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Research paper

Digital Technologies as A Tool for Developing Health Preserving Competence in Future Educators

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Abstract

The article considers the theoretical principles of health preservation and the development of health-preserving competence in future educators using digital technologies. The main elements of the innovative digital space are highlighted, and the conditions (organisational-pedagogical, psychological-pedagogical, information-methodical, technological, socio-cultural) that contribute to the effective development of health-preserving competence in future educators using digital technologies are revealed. The main stages in the development of health-preserving competence are discussed, and a general scheme for its development in future educators using digital technologies is presented. An organized experimental work was carried out to form health-preserving competence in future educators using digital technologies, because the ascertaining stage of the study showed the advantage of low and medium levels of developing of health-preserving competence, which actu-alized the need to introduce pedagogical conditions that will contribute to increasing the level of developing of health-preserving competence of students in the process of their professional training using digital technologies. At the stage of implementing pedagogical conditions during the experiment, the number of respondents with a high level of development of health-preserving competence significantly increased. In contrast, those with a low level significantly decreased. This allows us to assess the success of our work on developing health-preserving competence using digital technologies.

Keywords: *Health-Preserving Competence; Future Educators; Digital Technologies; Innovative and Digital Space; Stages of Formation of Health-Preserving Competence.*

1. Introduction

Nowadays, the development of health-preserving ability in future educators using digital technologies is a key priority of the state and an urgent need of modern society, which is caused by the conditions of an increase in diseases in the world, the growth of psycho-emotional and physical stress, stressful experiences, and global trends that affect modern education.

The issue of health preservation has become quite relevant today due to the radical changes in society. Effective pedagogical activity aimed at the development of health-preserving competence in future educators using digital technologies and at ensuring a high-quality educational space is possible only when the educator himself, to strengthen and preserve his own and students' mental and physical health, possesses such competence.

Educators and students who are applicants must have practices and knowledge that strengthen and preserve mental and physical health, prevent disease, promote stress resistance, foster social responsibility, and promote cyber hygiene, etc. Educational establishments expression the challenge of making a digital, modern, and innovative space that fosters practical habits that support the creation of a safe educational environment, minimise risks, implement digital and health-saving technologies, carry out educational public activities, and actively use value-based methods, etc. The educational institution should have an “ecological”, innovative, and digital space for health, and health-saving technologies should balance educational goals, innovations, and the prevention of digital risks, and should form in students a culture of caring for their mental state and their own physical condition, rather than simply equipping them with knowledge.

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2. Literature Review

Now, research into augmented and virtual realities is relevant, aimed at finding ways to practice the latest digital technologies to form a person's health-preserving competence.
Klochko et al. [1] proposed a methodology for using augmented reality to develop educators' health-preserving competence. The authors analysed software products that use augmented reality to help form strategies for sports behaviour and simulate real sports situations; they demonstrated that the practice of augmented reality contributes to the technologization, professionalisation, humanisation, and axiology of educators' professional activities, particularly the health-preserving component.
Yevtuch et al. [2] improved the organization for creating health-preserving competence of educators grounded on the practice of virtual and augmented reality skills; presented the software tool "Virtual model, which contributes to the development of skills of fundamentalization of health-preserving knowledge in correctional and developmental and health-preserving work, is necessary for the improvement of physical education and health-improving technologies, and is a factor of health-preserving competence of an educator.
The types of digital technologies that are important when used in professional education are analysed in the work of scientists Wozniak et al. [3]. The authors reveal the role of learning management systems (Moodle, Blackboard); show the importance of massive open online courses (Coursera, edX); the role of blogs, social media (Facebook, LinkedIn, X); show the role of virtual patients, games, augmented reality; reveal the importance of tools for surveys and voting; mobile learning; virtual classrooms, video conferences, webinars; online portfolio in the educational process.
Examples of the use of augmented reality technology in education, particularly in the development of health-preserving competence in future educators, are presented in the work of Geroimenko [4].
Lunevich [5] argued that an innovative partnership of technology and pedagogy is digital pedagogy, which aims to create a new interactive learning experience using various technologies to foster health-saving ability and is not limited to the practice of information technologies for learning and training.
Thus, in analysing scientific thought on the use of digital technologies in teaching and health care, devotion is absorbed on the theoretical basics of the development of health-saving competence among future educators. These studies provide a solid, practical, theoretical, and methodological basis for solving tasks and conducting scientific research. However, insufficient attention is paid to the challenges of developing health-saving ability using digital technologies among future educators.
Purpose of the study. Development and verification of the effectiveness of pedagogical conditions for the development of health-saving competence in future educators using digital technologies.

3. Methodology

To solve the set goal of the study, a established of study methods was used: theoretical: investigation of pedagogical, psychological, philosophical, socio-pedagogical scientific sources for analyzing the outlined problem; systematization, comparison, synthesis, generalization of scientific and theoretical provisions to clarify the essence of health-preserving competence of future educators, justification of pedagogical conditions in educational activities; generalization of research in order to determine the levels and develop criteria, indicators of the developing of health-preserving competence of future educators; empirical: questionnaires, observations to clarify the state of developing of health-preserving competence; pedagogical experiment – to identify the dynamics of the levels of developing of health-preserving competence of future educators using digital technologies in the process of professional training, to verify the effectiveness of pedagogical conditions for the developing of health-preserving competence using digital technologies; statistical: to generalize the results of experimental work – methods of mathematical statistics.
Between 2021 and 2024, organised experimental work was conducted to develop health-preserving competence in future educators using digital technologies. The purpose of the experimental work was to evaluate the use of the developed educational settings for fostering health-preserving competence among future educators who use digital technologies.
The learning the development of health-preserving competence through digital technologies among future educators included several stages.
The content of the preparatory stage: clarification in practice and theory of the state of the problem of the development of health-preserving competence in the professional training of future specialists.
Pilot stage: took place at a higher educational establishment without violating the usual situations of the training process for students.
At the indicated stages, the study's experimental basis was resolute, the research program and the study's structure and logic were settled, the study's stages and procedures were clarified, the empirical data were analysed, and statistical processing methods were used.
The experimental stage consisted of the statement stage, the formative stage, and the control stage.
At the statement stage, the selection, application, and development of diagnostic tools were carried out to determine the levels of developing of health-preserving competence of future educators as the selected criteria.
The formative stage included: substantiation of the developed educational circumstances for the development of health-preserving skill using digital technologies for specialists, and their experimental implementation in the educational process; and conducting a cross-sectional study of the equal of the creation of health-preserving competence among future educators.
At the control stage, the dynamics of the development of the outlined competence in students were tracked by comparing indicators obtained at previous stages of the study; control diagnostics of the level of development of health-preserving skills using digital technologies were conducted among future educators.
When analyzing and interpreting the results obtained, an analysis of the use of the implementation of the developed author's educational settings for the creation of health-preserving competence of students was carried out; the statistical significance of changes was checked, and the practical importance of changes in the indicators of the identified ability of future specialists was calculated; the conclusions of the study were formulated.
The determination of quantitative changes obtained at the ascertaining stage and the control stage, the dispensation of the consequences of the experimental work on the levels of developing health-preserving competence of educators, was carried out using Microsoft Office Excel (spreadsheet processor) – a program (programming language R) for working with electronic tables. Statistical methods for analysing the obtained data, used to diagnose the grades of the pedagogical experiment, helped systematise and summarise the experiment's materials and move from qualitative characteristics to their quantitative expressions.
After the operation of the developed, substantiated educational settings for the development of students' health-preserving ability using digital technologies, the statistical significance of the achieved changes was assessed using statistical methods (Wilcoxon-Mann-Whitney and Kruskal-Wallis).

At the ascertaining and control stages of the work, indicators were compared to track the dynamics of the levels of students' development of health-preserving competence.
According to the definite standards and their indicators, the components of the respondents' health-preserving competence were measured at three levels: high, medium, and low.
In the procedure of qualified training, the study of the state (statistical stage) of the developing of the respondents' health-preserving competence as specified criteria and indicators allowed us to conclude that future educators have a low and medium level of creation of health-preserving competence, and a high level of developing of health-preserving competence was found in a small number of future specialists, which highlighted the need to implement pedagogical conditions that will contribute to increasing the level of development of students' health-preserving ability in the process of their professional training.
In the experimental work, the formative stage provided for the outline of the educational development of higher education institutions, of educational conditions for the development of health-preserving competence using digital technologies of future educators in compliance with the principles of benevolent attitude and mutual respect; consistency and systematicity; in the process of personality development, reflective collective interaction.
Positive dynamics were demonstrated by the general grades of the formative stage of the experiment regarding the development of health-saving competence among future specialists using digital technologies.
As can be seen from the data, at the stage of implementing pedagogical conditions during the experiment, the number of respondents with a high level of developing of health-saving competence significantly increased, while those with a low level of developing of health-saving competence significantly decreased.
The presence of positive variations in the undercurrents of the level of creation of health-preserving competence among respondents was confirmed by the results obtained during the control stage of the experiment, which confirms the effectiveness of the implemented pedagogical conditions for the development of health-preserving competence of future educators during professional training.
We used the Cramer-Welch criterion to verify the statistical significance of the achieved changes. A statistical calculation was made on the p-value. The difference between the means is considered too large if the p-value < .05 to be random when the mean values do not differ. Therefore, the null hypothesis of equality of means is contradicted by the data, and we reject it, accepting the alternative that the mean indicators are unequal.
The same hypothesis was tested (for greater confidence) using the nonparametric Wilcoxon-Mann-Whitney test, which does not require normality.
The study showed that across all the health-preserving competence criteria we identified, there are significant statistical differences in the characteristics of the subjects in the experiment, indicating a general increase in the stages of development of health-preserving ability among specialists using digital technologies. This allows us to assess the success of our work in developing health-preserving competence among future educators using digital technologies.
The presence of a significant difference in the subtleties of the creation of health-preserving ability among respondents was confirmed by the results obtained at the stages of the experimental work, indicating the usefulness of the educational conditions developed and implemented in the higher education process.

4. Results and Discussion

4.1. Theoretical principles of health-preserving and the development of health-preserving competence in future educators using digital technologies

Health preservation in teaching means creating conditions that support the harmonious development of participants without harming their health, achieved through the introduction of health-preserving technologies and the creation of a comfortable, safe educational environment. Health preservation is an improvement in the quality of life and the ability of each individual to adapt to the load; it is the creation of conditions for harmonious development, rather than just the prevention of disease. Health preservation is considered an aspect of a preventive strategy, covering all aspects of life to prevent problems. The health preservation culture of educators comprises skills, value orientations, knowledge, and abilities aimed at strengthening and preserving one's own health, as well as fostering a health-preserving environment for students in the educational process. The development of health-preserving competence in future educators using digital technologies is grounded in a set of methodological approaches that provide the conceptual foundations of the educational process. Their effective, planned combination has an impact on the professional development of the individual, helps foster the motivation for a healthy lifestyle, and provides an opportunity to introduce health-saving technologies into future qualified actions [6].
The development of health-saving competence in future educators using digital technologies is one of the leading tasks of higher education institutions.
The significance of updating innovative modern processes of professional training for highly qualified educators capable of experienced, practical self-realisation, and of implementing (in a safe educational environment) health-saving technologies is heightened by the European integration vectors of changing the educational paradigm.
We consider health-saving competence separately within the entire spectrum of specialized and overall abilities of an educator, since in the modern world, the most critical vector for a person is changes in the world's value orientations regarding health and life.
According to the recommendations of the European Commission, the key competences of an individual include social, personal, and learning competences, including emotional well-being, the ability to maintain one's own physical and mental health, and the ability to lead a healthy lifestyle [7]. The source of an educator's health-preserving competence is formed by such abilities, supplemented by the skills to foster appropriate abilities in students and to care for their health.
The problem of rising health-preserving ability in educators through digital technologies, which is key to our study, was addressed at two levels: theoretical and experimental.
We consider the creation of health-preserving ability in future educators by means of digital skills as:

- A system of educational influences that provide for updating the content of academic disciplines, the use of innovative digital technologies to strengthen the health-preserving component in the content of education; in the process of professional training of students, the educational process of higher education is carried out through the academic and educational activities of students, aimed at forming in students value orientations and needs for health preservation; a system of motivation for health-preserving activities and a healthy lifestyle; ensuring the mastery of knowledge and practice in the field of health preservation; acquisition of sustainable expertise (related to personal health) on individual topics.

- developing of abilities to use digital technologies, cognitive skills to deepen and obtain knowledge on health-preserving problems; taking care of one's own health; conducting primary diagnostics and skills and preventive and educational work with education seekers; leading a healthy lifestyle; transferring experience of leading a healthy lifestyle; reflecting on one's own health-preserving activities for further professional practical activities [8].

4.2. The main elements of the innovative digital space

Let us highlight the main elements of the innovative digital space aimed at forming health-preserving competence in future educators using digital technologies:

- Support of a healthy environment and digital communication (virtual healthy lifestyle clubs, discussion of health-preserving practices, implementation of platforms for social interaction, marathons and online challenges, digital time management for load balancing, use of social networks, forums, messengers for educational purposes, virtual conferences and cloud technologies; international projects for joint work on tasks, etc.).
- Digital educational infrastructure for health-preserving (webinars, podcasts, online courses, lectures on valeological topics; virtual simulators, virtual laboratories, online learning platforms (Google Classroom, Moodle, etc.), simulation programs, electronic libraries, repositories, and scientific databases with materials on health-preserving technologies, etc.).
- Interactive educational environment (VR/AR technologies, interactive maps of healthy routes, gamification of learning, use of artificial intelligence and big data (Big Data), etc.).
- Psycho-emotional comfort and digital security (platforms for stress prevention, cyber hygiene and information security, digital assessment systems, burnout and psycho-emotional exhaustion, etc.).
- Smart technologies for health support and monitoring (mobile applications, fitness trackers, virtual psychological consultations, online platforms for self-diagnosis of health, support hotlines, etc.) [9].

4.3. The main stages of the development of health-preserving competence in future educators using digital technologies

Let's discuss the key steps of the development of health-preserving ability. The practice is structured in a precise, logical sequence that corresponds to the general scheme for the development of any competence.
Let's present the general scheme for developing health-preserving competence in future educators through digital technologies.

1) Readiness to demonstrate competence:
- Developing awareness of the need to preserve and value health using digital technologies.
- Creation of a motivational base for a healthy lifestyle.
- Identification of individual characteristics that affect the health of the individual.

2) Diagnosis and analysis of the state of health of the individual:
- Assessment of physical, social, and mental health (observation, survey, medical examinations).

3) Knowledge of the content of the competence:
- Study of factors that affect the mental, physical, and social health of a person.
- Familiarisation with the basic concepts of health preservation.
- Analysis of disease prevention, methods of maintaining health, and organisation of a healthy lifestyle.

4) Development of a health-preserving education program that takes into account the age characteristics of the individual:
- Integrate knowledge about a healthy lifestyle into various forms of the educational process.

5) Experience of health-preserving competence in future educators in standard and non-standard situations:
- Working out in different situations: behavioural models of forming health-preserving competence in future educators using digital technologies (providing first aid, stress resistance).
- Forming healthy lifestyle skills (physical activity, proper nutrition, hygiene, etc.).
- Exercises and practical tasks that consolidate the health-preserving behaviour of the individual.

6) Relation of the object of application of health-preserving competence to the content of education using digital technologies:
- Forming a positive attitude towards a healthy lifestyle and digital technologies.
- Awareness of responsibility for one's own health and the health of others.
- Development of social activity in health-preserving issues (dissemination of useful information using digital technologies, participation in thematic events using digital technologies).

7) Outline of communicating teaching approaches into the didactic course in higher education:
- Use of active forms of learning to promote better assimilation of knowledge about safety and health (discussions, training, role-playing games).

8) Emotional and volitional regulation of the result and process of manifestation of health-preserving competence:
- Learning to manage and self-control the emotional state using digital technologies.
- To maintain healthy habits, develop willpower.
- Developing psychological resilience to factors that can negatively affect health.

9) Partnership with volunteers and public organisations:
- Involvement of experts and additional resources to provide additional support and assistance to students using digital technologies.
- Monitoring and assessment of the use of the implemented measures to determine what has been achieved and directions for further improvement in educators using digital technologies [16].

These stages form a holistic understanding of health-preserving competence aimed at strengthening and preserving health as an integrative skill.

4.4. The state of development of health-preserving competence of future educators using digital technologies

Between 2021 and 2024, organised experimental work was conducted to develop health-preserving competence in future educators through the use of digital technologies.

The purpose of the research and experimental work was to verify the effectiveness of the advanced pedagogical conditions for the development of health-preserving competence in future educators using digital technologies.
The training of the foundation of health-preserving skills in future educators using digital technologies included several stages. The content of the preparatory stage: clarification in practice and theory of the state of the problem of developing health-preserving competence in the professional training of specialists.
Pilot stage: took place at a higher education organisation without violating the usual conditions of the professional training process for students.
At the indicated stages, the study's experimental basis was resolute, the research program and the study's structure and logic were developed, the study's stages and procedures were clarified, and the study's empirical data and statistical processing methods were analysed.
The experimental stage consisted of a statement stage, a formative stage, and a control stage.
At the statement stage, the selection, application, and development of diagnostic tools were carried out to control the levels of development of health-saving skills of future educators, according to selected criteria.
The formative stage included: substantiation of the developed pedagogical conditions for the development of health-saving competence for future specialists, and their experimental implementation in the educational process; and conducting a cross-sectional study of the level of development of health-saving competence among future educators.
At the control stage, the dynamics of the levels of competence development outlined for students were tracked by comparing indicators obtained at previous stages of the study; control diagnostics of the level of competence development in future educators were conducted using digital technologies.
When analyzing and interpreting the results obtained, an analysis was carried out of the effectiveness of the operation of the developed author's pedagogical conditions; the statistical significance of changes was checked, and the practical importance of changes in the indicators of the identified capability of specialists was calculated; the conclusions of the study were formulated.
The determination of quantitative changes obtained at the ascertaining and control stages, and the processing of the results of experimental work on the levels, were carried out using Microsoft Excel (spreadsheet processor) – a program (R programming language) for working with electronic tables. Statistical methods used to analyse the obtained data, which were used to diagnose the results of the pedagogical experiment, helped systematise and generalise the experiment's materials and move from qualitative characteristics to their quantitative expressions.
After applying the developed method, the statistical significance of the achieved changes was assessed using statistical methods (Wilcoxon-Mann-Whitney test, Kruskal-Wallis test).
At the determining and control stages of the work, indicators were compared to track the dynamics of the levels of development of students' health-preserving competence.
Given the specified criteria and their indicators, the components of the respondents' health-preserving competence were measured at three levels: high, medium, and low.
We have identified and investigated the criteria for the development of health-preserving competence of future educators:
The motivational criterion has the following indicators: recognition of the value of one's own health; a desire to develop health-preserving competencies in one's own life.
Thus, at the discovery stage, based on the results of students' responses, we obtained the following result for the motivational criterion:

- 64% of respondents reported low motivation.
- 26% - showed an average degree of motivation.
- 10% - showed a high degree of motivation.

All respondents ranked health among the most important values, but no one ranked it first. In the system of life values, we observe:

- 23% of respondents have a low level of recognition of the value of their own health.
- 61% - have an average level of recognition of the value of one's own health.
- 16% - have a high level of recognition of the value of their own health.

Thus, the results obtained allowed us to state that at the ascertaining stage, based on the results of students' responses, we obtained the following general indicators of the development of health-preserving competence as the motivational criterion (Fig. 1):

- 44% of respondents showed a low level of health-preserving competence was observed based on the motivational criterion.
- 43% - showed an average level of health-preserving competence based on the motivational criterion.
- 13% - showed a high level of health-preserving competence based on the motivational criterion.

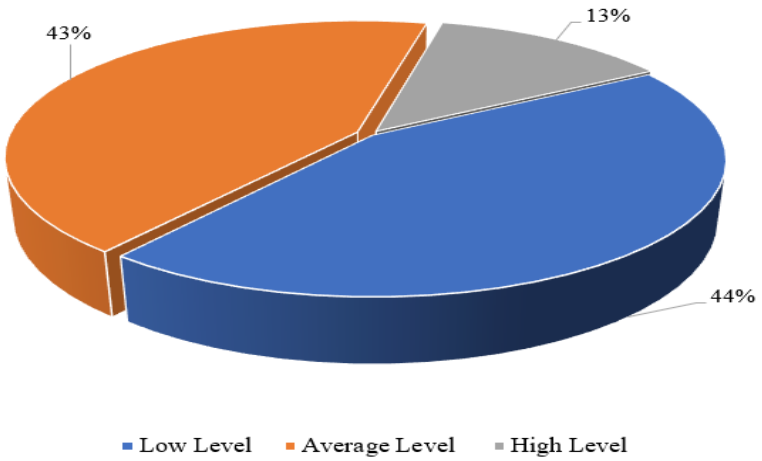


Fig. 1: Levels of Health-Preserving Competence Among Students based on the Motivational Criterion.

The cognitive criterion is characterised by the following indicators: health preservation; awareness in professional activities regarding the creation of a health preservation environment.

Thus, at the ascertaining stage, based on the results of the students' responses, we received a result based on the cognitive criterion, where the results obtained allowed us to state that at the ascertaining stage, based on the results of the students' responses. We received the following general levels of developing health preservation competence based on the cognitive criterion (Fig. 2):

- 52% of respondents demonstrated low health preservation competence based on the cognitive criterion.
- 32% - showed an average level of health preservation competence based on the cognitive criterion.
- 16% - showed a high level of health preservation competence based on the cognitive criterion.

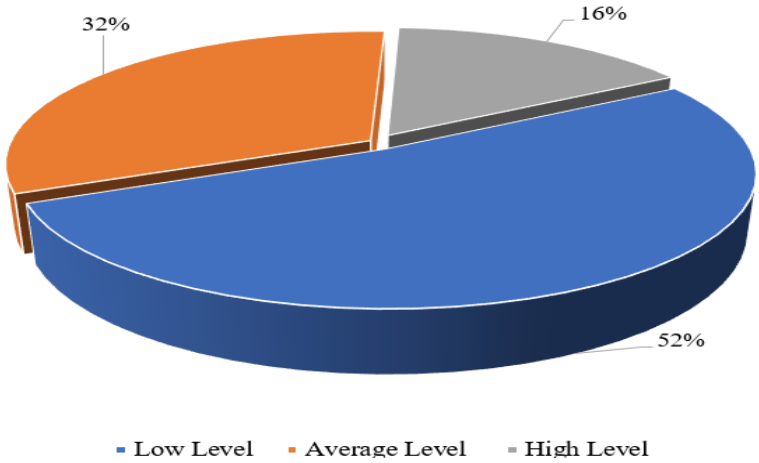


Fig. 2: Levels of Health-Preserving Competence Among Students Based on the Cognitive Criterion.

The activity criterion is characterised by the following indicators: the ability to improve self-health and organise a healthy lifestyle.
Thus, at the ascertaining stage, based on the results of the students' responses, we obtained a result based on the activity criterion, where the results obtained allowed us to state that at the ascertaining stage, based on the results of the students' responses. We obtained the following general levels of development of health-preserving competence based on the activity criterion (Fig. 3):

- 34% of respondents showed a low level of health-preserving competence based on the activity criterion.
- 39% - showed an average level of health-preserving competence, according to the activity criterion.
- 26% - showed a high level of health-preserving competence, meeting the activity criterion.

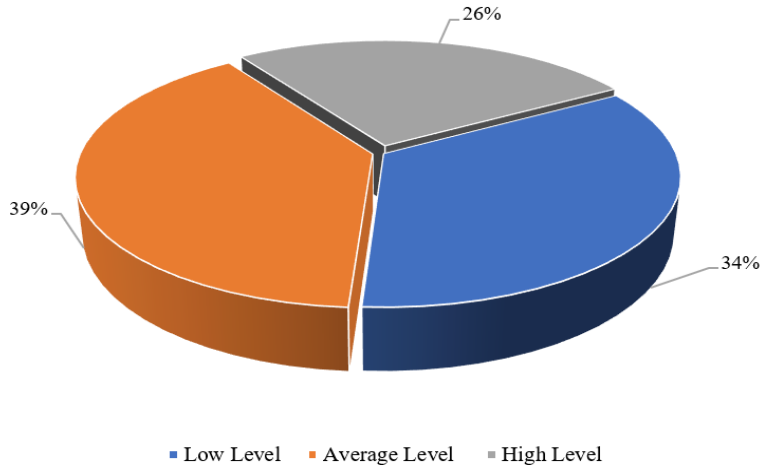


Fig. 3: Levels of Health-Preserving Competence Among Students Based on the Activity Criterion.

The reflective criterion is characterised by indicators: reflection on health-preserving activities and the presence of qualities (activity, purposefulness, empathy, responsibility) necessary for their implementation.
Thus, at the ascertaining stage, based on the results of the students' responses, we received a summary based on the reflective criterion, where the results obtained allowed us to state that at the ascertaining stage, based on the results of the students' responses. We obtained the following general levels of health-preserving competence developing based on the reflective criterion (Fig. 4):

- 60% of respondents showed a low level of health-preserving competence based on the reflective criterion.
- 31% - showed an average level of health-preserving competence based on the reflective criterion.
- 9% - showed a high level of health-preserving competence based on the reflective criterion.

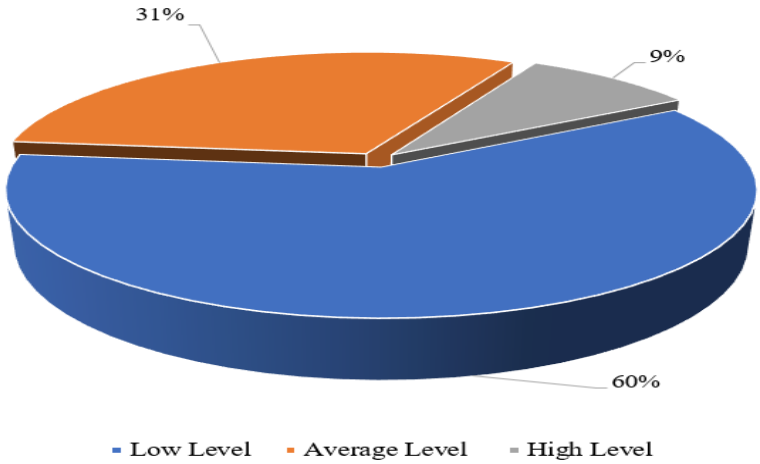


Fig. 4: Levels of Health-Preserving Competence Among Students Based on the Reflective Criterion.

Thus, in the procedure of training, the analysis of the state (statistical stage) based on the specified criteria and indicators allowed us to conclude that future educators are subjugated by a low and medium level of development of health-preserving competence. A high level of developing of health-preserving competence was found only in a small number of respondents, which actualized the need to implement pedagogical conditions that will contribute to increasing the level of developing of health-preserving competence of students in the process of their training.

Conditions (psychological-pedagogical, organisational-pedagogical, information-methodological, technological, socio-cultural) that contribute to the effective development of health-preserving competence in future educators using digital technologies.

Psychological and pedagogical settings: active involvement of higher education students in working with digital resources, developing of individual motivation to use modern digital technologies in health-saving, use of digital personalized programs for correction and assessment of emotional and physical state, individualization and differentiation of learning, prevention of digital fatigue, support of psychological comfort in the digital environment, ensuring a balance between offline learning and online learning [10].

Organizational and pedagogical conditions: mixing of digital technologies into the didactic process through the implementation of webinars, interactive platforms, online courses, digital simulators, developing of an theoretical digital environment for the development of electronic resources (interactive tasks, video lectures, testing) to raise students' awareness in the field of health care, ensuring access (through electronic textbooks) to current digital resources, virtual laboratories, mobile applications for health monitoring, equipping higher education institutions with modern digital devices (VR and AR technologies, smart boards, projectors, fitness trackers, tablets, etc.) [11].

Information and methodological conditions: for the purpose of using digital technologies in health care – development of methodological recommendations, implementation of video instructions, electronic manuals in work with higher education students, etc., development of digital competence of educators, ensuring an interdisciplinary approach, use of innovative forms of learning (gamification, blended learning, situational modeling, case methods), training in the use of digital tools for monitoring mental and physical condition, integration of health-saving technologies into educational disciplines [12].

Technological conditions: use of online platforms for health monitoring and self-monitoring (MyFitnessPal, Google Fit, StressScan, etc.), involvement of technologies (VR, AR) for modelling health-saving situations (physical exercises, virtual simulators, etc.), use of mobile applications, automation of physical condition analysis, use of smart devices, digital platforms for interaction between educators, etc. [13]

Sociocultural conditions: use of digital tools for sharing experience (social networks, forums, chats), popularisation of a healthy lifestyle through digital content (podcasts, blogs, online challenges, etc.), organisation of flash mobs and online marathons on a healthy lifestyle, interactive events [14].

We note that organising an innovative digital space enables increasing the development of health-preserving competence in future educators through digital technologies [15].

Therefore, the development of health-preserving competence in future teachers using digital technologies is effective with the help of psychological-pedagogical, organizational-pedagogical, information-methodical, technological, and socio-cultural conditions, as shown by the results in the experimental groups, where these conditions were implemented (Fig. 6).

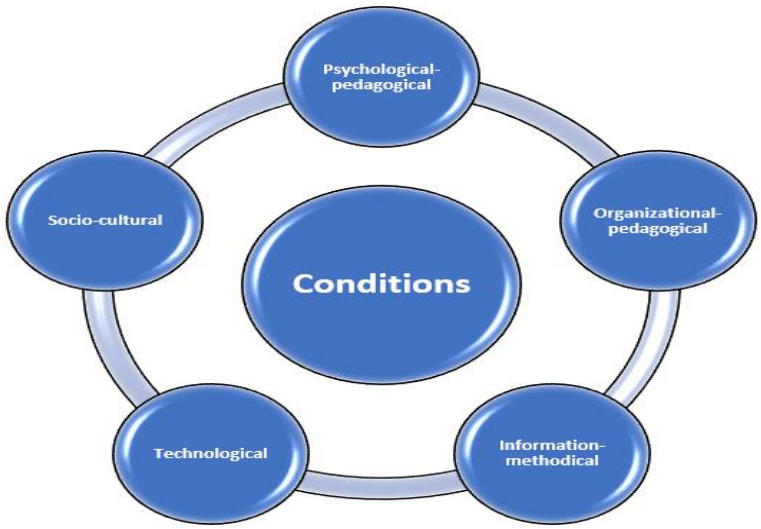


Fig. 6: Conditions for the Development of Health-Preserving Competence in Future Teachers Using Digital Technologies.

In the experimental work, the formative stage involved the introduction into the informative development of higher education institutions of pedagogical conditions for the development of health-preserving competence by means of digital technologies of future educators, in compliance with the principles of a friendly attitude and mutual respect; consistency and systematicity; and, in the process of personality development, reflective collective interaction.
The determined and substantiated pedagogical conditions enabled us to proceed with the formative experiment.

4.5. The formative stage of developing health-preserving competence through digital technologies in students in the educational process of higher education

To summarise the interim results on the effectiveness of their implementation, a second cross-sectional study of the level of development of health-preserving competence was conducted (Fig. 5).
Motivational criterion. The results of the second cross-section allowed us to state that, at the formative stage, based on the results of students' responses. The following general indicators of the development of health-preserving competence by means of digital technologies were obtained by the motivational criterion:

- 17% of respondents showed a low level of health-preserving competence based on the motivational criterion.
- 66% - showed an average level of health-preserving competence based on the motivational criterion.
- 17% - showed a high level of health-preserving competence based on the motivational criterion.

Cognitive criterion. The results of the second section allowed us to state that, at the formative stage, based on the results of students' responses. The following general indicators of the development of health-preserving competence using digital technologies, based on the cognitive criterion, were obtained:

- 22% of respondents showed a low level of health-preserving competence according to the cognitive criterion.
- 50% - showed an average level of health-preserving competence based on the cognitive criterion.
- 28% - showed a high level of health-preserving competence based on the cognitive criterion.

The identified positive changes demonstrated the effectiveness of the work methods used to develop specialists' health-preserving competence.
Activity criterion. The results of the second section allowed us to state that, at the formative stage, based on the results of students' responses. The following general indicators of the development of health-preserving competence using digital technologies were obtained based on the activity criterion:

- 19% of respondents showed a low level of health-preserving competence based on the activity criterion.
- 50% - showed an average level of health-preserving competence based on the activity criterion.
- 31% - showed a high level of health-preserving competence, meeting the activity criterion.

The identified positive changes demonstrated the effectiveness of the measures and forms of work implemented to develop the health-preserving competence of specialists.
Reflective criterion. The results of the second section of the level allowed us to state that, at the formative stage, based on the results of students' responses, the following general indicators of the development of health-preserving competence using digital technologies were obtained using the reflective criterion:

- 24% of respondents demonstrated a low level of health-preserving competence based on the reflective criterion.
- 54% - demonstrated an average level of health-preserving competence based on the reflective criterion.

22% - demonstrated a high level of health-preserving competence based on the reflective criterion (Fig. 5).

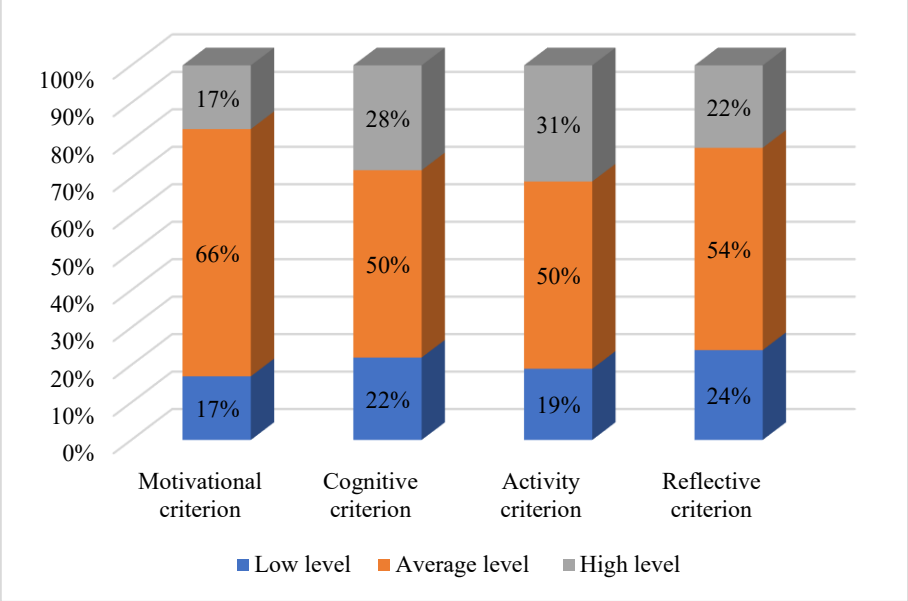


Fig. 5: Levels of Health-Preserving Competence at the Formative Stage.

The identified optimistic variations demonstrated the effectiveness of the measures and forms of work in developing health-preserving competence among specialists.
The general grades of the formative stage of experimentation regarding the development of health-preserving competence showed positive dynamics.
The number of respondents with a high or average level of health-preserving competence significantly increased, while those with a low level significantly decreased.

The presence of positive changes in the dynamics of the level of development of health-preserving competence among respondents was confirmed by the results obtained during the control stage of the experiment.
We used the Cramer-Welch criterion to verify the statistical significance of the achieved changes. A statistical calculation was made on the p-value. The difference between the means is considered too large if the p-value < .05 to be random when the means do not differ. Therefore, the null hypothesis of equality of means is contradicted by the data, and we reject it, accepting the alternative that the means are unequal.
The same hypothesis was tested (for greater confidence) using the nonparametric Wilcoxon-Mann-Whitney test, which does not require normality. The Wilcoxon-Mann-Whitney test was defined as follows: both samples were ranked and combined into a single row. The sum of the ranks for the values of one of the samples is calculated. If the sample size is small, then such a sum has a specific distribution. If the sample size is large, then such a sum, after a suitable transformation, tends to a normal distribution.
The null hypotheses are rejected for all indicators because the p-values (< .05. Therefore, the difference between the means in the first and second diagnostic samples did not arise by chance and is statistically significant.
Verification of the statistical significance of the achieved changes, after the implementation of justified socio-pedagogical conditions for the development of health-preserving competence of future social educators, was carried out using mathematical statistical methods (Wilcoxon-Mann-Whitney test).
The formula used to calculate the Wilcoxon-Mann-Whitney test was:

$$R^* = \frac{R_1 - \left[\frac{n_1(n_1+n_2+1)}{2}\right]}{\sqrt{\frac{n_1 n_2 (n_1+n_2+1)}{12}}}$$

Where
R1 is the smallest sum of ranks from two samples.
n1 is the size of this sample;
n2 is the size of the other sample.
The statistical significance of the differences does not always imply practical relevance, and it may happen that the statistical criterion, used due to the large sample size, has high power and detects minor differences (even tiny ones) that do not make sense in practice.
Thus, the study showed that across all the health-preserving competence criteria we identified, there are significant statistical differences in the characteristics of the subjects in the experiment, indicating a general increase in the identified levels of developing health-preserving competence among specialists using digital technologies. This allows us to assess the success of our work in developing health-preserving competence among future educators using digital technologies. The presence of a significant difference in the dynamics of the development of health-preserving competence among respondents was confirmed by the results obtained at the steps of the experimental work.

5. Conclusion

The theoretical foundations of health preservation and the development of health preservation competence in future educators using digital technologies are considered. The main elements of the innovative digital space are identified, and the conditions (organisational-pedagogical, psychological-pedagogical, information-methodological, technological, socio-cultural) that contribute to the effective development of health preservation skills in future educators using digital technologies are revealed.
The main stages in the development of health preservation competence are discussed, and a general scheme for its development in future educators using digital technologies is presented.
Between 2021 and 2024, organised experimental work was conducted to develop health preservation competence in future educators using digital technologies. The purpose of the research and experimental work was to verify the effectiveness of the developed pedagogical conditions for the development of health preservation competence in future educators using digital technologies.
In the process of professional training, the analysis of the state (confirmatory stage) of the developing of health-preserving competence of respondents based on the specified criteria and indicators allowed us to conclude that future educators are dominated by low and medium levels of developing of health-preserving competence, and a high level of developing of health-preserving competence was found in a small number of future specialists, which actualized the need to implement pedagogical conditions that will contribute to increasing the level of developing of health-preserving competence of students in the process of their professional training.
In the experimental work, the formative stage provided for the introduction into the educational process of higher education institutions of pedagogical conditions for the development of health-preserving competence by means of digital technologies of future educators, with observance of the principles of benevolent attitude and mutual respect; consistency and systematicity; in the process of personality development, reflective collective interaction.
Positive dynamics were demonstrated by the general results of the formative stage of the experiment regarding the development of health-preserving competence among future specialists using digital technologies. As shown in the data, during the experiment, the number of respondents with a high or average level of developing of health-preserving competence significantly increased. In contrast, those with a low level significantly decreased.
The study presented that across all the health-preserving competence criteria we identified, there are reliable statistical differences in the characteristics of the subjects in the experiment, indicating a general increase in the identified levels of developing health-preserving competence among specialists using digital technologies. This allows us to state the success of the work we have carried out in developing the health-preserving competence of future educators using digital technologies.
The presence of a significant difference in the dynamics of the development of health-preserving competence among respondents was confirmed by the results obtained at the stages of the conducted experimental work, indicating the effectiveness of the developed and implemented pedagogical conditions in the higher education process.
The specified problem of the development of health-preserving competence in future specialists during professional training is not fully addressed by the conducted research.
Further directions for the specified problem may include studying the relationship between the development of health-preserving competence among future educators and the use of health-preserving technologies in their teaching in general education institutions.

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