative approaches help educators create more effective and personalised learning/educational environments. They enable teachers to adapt training to the needs of each learner while developing their professional competencies. This approach takes into account various learning styles and promotes the active participation of students in the educational process. Thanks to this, teachers can more effectively implement new strategies and methods, which enhances their teaching skills (Ramírez-Montoya, 2021; Yildiz, 2021; Folomieieva, 2024).

The study results indicate a significant positive impact of the integration of neuropedagogy, trend-watching, gamification, robotics, and immersive technologies on the development of pedagogical skills. At the same time, various views are expressed regarding the effectiveness and the possibility of challenges in the application of these innovative methods. Trendwatching, or the analysis of trends in the field of education, is noted as a means of raising the professional level of teachers and adapting to changes in the educational environment. However, some researchers fear that this approach may distract them from traditional teaching methods. In particular, Ya. Slupska & O. Shkurenko (2022) and M.S. Ramirez-Montoya *et al.* (2021) note the positive impact of trend-watching on professional teachers' development, however, with a certain possibility of distraction in case of hyper-focus on trends.

Neuropedagogical methods, based on the knowledge about the cognitive processes of the brain, are also recognised for their ability to improve academic performance. However, there are concerns about a possible over-reliance on these methods, which could affect the individual approach to learning. For example, Ukrainian scientists O. Dushchenko (2021) and O. Nikulochkina *et al.* (2022), as well as Chinese researchers Yu. Cui & H. Zhang (2021) support the importance of the role of neuropedagogy in personalising learning but express concerns about the loss of the individual approach due to excessive reliance on these methods. Using artificial intelligence and robotics to personalise learning and analyse student needs opens new horizons in the educational process. However, it is important to maintain a balance between technology and the human factor in order not to lose the personal contact between teachers and learners. For example, A. Rakhmanina *et al.* (2022) emphasise the importance of robotics for increasing the effectiveness of the educational process, however O. Piddubna *et al.* (2023) caution against the possible loss of personal human interaction due to dependence on software.

Closely related to robotics is gamification, that is, the use of game elements to motivate teachers and increase the interest of students in learning. This study fully proved that gamification with the use of robotics and immersive technologies makes the educational process more interesting and exciting, which contributes to better assimilation of educational material and increased motivation of students. N. Folomieeva *et al.* (2024) emphasise that gamification significantly increases learner engagement and promotes a better understanding of complex concepts. At the same time, S. Fedko (2023) warns that gamification can lead to a decrease in the seriousness of learning, turning education into entertainment, which is not always appropriate. It is worth using gamification responsibly not to make the process look too childish and irresponsible to students. A study by H. Alsadoon (2023) proved that the use of gamification increased the motivation of teachers and learners, and also improved learning outcomes.

Immersive technologies, especially the use of virtual and augmented reality for modelling educational situations and immersing participants in the learning/educational process in a virtual environment, allow them to gain new experiences and knowledge that they can use in their work to create more interesting and effective classes. Research by N.V. Soroko & S.H. Lytvynova (2022) and R.A.Z. El Islami *et al.* (2022) confirm that immersive technologies significantly increase the interest of learners and improve their learning outcomes, but S.H. Alshammari (2019) notes that the implementation of such technologies requires significant resources and training, which is not available to all educational institutions. Yu. Trach (2023) notes the huge potential in the implementation of these technologies but emphasises that this requires significant investment, training, and adjustment, both on the part of teachers and on the part of the administration of educational institutions, which is still a complex and long process. This study showed that, regardless of financial difficulties, the use of immersive technologies allows teachers to create a more exciting educational environment, which contributes to both the improvement of teaching skills and better assimilation of educational material by students.

The use of innovative methods makes the work of teachers more interesting and exciting, which contributes to increasing their motivation and interest in professional development. I. Szőköl *et al.* (2023) and L. Sharma & M. Srivastava (2020) provide many examples of how innovative approaches stimulate teachers' self-development and continuous improvement. B. Artman & S. Crow (2022) and S. Prasad Bhatt (2021) insist that innovation in education is the key to improving the quality of teaching and learning. Innovation can sometimes lead to a loss of focus on the basic skills and knowledge required for foundational learning.

The integration of trendwatching, gamification, and immersive technologies allows teachers to go beyond traditional teaching methods and look for new, more creative, and innovative ways of presenting educational material and organising the educational process. O.V. Sagan (2023) and L. Elouafi *et al.* (2021) sharpen the focus of attention only on individual methods as unique, but this study demonstrates that a comprehensive approach in the form of integration of these methods brings the most positive results. The use of interactive elements offered by gamification and immersive technologies together promotes the activation of the educational process and increases the level of interaction between teachers and students. Students are more involved in learning and take an active part in educational activities, which allows teachers to better assess their knowledge and skills, as well as provide them with individual support. R. Nacional (2024) and N.A. Grigorieva *et al.* (2021) confirm that interactive methods are an important component of modern education, which is fully correlated with this study.

It is important to continue a fruitful and constructive discussion and to join the efforts of educators and scientists to determine the most effective ways of integrating innovative methods, developing optimal models of their application, and evaluating the long-term impact of these methods on the educational/educational process, as well as creating conditions for all educators to be able to take advantage of both individual innovative methods and their combinations. Achieving these goals will contribute to the creation of a new generation of Ukrainians and the construction of a new European Ukraine, making Ukrainian education one of the best in the world.

CONCLUSIONS

Education is a key tool for adapting to new challenges and ensuring the successful development of society. The results of this study confirm that the integration of neuropedagogy, trend-watching, gamification, robotics, and immersive technologies has a significant positive impact on the development of pedagogical skills. The obtained results testify to

the positive impact of the introduction of innovative pedagogical approaches on the level of teachers' knowledge and skills. A comparison of the data "before" and "after" the implementation shows a significant improvement in all evaluation criteria, in particular, increasing knowledge of pedagogical theory, mastery of teaching methods, and the use of information and communication technologies (ICT), as well as increasing the level of pedagogical skills. The observed positive changes testify to the effectiveness of new approaches in the development of pedagogical practise and the preparation of pedagogical personnel for modern challenges.

Teachers who use these innovative methods demonstrate better knowledge and skills, which becomes an important prerequisite for improving the quality of education. In particular, the use of innovative technologies helps to increase the motivation and interest of teachers in professional development, which has a direct impact on the effectiveness of the educational process. The world of robotics in education opens up many new opportunities to improve learning and development at all levels. The rapid development of artificial intelligence, interactive robots, and data analysis systems creates the prerequisites for personalised learning and improving the quality of education. The introduction of robot teachers is not just a change of tools, but a real transformation of the entire education system.

Further research should be aimed at studying the long-term impact of these technologies on pedagogical skills, as well as at developing effective models of their integration into the system of educators' professional development. Only through the joint efforts of the government, educational institutions, and the public will Ukraine be able to respond to the challenges of global digital transformation and provide quality education for future generations. Within the scope of further research, neuropedagogical design of educational environments using immersive technologies to stimulate transversal thinking will be of great importance.

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CONFLICT OF INTEREST

None.

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Вплив інтеграції нейропедагогіки, трендвотчингу, гейміфікації, роботизації, імерсивних технологій на розвиток педагогічної майстерності

Анотація. Актуальність теми полягає в необхідності вдосконалення освітнього процесу в умовах постійної технологічної трансформації суспільства. Інтеграція нових методів і технологій навчання є ключовим фактором підвищення якості освіти та розвитку професійної майстерності педагогів. Метою дослідження було виявлення синергетичного ефекту від інтеграції інноваційних педагогічних методів до навчального процесу та визначення їхнього впливу на розвиток професійних компетентностей педагогів. Методи аналізування проблеми включали в себе теоретичний аналіз наукової літератури, узагальнення педагогічного досвіду, використання методів статистичного аналізу та дослідження практики використання інноваційних методів навчання. Основними результатами дослідження є доведення синергетичного ефекту інтеграції передових педагогічних підходів в контексті сприяння розвитку професійної майстерності педагогів. Встановлено, що нейропедагогіка допомагає зрозуміти мозкову активність учнів та персоналізувати навчальний процес для кожного з них. Трендвотчинг надає можливість вчителям вчасно реагувати на нові тенденції й адаптувати свою практику. Гейміфікація створює мотиваційне середовище для навчання, а роботизація допомагає виконати рутинні завдання, звільняючи час для індивідуального підходу до кожного здобувача освіти. Імерсивні технології дозволяють учням відчувати занурення до навчального процесу та досліджувати на практиці. З'ясовано, що інтеграція передових педагогічних підходів є важливим кроком у розвитку професійної майстерності вчителів і підвищенні якості освіти. Синергетичний ефект і персоналізація навчання дозволяють досягти більшого успіху в навчальному процесі та забезпечують індивідуальний підхід до кожного учня. Цінність отриманих результатів полягає у розробці рекомендацій, що можна застосовувати на практиці для покращення навчального процесу та розвитку педагогічної практики в цифрову епоху

Ключові слова: інноваційні підходи до навчання; синергетичний ефект; модернізація; персоналізація; навчальний процес

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