Development of digital competence of the military leadership officers in the system of advanced training: a pedagogical experiment

Olha P. Pinchuk[1], Alla A. Prokopenko[2]

[1]Institute for Digitalisation of Education of the NAES of Ukraine, 9 M. Berlynskoho Str., Kyiv, 04060, Ukraine
[2]The National Defence University of Ukraine, 28 Povitryanykh Syl Ave., Kyiv, 03049, Ukraine

Abstract

The study aims to find ways to solve the urgent problem of improving the military education system – the development of servicemen members's digital competence. As a result of theoretical, methodological, and experimental work, the relevance of and needs for developing digital competence of the military leadership officers in various competence areas have been studied: Information and data literacy, Communication and collaboration, Digital content creation, Safety, and Problem-solving. To fulfill these needs, an online optional course, "Digital Technologies in the Professional Activity of the military leadership officers of the Armed Forces of Ukraine", and a corresponding curriculum have been developed.

The study also developed a computer-oriented methodological system aimed at enhancing digital competence within the framework of the advanced training system for military leadership officers. The effectiveness of this system was thoroughly tested during a pedagogical experiment. The analysis of the level characteristics of development in the experimental group before and after the formative experimental influence showed positive and statistically significant changes in digital competence development among officers of the Armed Forces of Ukraine's military command. Positive shifts across all components of digital competence (cognitive, operational-activity, and value-motivational) confirmed the achievement of the research goals and objectives, indicating the success of the implemented methodology and selected teaching tools.

This research significantly contributes to modernizing military education by emphasizing the formation and development of digital competence, which is crucial for conducting modern military operations and making operational decisions.

Keywords

digital competence, pedagogical experiment, digital tools, the Armed Forces of Ukraine, military leadership, military education, ICT, advanced training of a serviceman

1. Introduction

Ukraine is experiencing a challenging military and political situation, which is significantly affecting all educational institutions, including higher military education institutions (HMEIs). The COVID-19 pandemic and the full-scale war in the country have become extraordinary challenges for the HMEIs and have caused problems in providing servicemen's training for Ukraine's national security and defence.

Under the conditions of the Russian-Ukrainian war, the digital competence of the military leadership officers (MLOs) should become an integral part of their professional training in the context of effectively countering threats, ensuring national security and defence of the state. Understanding the importance of acquiring continuous development of digital competence of the military leadership officers becomes a strategic prerequisite for strengthening Ukraine's defence capability and successful functioning of the Armed Forces of Ukraine (AFU) in an environment loaded with computer-oriented and network technologies, digital means, and robotic equipment.

The active introduction of new computer-oriented methods and relevant digital tools to optimise and automate management and decision-making processes is crucial for the country's defence capability.

DigiTransfEd 2024: 3rd Workshop on Digital Transformation of Education, co-located with the 19th International Conference on ICT in Education, Research, and Industrial Applications (ICTERI 2024, September 23-27, 2024, Lviv, Ukraine
opinchuk@iitlt.gov.ua (O. P. Pinchuk); allicka7@gmail.com (A. A. Prokopenko)
https://iitlt.gov.ua/eng/structure/detail.php?ID=442 (O. P. Pinchuk)
0000-0002-2770-0838 (O. P. Pinchuk); 0000-0001-5719-844X (A. A. Prokopenko)

Military professionals must be highly digitally competent. This means that new pedagogical techniques and the active use of digital tools as learning tools are needed.

Planning, development of digital content, dissemination and exchange of data through digital technologies, communication and cooperation, ensuring security in the digital environment (protection of personal data), and collection, processing and analysis of information in real-time should become areas of high digital competence of the military leadership officers, which will enable them not only to overcome the challenges of the modern world, but also to contribute to the effective performance of duties and tasks, and to respond quickly to changes.

According to the Policy of the Ministry of Defense of Ukraine on military education and the Concept of transformation of the military education system, the development of military education involves its professionalisation by building a modern model of military education that provides training for military specialists based on their continuous advanced training. One of the main principles of the policy is the integration of the military education system of Ukraine into the European military education space and the continuity and consistency of military education (training) throughout the military career, which should correspond to the priority areas of development of the national military education.

Given the imminent transition of the Ukrainian Defense Forces to modern NATO weapons, which has accelerated as a result of Russian aggression against Ukraine, the tasks of training, retraining and advanced training of the servicemen of the Ukrainian Defense Forces in the context of transformation, in particular digital transformation, of all critical aspects of training, employment, command and control and support of troops (forces) are becoming more urgent. This process should continue throughout the military career, which is in line with the concept of continuity and flexibility of education [1].

In order to fulfil the tasks defined in the Strategic Defense Bulletin (SDB) [2], defence reform measures for the medium term are being implemented. The legal basis of the SDB of Ukraine is the Constitution of Ukraine, several laws of Ukraine [3, 4], as well as the National Security Strategy of Ukraine [1]; Military Security Strategy of Ukraine [5], Report on the results of the defence review by the Ministry of Defense of Ukraine [6].

The documents above detail that the Ukrainian Defense Forces should undergo a digital transformation, introduce modern technologies for automating the management of troops and weapons, introduce monitoring information analysis; modelling, creation of expert systems, implement special software and information systems; create organisational and logistical conditions for the formation and use of a single information environment of the defence forces through the use of common standards, protocols, architectures (design solutions); application of the necessary services and full use of information resources aimed at the effective use of defence forces during defence operations (joint forces operations).

In conducting research and finding ways to overcome educational challenges related to digitalisation, there is a tendency to limit such a search to the level of school education or higher education in the humanities. There is a gap between the professional training received by military professionals in a particular field of knowledge and the requirements of modern military practice. It is a significant fact that currently, students in higher military education institutions are forced to interrupt their studies due to the need to exercise their duties directly in the war zone, as well as in connection with the treatment and restoration of physical and mental health. Thus, there is an urgent need to develop effective strategies to bridge the educational gap, to support the military in meeting their educational needs, to create conditions for their training, development and professional improvement; to develop and implement the latest programs to build a digital educational environment of HMEIs; and to direct the military education system to form a military leader, taking into account the needs of NATO integration. Active cooperation with NATO partners is not only an exchange of experience but also the introduction of best practices in the field of higher military education, which include elements of methodological systems for the development of digital competence of military professionals.

2. Related works and recent research

The application of the analytical and bibliographic method to scientific sources of formation and development of digital competence, in particular in the process of obtaining higher military education, made it possible to determine that the concepts of digitalisation and digital transformation, as well as the introduction of digital technologies in modern education and science at certain stages, have been studied by Spivakovsky et al. [7], Kuzminska et al. [8], Santos and Gomes [9], Schatz et al. [10].

Sharing the perspective of Krumsvik and Jones [11], our study focuses on the use of ICT by educators during the learning process. Additionally, we have developed methodological guidelines to promote more targeted and context-specific development of digital competence among military command officers of the Armed Forces of Ukraine within the professional development system.

We agree with Gawliczek [12], who emphasised using ICT in the educational process, mainly focusing on the changes occurring in modern academic education under the influence of the technological revolution. We have concentrated on applying various digital resources and tools, with a particular emphasis on using artificial intelligence, creating online courses, and developing innovative technologies to increase the efficiency and practicality of the educational process.

Despite the fact that the research by Cabero-Almenara and the works of Caena and Redecker [13, 14] target a different audience, we utilised specific approaches in designing questionnaires for focus groups and interviews to determine the level of digital competence, needs, and expectations regarding the professional development of specialists. This allowed us to gather diverse perspectives and opinions on what knowledge, skills, and competencies are necessary for officers in the digital age.

In particular, in the works of Schatz [15], Fautua et al. [16], Schatz and Walcutt [17], Lillerud [18] we have borrowed the ideas about the evolution of the field of military education, which acquires new properties under the influence of technological advances, changes in the tactics of warfare and a deeper understanding of human thinking. The key aspects are integrating technologies, distance and distributed learning, and data as a source of information.

Military training now heavily incorporates advanced technologies such as virtual reality (VR), augmented reality (AR), and simulations. These tools provide realistic scenarios. The growth of distance and distributed learning capabilities allows servicemen to access learning modules from anywhere, facilitating continuous learning. Using big data and machine learning algorithms allows higher military education institutions to analyse huge amounts of training data, identify trends, predict performance outcomes, and continuously improve curricula.

In addition, scientific and methodological approaches to adaptive learning, which focus on specific gaps in digital skills and are interdisciplinary, are important for our study. These approaches provide opportunities to maximise learning effectiveness.

The hypothesis of the study was to assume that the development of digital competence (DC) of the military leadership officers (MLOs) of the Armed Forces of Ukraine (AFU) will have a positive result if a specially designed computer-oriented methodological system for its development is implemented.

3. Results and discussion

In the context of modern challenges in the military field and the development of digital technologies, it is essential to constantly improve the qualifications of military leadership officers and create conditions for developing their digital competence. The choice of a methodological approach that takes into account the specifics of the military leadership and the peculiarities of digital competence, the development of tools for collecting data on the effectiveness of a computer-oriented methodological system, the pedagogical experiment to assess the organised impact in the system of advanced training of officers, the analysis of the results and their interpretation given the research objectives are essential stages of this study. Each of them jointly ensured the formulation of adequate conclusions and provided opportunities to substantiate the theoretical and practical significance of the results obtained in improving the level of the DC MLO of the AFU.

In order to achieve the purpose of the study, several theoretical and empirical methods were used: analysis of the state of research on the problem in scientific publications; generalisation of domestic and foreign experience; work in focus groups, surveys, interviews; study of practical experience in the use of digital tools and services in the service activities of military professionals; analysis of basic terms and concepts and the relationship between them; method of comparative analysis; development of practical cases and surveys appropriate for use in evaluating the results of scientific research. The study aimed to theoretically substantiate and experimentally test the effectiveness of a computer-based methodological system for developing digital competence of the military leadership officers of the Armed Forces of Ukraine in the system of advanced training. This necessitated the search for a methodological basis for achieving this goal. Taking into account the specifics of the military leadership and the peculiarities of developing the digital competence of professionals, our choice of methodological approach took into account as follows:

1. Various aspects of military leadership and the development of digital competence require a combination of methods of pedagogy, military science, information technology and other fields. We have implemented the interdisciplinary approach.
2. The pedagogical experiment allowed for controlled pedagogical influences on officers who underwent advanced training from December 2023 to February 2024 and to analyse and improve methods of developing their digital competence.
3. The study of real-life scenarios of military leadership involving digital technologies helped specify the challenges and learn about the opportunities that emerge in the military environment (case study at the preparatory stage).
4. Surveys and focus groups, used as data collection methods among military professionals, helped obtain information on their needs and preferences for developing digital competence.
5. The focus on practical application and prospects for implementing the results obtained in military practice contributed to the qualitative formation of a list of specific recommendations for teachers to improve officers' digital competence.

The pedagogical experiment has been aimed at researching and testing new pedagogical concepts, methods, techniques, programs, approaches, etc. The interpretation of the term "pedagogical experiment" is more or less established, but may differ from one scholar to another, and depends on the range of scientific interests and the theoretical framework – a conceptual structure used to organise and understand specific information, providing a set of principles, models and assumptions for interpreting data.

The primary purpose of any pedagogical experiment is to empirically confirm or refute the research hypothesis, i.e. to prove that the proposed pedagogical impact is more effective than other previously applied ones. The purpose of our pedagogical experiment was to test the hypothesis, which was to assume that the development of digital competence of the military leadership officers of the Armed Forces of Ukraine will have a positive result (officers will achieve a sufficient and high level of DC), provided that the components of the specific and individually developed computer-oriented methodological system are introduced into the process of improving their qualifications.

The authors chose the sequential pedagogical experiment method, meaning that the same group of subjects is analysed. It simultaneously acts as a control group (its initial state at the baseline stage) and an experimental group (after the formative experiment). In other words, a sequential experiment is conducted within one study group, where the level of formation or development of a pedagogical phenomenon according to the traditional system (organisational and pedagogical approaches, methods, means, etc.) is recorded and then compared with the effectiveness of pedagogical innovations after their implementation as an experimental factor in the same group. In our experiment, there was no control group. The analysis was conducted about the same group of respondents – participants of the advanced training courses. Thus, the same group was used as a control group (condition before the experimental training) and an experimental group (condition after the experimental training). Before the experiment begins, the control, factor, and neutral characteristics of the research object – their components and

content – are clearly recorded. After that, changes are made to the factor (experimental) characteristics of the group and the conditions of its functioning – the process of developing the digital competence of the Military Command and Control Bodies during the organised pedagogical influence in the advanced training courses and under the influence of the created controlled pedagogical conditions. After the experiment's formative stage, the second digital competence test is carried out, taking into account the control characteristics.

The experiment was conducted in three stages: baseline, formative, and statistically implementable. It was conducted at the National Defense University of Ukraine (NDUU). At different stages of the study, 150 respondents were surveyed. The pedagogical experiment at the formative stage included 34 officers of the military leadership course who were undergoing advanced training at the NDUU. The authors of the article used methods of statistical data processing that provide objective results on small data sets.

At the baseline stage of the pedagogical experiment, the criteria and indicators of development of the DC MLO were substantiated [19]. The expert evaluation of the selected indicators of development of DC MLO in the system of advanced training was carried out (table 1), and the state of formation of the DC of the military leadership officers was identified [19].

At the baseline stage, 21 experts have included Doctors of Sciences, Doctors of Philosophy, Candidates of Sciences, professors, associate professors, and researchers in the field of education who conduct research and educational activities in research institutes, centres and departments of domestic higher education institutions, including higher military education institutions, and train and retrain military professionals. The overwhelming majority of experts work in the field of military education, the use of digital technologies, and information security.

Table 1
According to experts, the most significant are the indicators of development of the DC MLO of the AFU.

Criteria		
Cognitive	**Operational and activity-based**	**Value and motivational**
Competence area: development of digital content		
knowledge of the effective use of software products and tools for creating interactive content (data presentation, interactive visualisation)	ability to present projects to colleagues with the addition of text, images and visual effects	ability to create new content of the existing digital content using iterative tools (testing, presentation)
Competence area: dissemination and exchange of information via digital technologies		
knowledge of digital tools for collecting data (information) and the possibilities of presenting them in an accessible way (using table editors)	ability to collect, analyse and interpret data from various sources, combine information from all sources and intelligence into analytical reports	ability to take into account the transparency and reliability of information/data when using/presenting them
Competence area: communications and cooperation		
knowledge of the basics of using digital tools in the context of collaboration to distribute tasks and responsibilities	ability to organise online collaboration using programs that allow users to collaborate on projects (developing a project status report, organising verification and acceptance of project results)	ability to perceive and take into account the opinions of others
Competence area: security in a digital environment (personal data protection)		
knowledge of the procedures for protecting personal data and information with restricted access	ability to choose the appropriate cyber hygiene strategy	ability to recognise the presence of various risks in the digital environment

At the formative stage, the topical modules, digital technology services, and relevant teaching methods were selected as elements of a computer-oriented methodological system for the development of the digital competence of military leadership officers in the advanced training system. The specific distance

learning course "Digital technologies in the professional activity of the military leadership officers of the Armed Forces of Ukraine" has been developed.

Course objective: to increase the level of digital competence of the military leadership officers in planning and resource management in the field of defence, managing projects in the field of informatisation and project management in the Armed Forces of Ukraine, organising information activities and strategic communications, systematic and contextual application of information and communication technologies in the professional activity of military specialists, systematic integration of digital technologies into their professional activity; formation of competencies in organising professional activity using digital technologies; motivating professional self-improvement and continuous learning throughout the military career.

The online course "Digital Technologies in the Professional Activity of the military leadership officers of the Armed Forces of Ukraine" is available on the NDUU's Moodle electronic educational platform.

The course is based on the application of microlearning pedagogical technology. However, we believe it is more appropriate to use the term "approach" or "learning strategy" rather than "technology", a complex of interrelated and interdependent pedagogical technologies. They include as follows: self-microlearning as a technology for achieving an educational objective in small steps; e-learning; gamification of learning; learning-on-demand; m-learning, defined by some authors as learning-on-the-go and bring-your-own-device (BYOD). The implementation of microlearning as an approach to the educational process involves micro structuring content suitable for assimilation in small portions. This requires, in turn, a completely different approach to forming a model of planned educational outcomes.

We consider microlearning a promising form of organising the learning of course content. The educational material is organised into independent units/elements of microcontent (mini-blocks, microlearning modules, micromedia resources).

The course content is divided into complete information elements (lessons), subject to learning outcomes assessment. There is also an opportunity for constant feedback through forum questions and feedback, which is the key to success in learning (table 2).

The learning course is the core, the central element of the developed structural and functional model of the computer-oriented methodological system for developing the DC MLO of the AFU in the system of advanced training [20]. The components of the methodological system built based on the model include the following: conceptual, target, content and methodological block, procedural, technological, and resultative. It should be noted that, in addition to the learning mentioned above course, the content

Table 2
Content of the distance course "Digital technologies in the professional activity of the military leadership officers of the Armed Forces of Ukraine".

Learning module	Contents	Hours
Topic 1. Design basics and creation of interactive presentations.	Design basics and principles. Tools for creating content visualisation. Basics of working with Canva. Creating interactive presentations and videos in Canva. Data visualisation using Microsoft Excel and Power BI.	20
Topic 2. Use of digital tools for planning, project activities, and information collection.	Overview of modern digital tools for planning, project activities, and information collection. Five free-of-charge project management programs (Todoist, Slack, Trello, Asana, GanttProject).	8
Topic 3. Security in the digital environment (personal data protection).	Procedures for protecting personal data and restricted information. Information and telecommunication systems (ITS) and cyber threats. Principles of organising information technology in modern ITS. Types of information, access to information. Protection of information in information and telecommunication networks. Consequences and liability for violation of cybersecurity measures. Threats from personal mobile and communication devices. Cyber threats when using the Internet. Threats from the use of wireless networks. Malicious software. Interactive games and quests.	10

and methodological block includes the elements as follows: cloud services; information, didactic and teaching aids, multimedia objects, VR/AR tools, AI elements that allow for the selection of existing or creation of new training materials; diagnostic tools, etc.

The effectiveness of the author's distance learning course "Digital Technologies in the Professional Activity of the military leadership officers of the Armed Forces of Ukraine" was tested on the LMS Moodle distance learning platform of the NDUU in online mode by comparing the level of knowledge of students before they took the proposed course and after the course training. The levels of development of the digital competence of the MLO (basic, sufficient, high) were determined according to three criteria (cognitive, operational and activity-based, and value and motivational). The development of the digital competence of the MLO of the Ukrainian Armed Forces in the advanced training system was evaluated using specifically selected diagnostic tools (questionnaire, testing and practical tasks) published on the LMS Moodle. The evaluation scale is shown in figure 1. The sum of points from 50 to 69 corresponds to the AFU's basic level of the DC MLO, 70-89 – sufficient level, 90-100 – high level.

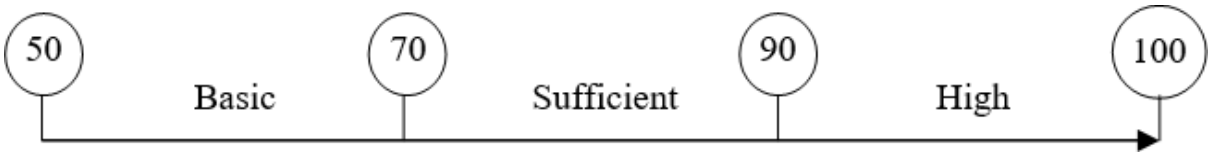

Figure 1: Evaluation scale of development of the DC MLO of the AFU.

In order to confirm the effectiveness of the computer-oriented methodological system for the development of digital competence of the military leadership officers of the Armed Forces of Ukraine, the significance of the learning outcomes of the course training was evaluated using two methods: the method of statistical hypothesis testing by Student's t-distribution and the Wilcoxon method of ranking differences between independent samples (figure 2).

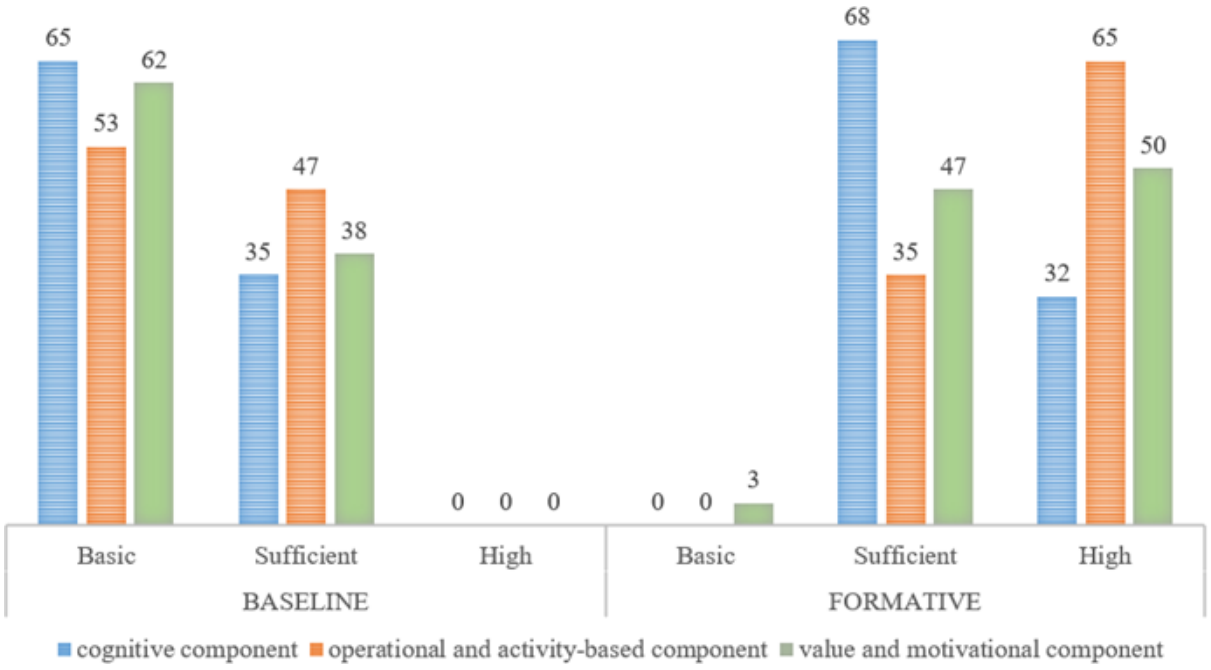

Figure 2: Correlation of the DC development levels at the baseline and control stages of the study.

The results indicate a positive trend in developing all components of digital competence after the introduction of distance learning. Thus, we note the emergence of respondents with a high level of development of the cognitive component (32%), operational and activity-based component (65%), value and motivational component (50%) of digital competence. No respondents with a basic level of digital

competence were identified.

To confirm the empirical hypothesis and find out whether there is a significant statistical relationship, the Wilcoxon signed-rank test was carried out using IBM SPSS Statistics 27. This allowed us to confirm the previously formulated hypothesis and note the positive impact of the implemented author's course on all components separately and on the digital competence of respondents in general.

The differences between the groups before and after the experiment were also proved statistically significant using Student's t-distribution (ts) significance criteria with $p \leq 0.01$.

The analysis of the level characteristics of the development of the DC before and after the formative experimental impact shows that there have been positive and statistically significant changes in the development of the DC MLO of the AFU. The presence of positive changes in all components of digital competence confirms the achievement of the purpose and objectives of our study.

4. Conclusions

It has been found that digitalisation and automation of troops and weapons management processes is one of the priority areas of digital transformation in the Armed Forces of Ukraine. Modernisation of military education should include the creation of an effective military education system that will be compatible with similar systems already in place in NATO member countries; providing and managing organised training for personnel at the operational and strategic levels; implementation of the "Education throughout the military career" principle; ensuring that the quality of military education meets modern NATO standards; mutual recognition of diplomas and certificates issued by Ukrainian military education institutions and educational institutions of NATO member countries.

Military professionals should be allowed to improve their digital competence during retraining and advanced training.

The following components of the DC MLO of the AFU have been identified and substantiated: cognitive, operational and activity-based, value and motivational and relevant criteria and indicators of development of the DC MLO of the AFU, which have been used during the pedagogical experiment to determine the effectiveness of the proposed innovations.

The author's online optional course "Digital Technologies in the Professional Activity of the military leadership officers of the Armed Forces of Ukraine" and the corresponding curriculum have been verified during the experimental training of students at the advanced training courses. The positive dynamics of the digital competence development of the military leadership officers of the Armed Forces of Ukraine have been statistically confirmed. The analysis of the data obtained during the pedagogical experiment shows that the developed and tested elements of the computer-oriented methodological system for the development of the DC MLO of the AFU are practical.

Further study of this problem should be carried out in the direction of improving the methodological system [20], in particular its technological component, which includes a variety of software for education and training (specialised computer programs, video and audio materials, virtual tutors, websites, multimedia manuals and other hardware and software). This component is undergoing significant changes as digital technologies and telecommunications networks improve and artificial intelligence and robotics systems are introduced.

In our opinion, more attention should be paid in pedagogical research to the formation and development of the value and motivational component of military leadership officers' digital competence.

References

[1] The National Security Strategy of Ukraine, approved by the Decree of the President of Ukraine dated September 14, № 392, 2020. URL: https://www.president.gov.ua/documents/3922020-35037.

[2] The Strategic Defense Bulletin of Ukraine, approved by the Decree of the President of Ukraine dated September 17, №473, 2021. URL: https://www.president.gov.ua/documents/4732021-40121.

[3] The Law of Ukraine "On Stimulating the Development of the Digital Economy in Ukraine" №1667-X, 2023. URL: https://zakon.rada.gov.ua/laws/show/1667-20#Text.
[4] The Draft Law "On the National Informatization Program" № 1556-VII, 2021. URL: http://surl.li/udhab.
[5] The Military Security Strategy of Ukraine, approved by the Decree of the President of Ukraine dated March 25, № 121, 2021. URL: https://www.president.gov.ua/news/prezident-zatverdiv-strategiyu-voyennoyi-bezpeki-ukrayini-67361.
[6] The Report on the Results of the Defense Review Conducted by the Ministry of Defense of Ukraine, approved by the decision of the National Security and Defense Council of Ukraine dated March 24, № 106, 2020. URL: https://zakon.rada.gov.ua/laws/show/n0003525-20#Text.
[7] A. Spivakovsky, L. Petukhova, O. Anisimova, A. Horlova, V. Kotkova, A. Volianiuk, ICT as a Key Instrument for a Balanced System of Pedagogical Education, in: A. Bollin, H. C. Mayr, A. Spivakovsky, M. V. Tkachuk, V. Yakovyna, A. Yerokhin, G. Zholtkevych (Eds.), Proceedings of the 16th International Conference on ICT in Education, Research and Industrial Applications. Integration, Harmonization and Knowledge Transfer. Volume I: Main Conference, Kharkiv, Ukraine, October 06-10, 2020, volume 2740 of *CEUR Workshop Proceedings*, CEUR-WS.org, 2020, pp. 307–321. URL: https://ceur-ws.org/Vol-2740/20200307.pdf.
[8] O. Kuzminska, M. Mazorchuk, N. Morze, V. Pavlenko, A. Prokhorov, Study of Digital Competence of the Students and Teachers in Ukraine, in: V. Ermolayev, M. C. Suárez-Figueroa, V. Yakovyna, H. C. Mayr, M. Nikitchenko, A. Spivakovsky (Eds.), Information and Communication Technologies in Education, Research, and Industrial Applications, Springer International Publishing, Cham, 2019, pp. 148–169. doi:10.1007/978-3-030-13929-2_8.
[9] M. R. Santos, M. M. F. Gomes, Lifelong Digital Learning: "Computer Literacy," "Digital Literacy," And "Digital Competence" As Dimensions For Digital Skills, Revista de Gestão Social e Ambiental 18 (2023) e04403. URL: https://rgsa.openaccesspublications.org/rgsa/article/view/4403. doi:10.24857/rgsa.v18n1-028.
[10] S. Schatz, D. Fautua, J. Stodd, E. Reitz, The Changing Face of Military Learning, Journal of Military Learning (2017) 78–91. URL: https://www.armyupress.army.mil/Journals/Journal-of-Military-Learning/Journal-of-Military-Learning-Archives/April-2017-Edition/The-Changing-Face-of-Military-Learning/.
[11] R. Krumsvik, L. Jones, Teachers' digital competence in upper secondary school: (work in progress), in: ICICTE 2013 Proceedings, 2013, pp. 171–183. URL: http://www.icicte.org/Proceedings2013/Papers%202013/05-1-Krumsvik.pdf.
[12] P. Gawliczek, Technologie informacyjno-komunikacyjne jako narzĘdzia kształcenia. Studium przypadku – filia w EŁku Uniwersytetu WarmiŃsko-Mazurskiego w Olsztynie, Civitas et Lex 3(23) (2019) 33–39. URL: https://cejsh.icm.edu.pl/cejsh/element/bwmeta1.element.desklight-3b016fcd-7632-46b7-8f10-d8e0c8c5d25d.
[13] J. Cabero-Almenara, R. Romero-Tena, A. Palacios-Rodríguez, Evaluation of Teacher Digital Competence Frameworks Through Expert Judgement: the Use of the Expert Competence Coefficient, Journal of New Approaches in Educational Research 9 (2020) 275–293. doi:10.7821/naer.2020.7.578.
[14] F. Caena, C. Redecker, Aligning teacher competence frameworks to 21st century challenges: The case for the European Digital Competence Framework for Educators (Digcompedu), European Journal of Education 54 (2019) 356–369. doi:10.1111/ejed.12345.
[15] S. Schatz, Simulation-based training for irregular warfare, SpringSim '10, Society for Computer Simulation International, San Diego, CA, USA, 2010, p. 36. doi:10.1145/1878537.1878575.
[16] D. Fautua, S. Schatz, E. Reitz, J. Killilea, Joint Continuum of eLearning: Implementing Engaging, Effective, and Meaningful Military E-Learning, in: Proceedings of the Interservice/Industry Training, Simulation and Education Conference (I/ITSEC), 2012, p. 12138. URL: https://www.researchgate.net/publication/278962781_Joint_Continuum_of_eLearning_Implementing_Engaging_Effective_and_Meaningful_Military_E-Learning#fullTextFileContent.
[17] S. Schatz, J. Walcutt, Modeling what matters: AI and the future of defense learning, The Journal

of Defense Modeling and Simulation 19 (2022) 129–131. doi:10.1177/15485129221088718.
[18] B. G. Lillerud, Ukraine-Norway military cooperation: A short overview, 2021. URL: https://sites.utu.fi/bre/ukraine-norway-military-cooperation-a-short-overview/.
[19] O. Pinchuk, A. Prokopenko, Actual Areas of Development of Digital Competence of Officers of The Armed Forces of Ukraine, in: S. Lytvynova, O. Y. Burov, N. Demeshkant, V. Osadchyi, S. Semerikov (Eds.), Proceedings of the VI International Workshop on Professional Retraining and Life-Long Learning using ICT: Person-oriented Approach (3L-Person 2021) co-located with 17th International Conference on ICT in Education, Research, and Industrial Applications: Integration, Harmonization, and Knowledge Transfer (ICTERI 2021), Kherson, Ukraine, October 1, 2021, volume 3104 of *CEUR Workshop Proceedings*, CEUR-WS.org, 2021, pp. 19–30. URL: https://ceur-ws.org/Vol-3104/paper129.pdf.
[20] O. Pinchuk, A. Prokopenko, Model of a Computer-Oriented methodological system for the development of digital competence of officers of the military administration of the armed forces of Ukraine in the system of qualification improvement, Collection of Scientific Papers of the National Academy of the State Border Guard Service of Ukraine. Series: Pedagogical Sciences 33 (2023) 283–317. doi:10.32453/pedzbirnyk.v33i2.1380.