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Innovative potential of future teachers in the information space

El potencial innovador de los futuros docentes en el espacio de la información

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Abstract

The article highlights the importance of developing the innovative potential of future teachers during their professional training. It emphasizes modern requirements in both the theoretical and practical aspects of training within the information space, especially when using innovative teaching tools. The analysis covers

the results of experimental work aimed at fostering the innovative potential of future educators in this digital environment. The initial findings from the starting phase of the experiment reveal low levels of development in the innovative potential of future teachers. However, the formative stage of the study showed significant positive changes in the development levels of the students' innovative potential, aligning with the initial results. This demonstrates the effectiveness of the pedagogical conditions we created to enhance the innovative potential of future teachers within their professional training environment.

Keywords: personality development, information space of education, innovative potential of the student, future teachers, professional training.

Resumen

El artículo demuestra la necesidad de desarrollar el potencial innovador de los futuros docentes durante su formación profesional y destaca las exigencias actuales en la formación teórica y práctica de los futuros docentes en el ámbito de la información, en el contexto del uso de recursos didácticos innovadores. Se analizan los resultados del trabajo experimental sobre el desarrollo del potencial innovador de los futuros docentes en dicho ámbito. Los resultados de la fase de verificación, realizada al inicio del experimento pedagógico, indican un bajo nivel de desarrollo del potencial innovador de los futuros docentes. La fase formativa permitió afirmar que se observaron cambios positivos significativos en el desarrollo del potencial innovador de los estudiantes de GE durante la etapa formativa del estudio, de acuerdo con los resultados del experimento. Esto subraya la eficacia de la implementación de las condiciones pedagógicas para el desarrollo del potencial innovador de los futuros docentes en el ámbito de la información, desarrolladas por nosotros.

Palabras clave: desarrollo de la personalidad, ámbito de la información educativa, potencial innovador del estudiante, futuros docentes, formación profesional.

Introduction

Modern society demands a high level of teacher competence, which requires comprehensive improvement and the exploration of new ways to boost the innovative potential of future teachers within the professional training information space. In the education sector, one of the most critical scientific and practical challenges is preparing highly qualified teachers. The development of the education system worldwide focuses on creating not just a modern teacher but also a person who can think productively and independently, adapt to changing situations in the information space, make quick and appropriate decisions, and demonstrate creative initiative. Addressing this issue involves implementing and seeking the most effective innovative teaching tools within the professional training information space to foster the innovative potential of future educators. Nowadays, the content of professional training of future teachers is being reformed by the features of the current stage of development of pedagogical higher education, new requirements are being formed for the development of the innovative potential of future teachers in the information space, their professional competence in the process of professional training, innovative technologies of professional training are being introduced.

Today, the problem of training future teachers who must have practical skills, deep professional knowledge, and be able to apply them competently in future professional activities in the information educational space is emerging. The basis of professional training for this purpose should be a personal and activity approach, the principles of democratization and humanization of education, updating the forms and content of the organization of the educational process with the use of educational innovations and the latest technologies in the information space (Sablo Sutton et al., 2022).

A modern teacher must have a high level of creative potential, creative thinking in order to provide students with conditions for self-expression in the information space of professional training, increasing their activity and creative self-realization, their individuality in personal development and formation. The need for

readiness for creative professional activity and the development of creative potential determines the multifaceted nature of the teacher's actions in the information educational space.

Thus, attention to the study of the state of practice and theory of teacher training, scientific and pedagogical inheritance, and the development of the innovative potential of future teachers in the process of professional training in modern conditions makes it possible to trace the genesis of the formation of the teacher's creative potential in the information educational space.

Literature Review

Scientists of our society have been engaged in the problem of developing the innovative potential of future teachers in the process of their professional training and researching effective innovative teaching tools in the information space of professional training and substantiating theoretical provisions of teaching technology aimed at activating the cognitive and emotional spheres of students.

The problem of training future teachers for pedagogical innovation is studied by scientists Rocha & Salvi (2017), who analyze the factors of the spread and emergence of innovations in the modern education system; determine the importance and necessity of the individual and creative development of the personality of the future teacher, his professionally significant qualities and pedagogical abilities in the process of his professional training. The researchers showed the priority ways of preparing future teachers for innovative activities: development of students' creative potential, individualization of the learning process; development of the ability to navigate innovative technologies, new programs, techniques and methods of pedagogical activity; flexibility of thinking; formation of an integrative approach to teaching specialized subjects; development of the ability to work based on the principles of partnership pedagogy; formation of students' practical application and use of Internet resources; formation of skills of working with electronic databases and deepening of knowledge when working with various sources of information.

The study by Manske & Staffen (2021) is interesting, as she carried out a theoretical substantiation of the structural-functional model of development in the process of professional training of future teachers' professional potential in the information space and proved that the implementation of the developed model in the educational process helps to identify the key features of the innovative processes under study, reflects the fundamental properties of the prototype object, makes it possible to analyze the dynamics of the educational process, contributes to the development of the innovative potential of future teachers in the process of their professional training, reveals cause-and-effect, structural-functional, and genetic relationships between all components in the process of professional training between the elements of innovative processes of development of the professional potential of future teachers. Ways of implementing pedagogical conditions and scientific approaches for the development of the innovative potential of future teachers in the information space of professional training are shown.

The problem of developing the innovative potential of future teachers in the information space of professional training and revealing the features of training future teachers for innovative activity in the conditions of a higher education institution is devoted to the study of Cortés et al. (2019). The researchers proved that "pedagogical innovations require fundamentally new methodological developments, a new quality of pedagogical innovation. The success of innovative activity assumes that the teacher is aware of the practical significance of various innovations in the education system, not only at the professional, but also at the personal level".

The current problem of professional training of future teachers is the subject of a study by Ferreira & Rady de Almeida (2018). The researchers substantiated the need for methodological support of educational processes and proved their importance in the information space of professional training as an important basis in the pedagogical activity of teachers for determining the strategic guidelines of the present. The study focused on the importance of forming professional competence of future teachers as a

multi-level complex structure consisting of pedagogical experience, professionally significant skills, knowledge, and personal qualities of the teacher.

Thus, scientists have proven the feasibility and relevance of professional training of future teachers using innovative technologies. Innovative teaching methods are aimed at activating the emotional and cognitive spheres of the student and are considered as a process of developing students' professional abilities, which provides opportunities for the development of the innovative potential of future teachers in the information space of professional training to transform knowledge and skills into the professional competence of the teacher.

Research purpose. Development of the innovative potential of future teachers in the information space of professional training.

Methodology

To achieve the research goal, we used a set of research methods:

- **Theoretical** − control and comparative analysis and system-analytical analysis, to clarify the state of the identified problem; systematization, synthesis, generalization – to formulate the conceptual and terminological apparatus, determine the content of basic concepts; classification, structural-functional method, generalization, comparison, modeling – to substantiate the pedagogical conditions for the development of the innovative potential of future teachers in the information space of their professional training;
- **Empirical** – conversation, survey, pedagogical observation, questionnaire, self-observation – to diagnose the development of the innovative potential of future teachers in the information space of professional training; pedagogical experiment – to verify the effectiveness of the proposed pedagogical principles for the development of innovative potential in the information space of professional training of future teachers; mathematical statistics – for the interpretation (quantitative and qualitative) of experimental research data.

An analysis of the results of experimental work on the development of the innovative potential of future teachers was conducted.

In the 2022-2023 academic year, we conducted an ascertaining stage of the pedagogical experiment in order to determine the level of development of the innovative potential of future teachers in the information space of professional training in the process of professional training of students.

The program of the ascertaining experiment was aimed at substantiating the identified components of the innovative potential of future teachers (motivational, cognitive, activity, productive), as well as at determining the criteria (motivational, gnostic, procedural, reflective) and indicators. Their level of formation characterized the level of development of the innovative potential of future teachers in the information space of professional training.

The stages of development of the innovative potential of future teachers are identified. The levels of development of the innovative potential of future teachers (reproductive, corrective, innovative) are proposed, according to which the stages of the experimental study were carried out.

Under the components of the clarification of the innovative potential of future teachers, criteria and indicators, a diagnosis of the respondents of two groups was carried out regarding the state of development of the innovative potential of future teachers. The total sample size is 117 respondents, including 62 from the Experimental Group (EG) and 55 from the Control Group (CG).

The results of the ascertaining stage, which took place at the beginning of the pedagogical experiment, indicate low indicators of the level of development of the innovative potential of future teachers in the information space of professional training.

The next stage of the pedagogical experiment in our study was the formative stage, which was a holistic system of developmental tasks and exercises, a complex of application of innovative technologies, methods, forms of work, and techniques, and psychodiagnostic techniques.

The methodological basis of our experiment was innovative, systemic, competency-based, axiological, personal, environmental, and activity approaches.

The study took place in the following stages:

- **Preparatory stage** (theoretical and search) − the scientific apparatus of the study was determined; the scientific and pedagogical, methodological literature was analyzed and processed to clarify the essence of the main concepts of the study;
- **Diagnostic stage** − an ascertaining stage of the experiment was conducted to clarify the levels of development of the innovative potential of future teachers in the information space of professional training, to substantiate the structural parameters of the innovative potential of future teachers; its components, indicators, levels, theoretical justification of the developed pedagogical conditions for the development of the innovative potential of future teachers in the information space of professional training;
- **Experimental stage** − the effectiveness of the developed pedagogical conditions was tested, and a formative experiment was conducted to test the development of the innovative potential of future teachers in the information space of professional training;
- **Generalizing stage** − statistical processing was carried out, and the results of the formative experiment were summarized.

Experimental work led to an improvement in the results in the EG on the development of the innovative potential of future teachers in the information space of professional training for all components.

Monitoring of the dynamics of changes in the EG and CG groups was carried out during the final cut for all criteria and indicators.

The experiment was conducted in Pavlo Tychyna Uman State Pedagogical University, Ukraine, Ivan Franko State Pedagogical University, Ukraine, State institution «South Ukrainian National Pedagogical University named after K. D. Ushynsky», Ukraine. The conduct of the experiment is permitted by the scientific councils of the universities in order not to violate ethical considerations in institutions of higher education.

The results of diagnostic practices and methods, by generalizing the results obtained, allowed us to determine the integral indicators of the levels of development of the innovative potential of teachers in the information space of professional training.

By generalizing the diagnostic indicators for each student within the formative experiment, the general level of development (of all EG and CG respondents) of innovative potential was determined.

To confirm the representativeness of the data during the formative stage, obtained as a result of the pedagogical experiment, Pearson's χ^2 (chi-square) was used – a non-parametric criterion of agreement.

Therefore, the null hypothesis ($H0$): the level of development of innovative potential in EG and CG students at the formative stage is similar.

Alternative hypothesis ($H1$): the level of development of innovative potential in the information space of professional training in EG and CG students at the formative stage of the experiment significantly differs. When comparing the levels of development of innovative potential of future teachers, provided that in EG and CG the value of χ_{emp}^2 is less than χ_{crit}^2, we will consider hypothesis $H0$ proven, and if the value of χ_{emp}^2 is greater than χ_{crit}^2, we will recognize hypothesis $H1$ as confirmed.

During the study, at the formative stage of the experiment using Pearson's chi-square criterion χ^2, the alternative hypothesis ($H1$) was accepted and the null hypothesis ($H0$) was rejected, since the actual value of χ_{emp}^2 is greater than χ_{crit}^2. This proves that the indicators of EG respondents are significantly different from the indicators of CG students.

Pearson's χ^2 (chi-square) criterion allowed us to determine that there were significant positive changes in EG students in the levels of development of innovative potential in the information space of professional training at the formative stage of the study, according to the results of the ascertaining experiment.

The empirical distributions of CG and EG respondents by changes in the levels of development of innovative potential at the ascertaining and formative stages differ significantly from each other.

It was found that the difference in future teachers in their changes in the levels of development of innovative potential in the information space of professional training in the CG and EG at the formative and ascertaining stages of the experiment is significantly different: significantly better results were demonstrated by EG respondents at the final stage compared to CG respondents. This emphasizes that the mentioned changes are due to the implementation of the pedagogical conditions developed by us for the development of the innovative potential of future teachers in the information space of professional training, and changes in the levels of development of innovative potential in EG are not a random phenomenon.

Using chi-square – Pearson's χ^2 agreement criterion allowed us to assess the probability of differences between the two groups during the formative and ascertaining experiments, on the example of which the effect of our pedagogical conditions on the development of the innovative potential of future teachers in the information space of professional training was demonstrated.

Results and Discussion

The need to develop the innovative potential of future teachers in the information space of professional training and modern requirements that are put forward in the theoretical and practical training of future teachers, in the context of the use of innovative teaching aids.

A professionally trained, competent teacher should be the result of the educational process; he should have developed innovative potential in the information space of professional training, he should be able to adapt to the modern fluid world, he should be creative, active, and endowed with a sense of duty and responsibility to society. A characteristic trend of the modern teacher is the increase in the role of the individual, the continuous growth of the amount of information, and the intellectualization of the teacher's activity.

Currently, in higher education, to build a conceptual innovative base of the education system, various approaches are being developed that meet the spiritual and material needs of our time, by using innovative achievements of science and directing their tasks to the formation of a creative, harmonious, innovative personality of a modern teacher, since today education requires creative teachers of highly qualified professionals, therefore the main direction of higher education is the training of teachers who are capable of innovative activity, who have developed innovative potential in the information space of professional training. Higher education is called upon in the information space of professional training to educate a harmoniously developed personality of a citizen of society, who will be able to realize his creative potential, who can be happy, change and develop a personal strategy in changing life circumstances; for whom the

need to increase the level of creative potential, in fundamental knowledge is necessary, and all this is associated with strengthening the education of his state. Increasing demands of modern society for teacher training, development of innovative potential of future teachers, necessitate the formation of a creative personality in the process of professional training of a modern teacher, readiness for creative professional activity, and development of their creative potential in the information educational space.

Trends in the modern higher education system are to change the approach to the development of the innovative potential of future teachers from the traditional pedagogical model of the professional training process to a new paradigm of an innovative type using modern information technologies of education. In the process of professional training, the new paradigm of the development of the innovative potential of future teachers in the information space of professional training necessitates the need for corresponding changes in teacher training. In higher education, professional training is a process of forming a general and professional culture, the formation of the personality of future teachers, and the process of forming professional competencies, which are a factor in the successful activity of a teacher. An indicator of the effectiveness of a future teacher is their professional readiness, which expresses the qualitative characteristics of pedagogical thinking, professional orientation, and the level of mastery of professional skills and abilities (Mercado Borja et al., 2024). The main task of professional training is to develop the innovative potential of future teachers in the information space of professional training, the readiness to think productively, and not only to provide solid knowledge for professional activity and the implementation of acquired knowledge, skills, and abilities in practice. Future teachers, as a result of professional training, must be able to independently acquire new knowledge, adapt to changing conditions of pedagogical activity, make decisions, navigate in non-standard new situations, and introduce progressive innovative technologies in professional activity. Such an approach to higher education is necessary in order to provide future teachers with personal and creative potential and mobility in pedagogical activity (Alburquenque Campos & Tejada Fernández, 2023).

It is worth defining the modern requirements that are put forward in the theoretical and practical training of future teachers, in the context of using innovative teaching aids in the information educational space.

- A teacher of a new formation must know the content of innovative technologies in the pedagogical field; forms, principles, and methods of organizing innovative teaching; socio-cultural, psychological, and pedagogical foundations of innovative technologies in the information space of professional training;
- It is necessary to determine the skills, by theoretical knowledge, that should characterize a modern teacher: to plan, conduct classes and organize the educational and educational process with the use of innovative technologies in the information space of professional training; to control the quality of the educational process, to evaluate the effectiveness of the use of innovative technologies; to apply modern methods and means of education in education, adequate to the content of innovative technologies; to adjust and analyze one's professional activity; to organize and conduct scientific research in the field of professional activity;
- During the theoretical and practical training of future teachers, in the context of the use of innovative teaching aids in the information space of professional training, it is necessary to optimize the acquisition of the necessary practical and theoretical skills and knowledge;
- The teacher's actions should be aimed at creating pedagogical conditions, at introducing innovative technologies that activate the student's independent and classroom cognitive activity in the information space of professional training;
- The future teacher should be able to combine the ability to systematize knowledge, transfer it to others, and use it in professional activities;
- Promote the ability to form students' needs for in-depth study of professional disciplines (Ferreira de Moraes & Nogueira, 2024).

Innovative technologies of education in the information space of professional training of a student are considered not simply as a form of organization of educational and educational activities, but as a process of development of innovative potential of future teachers in the process of professional training,

professional abilities of students, which makes it possible to transform skills and knowledge into part of professional competence. And it is with the introduction of innovative technologies in the information space of professional training of teachers into the educational process of higher education that the formation of an innovative teacher takes place in order to form a professional attitude to pedagogical problems, and better assimilation of the knowledge system (Isoda et al., 2021). This actualizes the expediency of using innovative achievements and contributes to the development of the innovative potential of future teachers in the process of professional training. Professional training of teachers acquires a variety of personally oriented approaches to the educational process by means of innovative technologies, and in the educational process contributes to ensuring differentiation and individualization of theoretical and practical training of future teachers in the information educational space. The use of modern innovative technologies to develop the innovative potential of future teachers in the information space of professional training creates new opportunities for activating professional thinking, improving learning, and forming professional skills and abilities (Campana, 2023).

Improving the educational process of higher education in the information space and implementing the development of the innovative potential of future teachers in the process of professional training in the context of global educational trends.

Implementing the development of the innovative potential of future teachers in the process of professional training takes place today in the context of global educational trends:

- According to the main provisions of the Bologna Declaration in the field of higher education, innovative processes require the creation of an innovative educational environment aimed at realizing the innovative potential of future teachers and strategic tasks and goals of educational development. Only innovative education in its essence, aimed at realizing the innovative potential of future teachers, can educate a person who is an independent, self-sufficient person, a comprehensively developed personality, living according to modern innovative laws of globalization;
- The systematic formation of an innovative educational environment has its own organizational and functional structure in a separate region and country. Interacting with each other, each of the elements of the structure fills the innovative environment with its direction of change and has the following main components: tactics for forming innovative processes, strategy for developing education in the region, organizational support, content of the innovative environment of the region, forecasting the development of education in the region (Arias Cardulis et al., 2023).

In the higher education system, the consolidation of information and educational resources and the use of modern computer technologies for the purpose of organizing a single educational space irreversibly change the pedagogical process itself, its organizational, content, and methodological foundations (Acosta Herrera et al., 2018).

The most important achievement in higher education when using educational and information environments is:

- Quick search for educational information;
- Implementation of systematic and dynamic control using computer testing;
- Ensuring individualization of learning;
- Formation of future specialists' reflection on their activities;
- Providing a large number of creative tasks for the independent work of students.

Modernization of educational processes in higher education is associated with the creation of an arsenal of the latest tools for accumulating, transmitting, and processing educational information through information channels. Among the channels for accumulating an arsenal of the latest tools are the creation of international and local educational networks, the use of mass media and media capabilities, the implementation of effective distance learning models, the conceptual introduction of open education

systems, the use and development of modern teaching aids, the implementation of project activities in the educational information space, etc.

The technological component of the formation of an educational innovation environment in the information space of professional training is associated with the technologization of the education system. In the structure of pedagogical innovation, I. Bogdanova distinguishes a specific direction, because it is focused in the higher education system on the study of technological processes, which was called "technomatics", which studies the technological needs of education and develops means, methods, ways to effectively meet the needs of the educational industry and is associated with specific implementation technologies and technologies of innovations in the educational space (Beltran-Sanchez et al., 2024).

Innovation technologies in the educational space perform the following main functions: modernizing, that is, improving, rationalizing, modifying the traditional pedagogical process of higher education, transforming, which radically changes and improves the traditional educational process, as well as combinatorial or complex, which combines elements of the innovative, pedagogical, traditional, process (Rojas de Francisco et al., 2020). We see that the technologization of the higher education process has the main task of improving the traditional pedagogical process by applying a system of actions, procedures, and operations that guarantee the achievement of a higher level of professional education of the teacher and the upbringing of the future teacher and are based on new achievements of science in the information space.

The main pedagogical conditions and factors that influence the development of the innovative potential of future teachers in the information space of professional training by the structure of the innovative educational environment.

By the structure of the innovative educational environment, the main pedagogical conditions for the development of the innovative potential of future teachers in the information space of professional training are determined:

- Creation of an innovative educational environment taking into account respect and trust of all participants in the educational process, partnership cooperation;
- Focus on the development and self-development of each teacher's personality in the information space of professional training;
- Work in a creative search mode in the information space of professional training;
- Application of innovative technologies in the information space of professional training of teachers.

We assessed the effectiveness of the educational environment according to various indicators, taking into account the structure of the development of the innovative potential of future teachers in the information space of professional training.

We highlight the following parameters:

1) The degree of mastery of innovative technologies in the information space of professional training, the effectiveness of the educational institution's activities (the level of general cultural development and knowledge of students; interaction with new-type universities);
2) Comfort of the educational environment – material and technical conditions, aesthetics of the environment, socio-psychological microclimate, sanitary and hygienic; the presence of a situation of choosing the forms and content of education; physiological justification of the work regime;
3) Security of the activities of a higher education institution – characteristics of the personnel potential; equipment, level of organizational, functional, and regulatory security; level and nature of management activities.

In the system of continuing education, an innovative educational environment plays a great role, in particular, in the process of training future teachers in the information space of professional training. The

conditions for innovative training in higher education are created by the association of various educational institutions, taking into account regional needs and ensuring the continuity of training of highly qualified personnel (Cisneros-Barahona et al., 2023).

For the development of the innovative potential of future teachers in the information space of professional training, the creative pedagogical activity of the teacher is important, the main criterion of which is to ensure the creative and innovative development of the student's personality. The creative pedagogical activity of each teacher has its own individual characteristics, and therefore in the structure of the creative personality it is necessary to distinguish: individual psychological originality, creative orientation, abilities for non-standard solutions to educational problems, creative activity during the creation of programs, author's projects, technologies; creative potential.

The concept of "creative potential of a teacher" includes high adaptability of the personality, its ability to transform, creative activity, strong-willed qualities, and highly developed intelligence, which makes all these positions the main object in the information space of professional training of future teachers. That is why the development of the creative innovative potential of future teachers in the information space of professional training is an important professional trait of a future teacher, which allows them to put forward hypotheses, solve creative problem situations, self-improve, and make non-standard decisions.

The creative innovative potential of future teachers in the information space of professional training acts as a kind of mechanism for adapting a person to a new situation, is a valuable and personal category of personality, provides the ability to change and develop at the same time, change the nature of one's own activity, thereby acting as one of the psychological mechanisms of innovative future activity and ensuring its success (Leal Uhlig et al., 2023).

Each teacher has their own level of development of creative potential. The creative, innovative potential of future teachers in the information space of professional training is enriched, developed, and changes in the process of activity are determined by the development of personal qualities and the specifics of professional training (Lima et al., 2022).

Gradually, educational activity acquires the features of creative activity. And it is the development of creative potential that leads to this. The future teacher actively seeks new methods of realizing his abilities, goes beyond the tasks set by the teachers, evaluates and interprets the results of his own activity in a new way. In these searches, the features of the teacher's subject are established and developed, which characterizes him as a creative personality.

The phenomenon of creative potential in the information space of professional training is an internally contradictory, but integral phenomenon, a necessary and general moment of the subjective active creative innovative ability of the human individual, which allows the individual to carry out objective activity. This integral property is the result of social and natural activity, which is externally manifested in purposeful activity or work, stimulated by certain conditions (Cárdenas Toledo et al., 2022).

There is reason to believe that the innovative potential of future teachers in the information space of professional training is such a base that is a systematic formation of a personality, which is characterized by psychophysiological, intellectual, and motivational reserves of development:

- The level of development of intellectual abilities of a global nature, which allow a person to effectively solve professional and life problems that are new to him: to be open to the new;
- Critical analysis of experience, the ability to conclude the past;
- A realistic approach to emerging problems;
- Possession of flexible and broad thinking, a vision of alternative ways to overcome and solve established stereotypes;
- Self-realization in cognition and communication, in various spheres of work;

- High working capacity of a person, his level of development of his psychophysiological capabilities (Cararo et al., 2021).

The development of the innovative potential of the individual is influenced by the following main factors: social environment, activity, and predispositions of the individual. Such a factor as the activity of the individual affects the individual as a self-developing system, which acts as an opportunity for self-realization, self-development, and self-actualization. All this forms the creative potential of a person. It is these qualities, separating and developing, that create a certain structure of the individual, which determines, as a personality trait, creative potential. A future teacher must have a high creative potential, which is manifested in deviation from traditional thinking, non-standard activity, and ensuring pedagogically productive activity (Santos & Bacury, 2022).

The innovative potential of future teachers in the information space of professional training is dynamic, it cannot be considered static, because it is a component of the student's pedagogical professionalism, is constantly undergoing transformations, and therefore, we can talk about its development in the system of university education in the process of professional training of teachers. The extent to which future teachers clearly understand the structure, content, and essence of creative potential, its impact on the nature of professional and pedagogical activity, and the stages of its development determines the success of the development of this complex personal formation.

Analysis of the results of experimental work on the development of the innovative potential of future teachers in the information space of professional training.

In the 2022-2023 academic year, we conducted an ascertaining stage of a pedagogical experiment in order to determine the level of development of the innovative potential of future teachers in the process of professional training of students in the information educational space.

The ascertaining experiment program was aimed at substantiating the identified components of the innovative potential of future teachers (motivational, cognitive, activity, effective), as well as at determining the criteria (motivational, gnostic, procedural, reflective) and indicators. Their level of formation characterized the level of development of the innovative potential of future teachers in the information space of professional training.

The stages of development of the innovative potential of future teachers in the information space of professional training were identified:

- The first stage − accumulation,
- The second stage − actualization,
- The third stage − implementation.

The levels of development of the innovative potential of future teachers in the information space of professional training (reproductive, corrective, innovative) are proposed, according to which the stages of the experimental study were carried out.

By the components of the clarification of the innovative potential of future teachers, criteria and indicators, a diagnosis of the respondents of two groups was carried out regarding the state of development of the innovative potential of future teachers. The total sample size was 117 respondents, including 62 from the experimental group (EG) and 55 from the control group (CG).

The generalization of diagnostic data for each respondent during the ascertaining experiment allowed us to determine the general level of development of each of the respondents of the EG and CG regarding their innovative potential.

The results of the ascertaining stage, which took place at the beginning of the pedagogical experiment, indicate low indicators of the level of development of the innovative potential of future teachers in the information space of professional training (Fig. 1):

- The reproductive level of development of the innovative potential of future teachers (according to indicators of all defined criteria) was detected in 30% of the EG respondents and 40% of the CG respondents;
- The corrective level of development of the innovative potential was shown by 62% of the EG respondents and 46% of the CG respondents;
- Only 8% of the EG students and 14% of the CG have innovative potential at the innovative level.

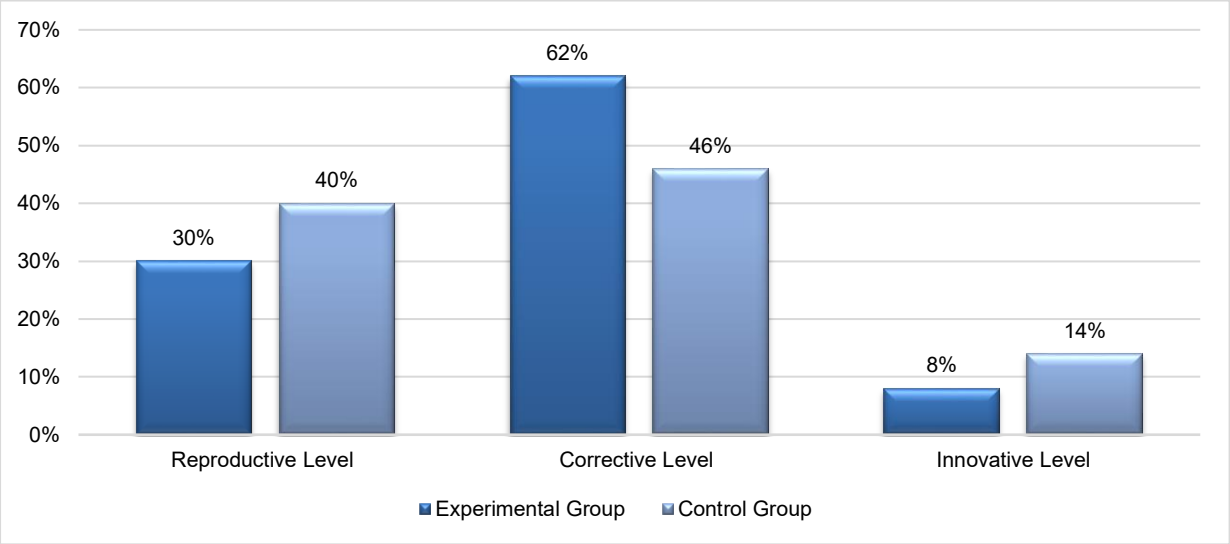

Figure 1. Innovative Potential Levels of Future Teachers (ascertaining stage).

At the ascertaining stage of the experiment, based on the results of statistical data processing, it was proven using the χ^2 criterion (Pearson's chi-square) that the composition of the respondents was qualitatively equal in the EG and CG, that is, the starting conditions were identical for both groups.

Qualitative analysis of the results showed that all components of education required active influence:

- Respondents on pedagogical innovation lacked basic knowledge;
- We observe a low level of development of professionally significant properties of students necessary for the implementation of innovative pedagogical activity in the information space of professional training;
- Insufficient mastery of practical skills of future teachers in the information space of professional training is proven;
- A significant part of future teachers demonstrated a lack of experience in reflection regarding their own innovative activity.

Therefore, the diagnostic results became the basis for the development and justification of pedagogical conditions for the development of the innovative potential of future teachers in the information space of professional training, identifying problems that required separate correction.

Reflection involved self-analysis conducted by the teacher and students. In our study, the portfolio became an effective method for future teachers to organize their reflective activity, which allowed students to accumulate and demonstrate skills, their knowledge, and experience.

During the pedagogical experiment, the effectiveness of pedagogical conditions that were developed to develop the innovative potential of future teachers in the information space of professional training was experimentally tested.

The next stage of the pedagogical experiment in our study was the formative stage, which was a holistic system of developmental tasks and exercises, a complex of application of innovative technologies in the information space of professional training, methods, forms of work, and techniques, and psychodiagnostic techniques. During the phased implementation of the above innovations that were introduced in the EG, a corrective effect was carried out, baseline data was established, and verification of the research results was ensured, which is reliable.

The degree of influence of the developed pedagogical conditions on the development of the innovative potential of future teachers in the information space of professional training determined the effectiveness of the results obtained by the respondents.

The methodological basis of our experiment was innovative, systemic, competency, axiological, personal, environmental, and activity approaches.

The study took place in the following stages:

- **Preparatory stage** (theoretical and search) − the scientific apparatus of the study was determined; the scientific and pedagogical, methodological literature was analyzed and processed to clarify the essence of the main concepts of the study;
- **Diagnostic stage** − the ascertaining stage of the experiment was conducted to clarify the levels of development of the innovative potential of future teachers, to substantiate the structural parameters of the innovative potential of future teachers; its components, indicators, levels, theoretical justification of the developed pedagogical conditions for the development of the innovative potential of future teachers in the information space of professional training;
- **Experimental** and **formative stage** − the effectiveness of the developed pedagogical conditions was tested, and a formative experiment was conducted to check the development of the innovative potential of future teachers in the information space of professional training;
- **Generalizing stage** − statistical processing was carried out, and the results of the formative experiment were summarized.

The experimental work led to an improvement in the results in the EG on the development of the innovative potential of future teachers in the information space of professional training in all components.

To identify qualitative and quantitative changes and determine the effectiveness of the developed pedagogical conditions for the development of the innovative potential of future teachers in the information space of professional training, a developed methodology was implemented using relevant practices, which provided for comparing the results of diagnostics, conducting diagnostic control sections in the Google-Forms format, which made it possible to verify the presence of significant changes in the indicators between the EG and the CG and see the dynamics of the development of the innovative potential of future teachers in the EG.

Monitoring of the dynamics of changes in the EG and CG groups was carried out during the final cut-off according to all criteria and indicators.

The results of diagnostic practices and methods, by generalizing the results obtained, allowed us to determine the integral indicators of the levels of development of teachers' innovative potential in the information space of professional training.

By generalizing the diagnostic indicators for each student within the framework of the formative experiment, the general level of development (of all EG and CG respondents) of innovative potential in the information space of professional training was determined (Table 1).

Table 1.
The general level of development of the innovative potential of future teachers in the information space of professional training in EG and CG.

	Levels					
	Reproductive		Corrective		Innovative	
	Stages of the experiment					
	Ascertaining	Formative	Ascertaining	Formative	Ascertaining	Formative
	%	%	%	%	%	%
EG	30	9	62	51	8	40
CG	40	27	46	54	14	19

At the end of the experiment, according to the indicators of all criteria (Fig. 2):

- The reproductive level of development of innovative potential significantly decreased in the EG compared to the results of the CG: by 21% in the EG and by 13% in the CG.
- The corrective level of development of innovative potential decreased in the EG by 11%, while it increased in the CG by 8%.
- The innovative level of students significantly improved in the EG by 31% and in the CG by 5%.

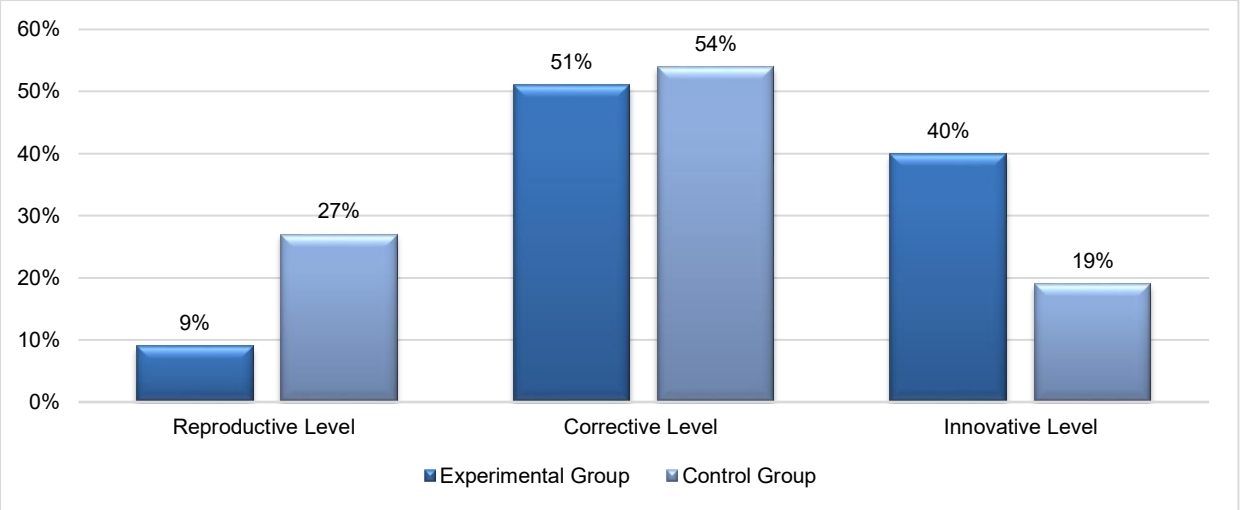

Figure 2. Innovative Potential Levels of Future Teachers (formative stage).

To confirm the representativeness of the data during the formative stage, obtained as a result of the pedagogical experiment, Pearson's χ^2 (chi-square) was used – a non-parametric criterion of agreement. Therefore, the null hypothesis ($H0$): the level of development of innovative potential in EG and CG students at the formative stage is similar.

Alternative hypothesis ($H1$): the level of development of innovative potential in the information space of professional training in EG and CG students at the formative stage of the experiment significantly differs.

When comparing the levels of development of innovative potential of future teachers, provided that in EG and CG the value of χ_{emp}^2 is less than χ_{crit}^2, we will consider hypothesis $H0$ proven, and if the value of χ_{emp}^2 is greater than χ_{crit}^2, we will recognize hypothesis $H1$ as confirmed.

During the study, at the formative stage of the experiment using Pearson's chi-square criterion χ^2, the alternative hypothesis ($H1$) was accepted and the null hypothesis ($H0$) was rejected, since the actual value of $\chi_{emp}{}^2$ is greater than $\chi_{crit}{}^2$. This proves that the indicators of EG respondents differ significantly from the indicators of CG students.

Therefore, the mentioned changes are due to the implementation of experimental pedagogical conditions for the development of the innovative potential of future teachers in the information space of professional training, and positive changes in EG in the levels of development of innovative potential are not a random phenomenon.

Pearson's χ^2 (chi-square) criterion allowed us to determine that significant positive changes occurred in EG students in the levels of development of innovative potential in the information space of professional training at the formative stage of the study, according to the results of the ascertaining experiment.

The empirical distributions of respondents of the CG and EG by changes in the levels of development of innovative potential in the information space of professional training at the ascertaining and formative stages differ significantly from each other.

The analysis of the levels of development of innovative potential of future teachers was based on a comparison of the results obtained after the impact (EG and CG at the stage of the formative experiment) on the experimental group and before the experimental impact (EG and CG), that is, the indicators of the achieved innovative potential of the general level of future teachers of the previous state and each of its isolated components.

It was established that the difference in future teachers in their changes in the levels of development of innovative potential in the information space of professional training in the CG and EG at the formative and ascertaining stages of the experiment is significantly different: significantly better results were demonstrated by EG respondents at the final stage compared to CG respondents. This emphasizes that the mentioned changes are due to the implementation of the pedagogical conditions developed by us for the development of the innovative potential of future teachers in the information space of professional training, and changes in the levels of development of innovative potential in EG are not a random phenomenon.

It should be noted that the use of chi-square – Pearson's χ^2 agreement criterion allowed us to assess the probability of differences between the two groups during formative and ascertaining experiments, on the example of which the effect of our pedagogical conditions on the development of the innovative potential of future teachers in the information space of professional training was demonstrated.

Conclusions

The need for the development of the innovative potential of future teachers in the information space of professional training is proven, and the modern requirements that are put forward in the theoretical and practical training of future teachers in the context of the use of innovative teaching aids are emphasized.

The educational process of higher education in the information space and the implementation of the development of the innovative potential of future teachers in the process of professional training in the context of global educational trends have been improved. The main functions of innovation technologies in the educational space are revealed, and the main pedagogical conditions and factors that influence the development of the innovative potential of future teachers in the process of professional training in accordance with the structure of the innovative educational environment are clarified.

The results of experimental work on the development of the innovative potential of future teachers in the information space of professional training are analyzed.

The results of the ascertaining stage, which took place at the beginning of the pedagogical experiment, indicate low indicators of the level of development of the innovative potential of future teachers.

The next stage of the pedagogical experiment in our study was the formative stage, which represented a holistic system of developmental tasks and exercises, a complex of application of innovative technologies, methods, forms of work, and techniques, and psychodiagnostic techniques.

The methodological basis of our experiment was innovative, systemic, competency-based, axiological, personal, environmental, and activity approaches.

Monitoring of the dynamics of changes in the EG and CG groups was carried out during the final cut-off according to all criteria and indicators.

To confirm the representativeness of the data during the formative stage, obtained as a result of the pedagogical experiment, Pearson's χ^2 (chi-square) was used. Pearson's χ^2 (chi-square) criterion allowed us to determine that there were significant positive changes in the levels of development of innovative potential of EG students at the formative stage of the study, according to the results of the ascertaining experiment.

It was established that the difference in future teachers in their changes in the levels of development of innovative potential in the information space of professional training in CG and EG at the formative and ascertaining stages of the experiment is significantly different: EG respondents demonstrated significantly better results at the final stage compared to CG respondents. This emphasizes that the mentioned changes are due to the implementation of the pedagogical conditions developed by us for the development of the innovative potential of future teachers in the information space of professional training, and changes in the levels of development of innovative potential in EG are not a random phenomenon.

The conducted research does not exhaust all aspects of the problem under study, but points to such promising areas of research as comparative studies of the development of the innovative potential of students in EU countries.

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