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DIGITAL COMPETENCE DEVELOPMENT IN HIGHER EDUCATION: PREPARING FUTURE SPECIALISTS IN PHYSICAL EDUCATION AND SPORTS

DESARROLLO DE LA COMPETENCIA DIGITAL EN LA EDUCACIÓN SUPERIOR: PREPARANDO A FUTUROS ESPECIALISTAS EN EDUCACIÓN FÍSICA Y DEPORTE

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ABSTRACT:

The article examines the digital competence of future physical education and sports specialists. The process of control through the active use of digital technologies in physical education and sports classes is presented. Ways of implementing artificial intelligence (AI) tools to develop digital competence in higher education for future physical education and sports specialists are described. During the experiment, the average growth coefficient was used to quantitatively assess the dynamics of results for individual indicators in the experimental and control groups, foraccounting the results at each level of digital competence development. At the final stage of the formative experiment, the final cut-off indicators revealed the highest positive growth in the EG by all criteria for the formation of digital competence. In the control group, there were no significant changes in the indicators' dynamics. The results obtained allowed us to conclude the pedagogical feasibility of the developed system and the identified pedagogical conditions for the outlined problem. To assess the effectiveness of the proposed pedagogical conditions, we used expert assessments. The correctness of the formulated hypothesis (we confirm hypothesis H_1) and the reliability of the obtained results were established by developing and implementing effective pedagogical conditions and experimental methods, and by conducting statistical analyses using the Wilcoxon-Mann-Whitney and Kramer-Welch criteria.

Keywords:

Digital competence, Future specialists, Artificial intelligence, Digital technologies, Higher education.

RESUMEN:

El artículo examina la competencia digital de los futuros especialistas en educación física y deportes. Se presenta el proceso de control mediante el uso activo de tecnologías digitales en las clases de educación física y deportes. Se describen las formas de implementar herramientas de inteligencia artificial (IA) para desarrollar la competencia digital en la educación superior para futuros especialistas en educación física y deportes. Durante el experimento,

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el coeficiente de crecimiento promedio se utilizó para evaluar cuantitativamente la dinámica de los resultados para los indicadores individuales en los grupos experimental y de control, para contabilizar los resultados en cada nivel de desarrollo de la competencia digital. En la etapa final del experimento formativo, los indicadores de corte finales revelaron el mayor crecimiento positivo en el GE según todos los criterios para la formación de la competencia digital. En el grupo de control, no hubo cambios significativos en la dinámica de los indicadores. Los resultados obtenidos nos permitieron concluir la viabilidad pedagógica del sistema desarrollado y las condiciones pedagógicas identificadas para el problema planteado. Para evaluar la efectividad de las condiciones pedagógicas propuestas, utilizamos evaluaciones de expertos. La exactitud de la hipótesis formulada (confirmamos la hipótesis H_1) y la fiabilidad de los resultados obtenidos se establecieron mediante el desarrollo e implementación de condiciones pedagógicas efectivas y métodos experimentales, y mediante la realización de análisis estadísticos utilizando los criterios de Wilcoxon-Mann-Whitney y Kramer-Welch.

Palabras clave:

Competencia digital, Futuros especialistas, Inteligencia artificial, Tecnologías digitales, Educación superior.

INTRODUCTION

Particularly acute in the context of today are the questions regarding the level of digital competence of student youth and their level of preparedness of physical culture and sports specialists to use digital tools in their professional activities, since the readiness of future physical culture and sports specialists to use digital tools and technologies is an important indicator for high-quality modern education. The degree of implementation of digital technologies in education largely reflects the scale and depth of society's informatization. This process is comprehensive in relation to the education system. Therefore, the implementation of digital technologies in the educational process helps fulfill the tasks facing the world's education system. Therefore, today's higher education applicants need to form digital competencies, in particular, future physical culture and sports specialists.

Currently, teaching at all levels in higher education institutions involves the use of the latest digital technologies and the appropriate methodology for their application, which requires powerful technical support. Modern digital technologies and equipment, software products, global networks, artificial intelligence, etc., create a new learning and working environment for teachers and students, significantly complementing the capabilities of pre-digital, traditional learning. Successful organization of the educational process in such circumstances requires educational personnel to implement and search for new methods, forms, and teaching aids, which leads to digital changes in practice, methodology, and theory of the educational process in general and in the training of future specialists in physical culture and sports, in particular.

Literature review

The current direction of modern educational activity is the development of digital competence across humanity, and in particular among higher education applicants. Therefore, scientists pay great attention to the outlined issue. Thus, Scheel et al. (2022) define digital competence as a key component of lifelong education that contributes to the development of digital skills and professional competence, ensuring the effective use of digital technologies in the educational process. Scientists emphasize the need to develop educational strategies to build digital competence among higher education students and to adapt educational programs to modern challenges and societal needs

Attila & László (2023) investigate the use of ICT tools in physical education, highlighting both challenges and opportunities for teachers and sports educators. Their study reveals that while teachers recognize the potential of digital tools, actual integration into lessons remains limited. The authors emphasize the need for methodological training and adoption of digital best practices to enhance the quality and effectiveness of physical education through ICT.

Zhao et al. (2021) identify digital competence of physical education and sports specialists as an important aspect of professional education, particularly in the context of developing information and communication skills, and emphasize the importance of personal factors and students' perception of digital competence as a criterion for their professional training.

Wallace et al. (2023) examine teacher digital competency in physical education, highlighting its critical role in integrating digital technology into lessons. The study finds that teachers perceive their competency as low, influenced by both personal and school-level barriers. The authors argue for a more nuanced understanding of the interplay between pedagogy and technology, beyond conventional digital competence frameworks.

Maksimovic & Lazic (2023) highlight that effective use of digital tools requires specific competencies, which can be developed through both formal and informal professional training. The research underscores the need to enhance

teachers' digital skills to confidently and purposefully implement technology in physical education.

Dang et al. (2024) analyze the tools and principles that ensure digital competence and support its effective development, in particular the use of digital resources and platforms to support the educational process. The scientists identified a lack of understanding of digital competence and its development opportunities in the LMS environment during the learning process; they emphasized the need to develop digital competence in both students and teachers, which is very important for the successful implementation of e-learning in higher education. Several important issues remain unresolved, despite existing research on the digital competence of higher education students. In particular, the system for developing digital competence among future specialists in physical culture and sports in higher education has not been sufficiently studied.

Purpose of the article. To develop and investigate the effectiveness of the system and pedagogical conditions for forming digital competence of future specialists in physical culture and sports in higher education

METHODOLOGY

To achieve the stated goal of the study, the following research methods were used: theoretical analysis and generalization of research and literary sources to compare different approaches to the problem under study, comparison; analysis of the training of higher education students in the specialty of Physical Culture and Sports, study of leading pedagogical experience in order to clarify the problem and its degree of development; empirical: surveys, observations, conversations, questionnaires in order to identify the features of the formation of digital competence in the higher education system; pedagogical experiment in order to obtain estimates of the effectiveness of the implementation of pedagogical conditions for the formation of digital competence; methods of mathematical statistics (Cramer-Welch criterion, Wilcoxon-Mann-Whitney criterion, descriptive statistics indicators) in order to confirm the reproducibility of the experimental study, in particular, its obtained results.

The purpose of the experimental research is to verify the effectiveness of the system and the pedagogical conditions for the formation of digital competence among future specialists in physical culture and sports in higher education.

In the study, a technology for the formation of digital competence in future specialists during professional training was developed to determine the criteria (motivational-value, cognitive, and activity) revealed through indicators (qualitative characteristics).

The corresponding levels of formation of digital competence of future specialists in physical culture and sports in higher education were determined: creative (high), productive (average), and basic (low).

The study took place in four stages (2022 – 2025): the preparatory stage, the ascertaining stage, the formative stage, and the generalizing stage.

The conducted ascertainment section allowed us to determine the control group and the experimental group of the study and obtain the initial results of the distribution of respondents in the experimental group and the control group according to the criteria of formation (motivational-value, cognitive, activity criteria) of the digital competence of future physical culture and sports specialists.

The dynamics of the determined indicators according to the criteria are described as creative (high), productive (average), and basic (low).

During the experiment, the statistical coefficient of average growth (G) was used to quantitatively assess the dynamics of individual indicators in both the experimental and control groups, foraccounting the results at each level of digital competence development. The formative stage of the experiment aimed to develop digital competence by increasing the role of practical skills and abilities of future physical culture and sports specialists, mastering digital activity methods and their application in real conditions, developing a digital activity strategy, and integrating practical experience. For this process, a system of innovative student training and pedagogical conditions for the development of digital competence during the professional training of physical culture and sports specialists has been developed.

When conducting a formative experiment, we, together with teachers and scientific and pedagogical staff, created a digital educational environment of a modern university space to develop digital competence during the period of study for future physical culture and sports specialists.

At the final (generalizing) stage of the formative experiment, the indicators of the final cut revealed the highest positive increase according to the motivational-value criterion for the formation of digital competence; the activity criterion showed a high, positive dynamics in the growth of the formation of digital competence. We also observe positive dynamics in the cognitive criterion indicators.

In the control group, no significant changes in the indicators' dynamics were observed.

The results obtained allowed us to conclude the pedagogical feasibility of the developed system and the identified pedagogical conditions for the formation of digital competence among future physical culture and sports specialists in higher education.

To determine the effectiveness of the proposed pedagogical conditions for the formation of digital competence among future physical education and sports specialists in higher education, we used expert assessments, the purpose of which was to obtain the necessary information for further research, experimental, and theoretical work on the problem.

The correctness of the formulated hypothesis (we confirm hypothesis H1) and the reliability of the obtained results are supported by developing and implementing the pedagogical conditions and experimental methods proposed in an effective, innovative educational system, and by statistical calculations using the Wilcoxon-Mann-Whitney and Kramer-Welch criteria. The results of the completed experimental work confirm that the study's goal has been achieved.

RESULTS AND DISCUSSION

The content of digital competence of future physical education and sports specialists. The process of control through the active use of digital technologies in physical education and sports classes.

The modern digital society dictates new rules of life, according to which digital technologies, the Internet, and social networks have become integral parts of our lives. It is they who, in promoting a healthy lifestyle, introduce people to sports news, various types of fitness programs, are the leading sources when it is necessary to engage in physical exercises, offer videos on the latest sports, where physical education and sports specialists prove the skill of performing motor actions, etc. The physical perfection of each person should be the basis of a full, normal life, the result of good health, determined by good posture, the ability to control one's body, coordinated movements, which depend on proper physical education. (Knysh et al., 2026).

The use of digital technologies in physical education depends on future physical education and sports specialists, their desire to develop digital competence, and their professionalism in professional activities.

Increasing the qualitative indicator of the qualification readiness of physical education and sports specialists during the educational process, and enhancing their methodological, didactic, and technological capabilities, is possible through the active use of digital technologies. The inclusion of modern digital technologies, in accordance with the current level of societal development, involves a stepwise transition to business models, digital technologies in management and production, and the digital transformation (absolute and primary) of the functioning base of applicants and teachers. It is necessary to adhere to a similar approach when understanding the digital process of the educational part of the transformation as a complex transformation of the training process, the components of which are teaching methods, means, radical changes in the professional model of training specialists through the active use of digital technologies, and approaches to assessing student activity, etc. (Garduño-Durán et al., 2025).

Let us consider the importance of the process of controlling students' educational activity through the active use of digital technologies in physical education and sports classes, where physical culture serves as a potential for individual health and its unique means. Physical activity increases a person's working capacity and relieves stress; therefore, it is an important condition for the normal development of an individual. Increasing students' physical fitness through systematic sports activities and physical education methods is influenced by many factors, among which control plays an important role (Mulato et al., 2024). Due to the active use of digital technologies, the process of controlling students in physical education and sports classes is being improved, with the fundamental component of managing a student's physical fitness being positioned. To increase the efficiency of managing such a process, it is necessary to have full information on physical training, including the dynamics of changes in its indicators of psycho-emotional and physical state, which will be obtained after conducting a test control. Therefore, for high achievements in sports activities and effective implementation of the target orientation of physical education, it is necessary to form an effective control system, because this involves conducting motor fitness of students, classification of the state of functional fitness, which creates the basis for making final decisions on the use of digitalization technologies to manage the process of physical training (Zasiekina et al., 2025).

Introduction of artificial intelligence (AI) tools in the formation of digital competence in future physical education and sports specialists in higher education.

The strategy for developing students' digital competence in higher education is necessarily associated with the intensive introduction of artificial intelligence (AI) tools into the educational process. For the development of digital competence in higher education, the interactivity of AI tools has significant potential, given their high communicative capacity. The use of artificial intelligence for tutoring in higher education is one of the main directions for introducing such tools into education. Developing programs to

foster digital competence in higher education enables the expansion of AI tool customization. It is the development of digital competence that allows educational technologies to be kept on the trajectory of development of modern digital tools through the use of AI, which contributes to the modernization of the educational process, taking into account the phenomenon of mass AI, which is associated with the integration of digital technologies into all components of the educational process. Therefore, it constitutes a separate direction for mastering AI tools in developing students' digital competence in higher education (Mytnyk et al., 2024).

The continuous development of digital applications forces everyone to adapt to technological changes in the formation of digital competence in higher education, especially in the educational space of training future specialists in physical culture and sports. There is a rather thin line between ethical norms and creative use of software, although artificial intelligence is cognitive. A significant number of countries are developing regulations in education to govern the use of such innovative technologies (Perea & Abello, 2022).

In China, unique devices are created based on digital programs; devices that allow tracking students' brain activity during classes are actively used, equipped with elements of artificial intelligence. Such an unusual method of thinking allows the teacher to pay more attention to lagging students and learn their real professional knowledge, which rationalizes work (Xue & Li, 2024).

In our opinion, the use of electronic resources and artificial intelligence shows the teacher's ability to adapt to the challenges of modernity, and not only facilitates their work.

The implementation of technological achievements in society has positive consequences. A current problem is the balanced regulation of the automation of educational processes.

Special emphasis is placed on developing students' interest in science and on fostering their interest in symbiosis with digital skills.

A key characteristic of artificial intelligence systems is their ability to draw logical conclusions from observations that go beyond basic data processing. This primarily concerns the process of obtaining output data (content, forecasts, decisions, derive, or recommendations that can affect the virtual and physical environment), as well as the ability of artificial intelligence systems to obtain algorithms or models from data or input data (Roche & Hagin, 2025).

An AI system is a machine that makes inferences from input data to generate results that can affect a virtual or physical environment. Different AI systems differ in their levels of adaptability (the ability to adapt to the environment and be flexible) and autonomy (the ability to operate without human intervention) after deployment (Cojocaru et al., 2022).

In general, the emergence and active use of artificial intelligence in everyday life have made it an indispensable assistant, as the amount of information grows exponentially. Software virtualization is constantly being updated, enabling rapid development of models and adoption of more modern technologies (Polishchuk et al., 2022).

Experimental verification of the effectiveness of the system and pedagogical conditions for the formation of digital competence in the process of professional training of physical culture and sports specialists.

In the development of modern pedagogical science, the leading vector of society is the formation of specialists, oriented towards achieving professional success and competence.

The purpose of the experimental research is to verify the effectiveness of the system and the pedagogical conditions for the formation of digital competence among future physical culture and sports specialists in higher education. Within the framework of the specified study, to identify the effectiveness and efficiency of the proposed integration-functional system and pedagogical conditions for the formation of digital competence of specialists, it is necessary to carry out a level differentiation of higher education applicants.

In the study, a technology for the formation of digital competence of future specialists during professional training was developed, which is revealed through indicators (qualitative characteristics).

The motivational-value criterion takes into account and reflects the interest in digital activities of future specialists in physical culture and sports in higher education, the orientation towards achieving results of digital activities, and the manifestation of initiative.

The cognitive criterion reflects the identification of the system of digital knowledge for future specialists in physical culture and sports: the definition, feasibility, and significance of digitalization in higher education, the specifics of sports, health, and recreation projects using digitalization, and the requirements for digitalization.

The activity criterion assesses the degree of processing and analytical processing of information through digitalization; mastery of various search methods; readiness for objective assessment of intermediate and final results of digitalization; and operation with the basics of digital elements in the professional sphere.

The corresponding levels of formation of digital competence of future specialists in physical culture and sports in higher education are determined: creative (high), productive (average), and basic (low).

The study took place in four stages (2022 – 2025): the preparatory stage, the ascertaining stage, the formative stage, and the generalizing stage.

The ascertaining section allowed us to determine the control group and the experimental group of the study and obtain the initial results of the distribution of respondents in the experimental group and the control group according to the criteria for the formation (motivational-value, cognitive, activity criteria) of the digital competence of future physical culture and sports specialists (in %) (Table 1).

Table 1: Initial results of the distribution of applicants in the experimental group and the control group according to the criteria for the formation of the digital competence of future physical culture and sports specialists (in %), establishment stage

Criterion	Basic (low) level, %		Productive (average) level, %		Creative (high) level, %	
	CG	EG	CG	EG	CG	EG
Motivational-value	39,8	39,7	45,5	45,8	14,7	14,5
Cognitive	43,3	43,2	43,5	43,5	13,2	13,3
Active	40,1	40,2	37,8	37,9	22,1	21,9

The results of the ascertaining section showed that the experimental and control groups were evenly distributed to ensure the reliability of the data, which indicated insufficient formation of the phenomenon under study. Thus, the results of the diagnostic section of the ascertaining experiment on the formation of digital competence of future specialists in physical culture and sports showed the predominance of the basic (low) and productive (average) levels across all criteria (most of their indicators).

Analysis of the results of the experiment on the formation of digital competence in the process of professional training of specialists in physical culture and sports. The state of formation of digital competence of applicants in the control and experimental groups was assessed by the criteria and indicators:

The motivational-value criterion takes into account the indicators (interest in the digital activities of future specialists in physical culture and sports in higher education, the orientation of education to obtain the results of digital activity, and the manifestation of initiative).

The cognitive criterion has indicators, including the formation of the digital knowledge system for future physical culture and sports specialists (definition, feasibility, significance of digitalization in higher education, specificity of sports and recreation projects using digitalization, requirements for digitalization).

The activity criterion has indicators (assessment of the degree of processing and analytical processing of information through digitalization; mastery of various search methods; readiness for objective assessment of intermediate and final results of digitalization; operation of the basics of digital elements in the professional sphere).

The dynamics of the determined indicators are described as creative (high), productive (average), and basic (low) levels.

The experimental verification of the proposed system and pedagogical conditions took place in stages that corresponded to the specified stages of digital competence development during the professional training of physical culture and sports specialists.

During the experiment, the average growth coefficient (G) was used to quantitatively assess the dynamics of results for individual indicators in the experimental and control groups, accounting for outcomes at each level of digital competence development. The coefficient was calculated using the following formula 1:

$$G = \frac{A_1 + 2A_2 + 3A_3}{4} \quad (1)$$

where G is the average growth coefficient of digital competence indicators (n);

A_1 is the increase at the basic (low) level of digital competence development in the group.

A_2 is the increase at the productive (average) level of digital competence development in the group.

A_3 is the increase at the creative (high) level of digital competence development in the group.

The formative stage of the experiment aimed to develop digital competence by increasing the role of practical, skills-based abilities of future specialists in physical culture and sports and by mastering the methods of digital activity and their application in real conditions; by forming a strategy of digital activity and integrating practical experience. For this process, a system of innovative student training and pedagogical conditions for the development of digital competence during the professional training of specialists in physical culture and sports was developed.

The digitalization of the modern educational process of training future specialists in physical culture and sports necessitates the development of a new system of physical training that includes pedagogical conditions and is based on the interdisciplinary integration of digital resources and the use of various professional methods. Therefore, we developed such a system, pedagogical conditions, and conducted it in the EG during the research process.

A promising direction for the training of future specialists in physical culture and sports was the practical implementation and development of highly effective, new, digital technologies, methods, and tools, and the management of this process. The growing importance of the scientific component in the field of theory and methods of physical education has led to the development of new control methods to maximize results and minimize time consumption. The main task of the teacher in such an educational process is to create comfortable conditions for the training of future specialists in physical education and sports, particularly for the acquisition of practical knowledge. EG, students chose teaching methods that enabled each student to increase cognitive and motor activity and to show their activity and ingenuity. That is why, under the conditions of using the latest digital technologies and updated physical education classes, it is possible to develop students' digital competence within such an education system, enabling them to acquire the knowledge base they will need in their future lives.

At the same time, the teacher ensured that the educational process did not adversely affect the student's health. Important here were health-preserving technologies that ensured the production of the necessary knowledge, skills, and abilities for the development of motor abilities and for leading a healthy lifestyle by introducing an adequate amount of motor activity in the university environment, through sections on various sports, physical education classes, and outdoor games.

A characteristic feature of the training of future specialists in physical culture and sports is that students have physical education classes, which are mainly held in sports halls or on open areas. However, modern trends in digital education could not fail to affect future specialists in physical culture and sports and their training, which were not previously inherent to the physical culture sector. Therefore, the higher school is responsible for modernizing the professional training of future specialists in physical culture and sports, ensuring content and qualification levels are aligned with the needs of the modern labor market.

Therefore, we have selected digital resources for EG students, whose use was of great importance in the educational process of training future specialists in physical culture and sports.

These include, in particular, the following:

- Web servers for creating educational games, interactive tests, discussions, quizzes, surveys: StudyStack, LearningApps, EDpuzzle, Quizziz, Quizalize, Triventy, Google From, Plickers, ClassMarker, Mentimeter.
- Application programs (cloud technology tools, web browsers, MS Word, MS Excel, MS PowerPoint), for modeling tactical actions and the pedagogical process, computer competitions; creation and use of databases.
- Online platforms (Prometheus, Educational Era, LearningApps.org) for students to complete non-formal education, use information technologies to service competitions.
- Means of electronic communication, synchronous (messengers, chats, video conferences) and asynchronous (forums, e-mail, social networks) (Google Meet, Zoom, ClassDojo, Google Classroom, Viber, Instagram, Skype, Facebook, Telegram, and others).
- Complex computer complexes-simulators and video analysis systems of movements for recording and tracking movements (Expert Vision Analysis, Motion Analysis Corp, Vicon, Oxford Metrics; CODA, Charnwood Dynamics, BioVideo, Kinovea).
- Software (mobile) applications: daily activity (number of steps, speed, etc.); physical condition ("Digifit iCardio", "Google fit", "Heart Graph", "Breathe", "BackExercises"); water balance of the body (Waterbalance, Watercheck, Water Your Body); body weight, balanced diet (Lifesum, Fatsecret, Myfitnesspal, Yazio Calorie Counter, LoseIt, Eat Slower).
- Web servers for creating interactive infographics and video scribing (Powtoon.com, PearDeck, Sparkol Video Scribe, Nearpod.

- Web servers for creating mental maps, memory cards (Mindomo, Mindmeister, Spiderscribe).

Although there is now significant interest in the use and development of digital programs in the educational and training process for future specialists in physical culture and sports, the issues of their implementation and development remain problematic. This is due to the state of development of digital technologies, which brings the education system in line with the needs of scientific and technological progress and the times. Therefore, we at the EG used ICT tools to solve a wide variety of tasks: reporting and monitoring the progress of knowledge acquisition, demonstrating in dynamics and in statics illustrative material comparing the biomechanical characteristics of the student's reference motor action; creating control and training programs, qualification works, modeling the educational and training and pedagogical process, etc.

In the EG, the specificity of educational technologies for learning, built on digitalization, provided for the use of new types of didactic materials, software, and methodological support for classes, as well as modern computer classes with digital programs. New approaches to the professional and pedagogical training of EG students accompanied all this.

In particular, EG students:

- See and experience for themselves the advantages of new digital learning technologies in the process of conducting educational and training classes. For this purpose, a bank of relevant didactic materials and qualified specialists was created to create digital materials and use them in the educational process.
- In the process of professional training, such tasks were set so that, during their solution, EG students could get a direct idea of the main directions in the educational and training process of digital technologies, develop digital tools, and use them in the cycle of sports and pedagogical disciplines.
- Certain changes were made to all components of the educational process of EG students: goals, content, digital technologies, and physical education. Mastering modern digital technologies has become a key component of the professional training of future specialists in physical culture and sports, requiring the introduction and development of digital programs and courses into the educational process of higher physical education, aimed at mastering the basics of digital knowledge and its use in professional activities.

The development of a digital learning system in the conditions of digitalization of education in sports and pedagogical disciplines in the EG is associated with the following factors:

- Increasing motivation to study modern digital technologies of future specialists in physical culture and sports to form their digital competence for future professional activities.
- Changing the needs of society in the field of digitalization, regardless of specific specialties.
- Increasing the digitalization of the entire educational process in universities and faculties of physical culture, improving the educational process in sports and pedagogical disciplines.
- Increasing the requirements for the level of digital training of specialists in the field of physical culture and sports.

In the system of work in the EG, students will be offered, to improve the quality of the educational and training process, using digital technologies, the following tasks:

- To exchange progress and scientific and practical information, and to create Internet sites for sports departments.
- Based on an assessment of physical fitness and health, create a card file for each applicant's academic group, including initial data.
- Based on current data, track health dynamics once a semester.
- Develop individual programs for self-training, nutrition, rest, and study regimens.
- Select an individual program for each applicant, designed for individual or corrective programs, for the entire course of study.
- Taking into account the specifics of future professional activities, prepare digital training programs for senior applicants.
- Test the level of knowledge using digital technologies.
- Monitor the psycho-emotional state of higher education applicants and conduct medical operational monitoring of students studying under a special program.

During the formative experiment, we, together with teachers and scientific and pedagogical workers, created a digital educational environment of a modern university space that will form digital competence during the period of study of future specialists in physical culture and sports, which involves planning and sustainable development – from the development of curricula that are directly aimed at building a digital educational space and developing digital competence of future specialists in physical culture and sports, including the modernization of equipment, its acquisition and preparation of recommendations for working in such an environment, as well as the formation of digital competence in specialists in this area. This strategy is key, and its essence lies in the need to use

effective, scientifically sound digital tools in the educational process and to adapt to rapid technological change. Thus, the creation of an educational digital environment will entail the specification of the formation of digital competence of future specialists in physical culture and sports in the EG at different stages of training.

Digital technologies in the formation of digital competence were one of the key factors, contributed to the effective processing of educational material by students, determined the degree of their success in performing professional tasks, contributed to the formation of autonomy in students in learning, which is a basic prerequisite at the current stage of development of professional competence and training of future specialists in physical culture and sports for independent active communication and activity in a modern digital environment. In the EG, modern digital technologies were introduced into higher educational institutions, which are extremely important for implementing a comprehensive reorganization of the educational process, including updating work and curricula, improving teachers' digital literacy, and ensuring appropriate technical support for universities. In the EG, online platforms provided classes, facilitated the exchange of educational materials, and improved the organization of student knowledge assessment. Digital educational tools and resources helped EG students create a favorable digital learning environment, making the educational process more attractive and effective. Digital educational tools and resources provided educational institutions with greater flexibility in accordance with each student's individual needs when setting up educational programs.

In particular, we identified pedagogical conditions for the formation of project competence (forming positive motivation to use digital activities of physical culture and sports specialists as a way of professional growth; professionally oriented design of the digital educational environment of the modern university space; implementation of interdisciplinary and transdisciplinary integration in the process of using a new type of didactic materials, software and methodological support for classes, the presence of modern computer classes with digital programs to form digital competence of future physical culture and sports specialists).

The digital orientation of activities within the framework of the formation of digital competence in the process of professional training of physical culture and sports specialists of the EG covered all forms of work: practical, seminar, test work, performance of laboratory, and independent tasks that contain elements of digitalization related to research issues; writing essays on a specific topic in the process of solving atypical research tasks, studying specialization courses, professional disciplines, electives, individual tasks.

In the process of developing digital competence of future physical culture and sports specialists, the final (generalizing) stage of the formative experiment involved analyzing the formation of the use of various forms and methods of digital activity; determining the degree of students' mastery of digital technologies for managing health, recreation, and physical culture and sports projects; assessing students' skills and abilities to make adjustments to the educational and training process and formulate substantiated conclusions taking into account the obtained practically digital results (Table 2).

Table 2: Dynamics of digital competence levels (results before and after the experiment) of future physical culture and sports specialists (in %) at the final stage of the formative experiment

Criterion		Basic (low) level, %		Productive (average) level, %		Creative (high) level, %	
		EG	CG	EG	CG	EG	CG
Motivational-value	Before the experiment	39,8	39,7	45,5	45,8	14,7	14,5
	After the experiment	38,1	7,0	46,9	43,9	15,0	49,1
Cognitive	Before the experiment	43,3	43,2	43,5	43,5	13,2	13,3
	After the experiment	40,2	15,8	44,9	37,1	14,9	47,1
Active	Before the experiment	40,1	40,2	37,8	37,9	22,1	21,9
	After the experiment	35,9	9,3	35,9	22,9	28,2	67,8

At the final (generalizing) stage of the formative experiment, the final cut indicators revealed the highest positive growth in the motivational-value criterion of the formation of digital competence; the activity criterion showed a high, positive dynamics in the growth of the formation of digital competence. We also see positive dynamics in the cognitive criterion indicators.

In the control group, no significant changes in indicator dynamics were observed.

The formula 2 determined the empirical value of the Wilcoxon-Mann-Whitney criterion:

$$W_{emp} = \frac{\left|\frac{N \cdot M}{2} - U\right|}{\sqrt{\frac{N \cdot M \cdot (N + M + 1)}{12}}} \quad (2)$$

The formula 3 for determining the reliability of the experimental results according to the Cramer-Welch criterion was used:

$$T_{emp} = \frac{\sqrt{M \cdot N}\,|\bar{x} - \bar{y}|}{\sqrt{M \cdot D_x + N \cdot D_y}} \quad (3)$$

The results obtained allowed us to conclude the pedagogical feasibility of the developed system and the identified pedagogical conditions for the formation of digital competence among future specialists in physical culture and sports in higher education.

To determine the effectiveness of the proposed pedagogical conditions for the formation of digital competence among future specialists in physical culture and sports in higher education, we used expert assessments to obtain the necessary information for further experimental and theoretical work on the problem.

The correctness of the formulated hypothesis (we confirm hypothesis H1) and the reliability of the obtained results were established by developing and implementing the pedagogical conditions and experimental methods proposed in an innovative, effective educational system, and by statistical calculations using the Wilcoxon-Mann-Whitney and Kramer-Welch criteria. The results of the completed experimental work confirm that the study's goal has been achieved.

CONCLUSION

The digital competence of future specialists in physical culture and sports was considered. The process of control through the active use of digital technologies in physical education and sports classes is presented. The ways of implementing artificial intelligence (AI) tools to develop digital competence in higher education among future physical education and sports specialists are described. The key characteristics of artificial intelligence systems and their capabilities for training future physical education and sports specialists are described.

The purpose of the experimental research is to verify the effectiveness of the system and the pedagogical conditions for the formation of digital competence among future physical education and sports specialists in higher education.

The conducted ascertainment section allowed us to determine the control group and the experimental group of the study and obtain the initial results of the distribution of respondents in the experimental group and the control group according to the criteria of formation (motivational-value, cognitive, activity criteria) of digital competence of future physical education and sports specialists. The dynamics of the determined indicators are described as creative (high), productive (average), and basic (low) according to the criteria.

During the experiment, the statistical coefficient of average growth (G) was used to quantitatively assess the dynamics of individual indicators in both the experimental and control groups, foraccounting the results at each level of digital competence development. The formative stage of the experiment aimed to develop digital competence by increasing the role of practical, skills-based abilities of future specialists in physical culture and sports and by mastering the methods of digital activity and their application in real conditions; by forming a strategy of digital activity and integrating practical experience. For this process, a system of innovative student training and pedagogical conditions for developing digital competence during the professional training of specialists in physical culture and sports was developed. During the formative experiment, we, together with teachers and scientific and pedagogical staff, created a digital educational environment of a modern university space to develop digital competence during the training period for future specialists in physical culture and sports.

At the final (generalizing) stage of the formative experiment, the cut-off indicators revealed the highest positive growth in the motivational-value criterion of digital competence formation; the activity criterion showed a high, positive growth dynamics in the formation of digital competence. We also see positive dynamics in the cognitive criterion indicators. In the control group, no significant changes in indicator dynamics were observed.

The results obtained allowed us to conclude the pedagogical feasibility of the developed system and the identified pedagogical conditions for the formation of digital competence among future specialists in physical culture and sports in higher education.

To determine the effectiveness of the proposed pedagogical conditions for the development of digital competence among future specialists in physical culture and sports in higher education, we used expert assessments to obtain the necessary information for further experimental and

theoretical work on the problem. The correctness of the formulated hypothesis (we confirm hypothesis H1) and the reliability of the obtained results are supported by developing and implementing the pedagogical conditions and experimental methods proposed in an effective, innovative educational system, and by statistical calculations using the Wilcoxon-Mann-Whitney and Kramer-Welch criteria. The results of the completed experimental work confirm that the study's goal has been achieved.

The research we conducted does not claim to fully address the outlined problem of forming digital competence in future specialists of the outlined profile. Therefore, further research is required to examine the theoretical and methodological foundations for building a system for a health-saving environment in higher education based on students' developed digital competence.

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CONFLICT OF INTEREST:

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Autor	Roles
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Maya Zubal	Formal Analysis, Conceptualization, Validation
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