



Competencia innovadora del estudiante como dirección prioritaria de la gestión educativa

Student's innovative competence as a priority direction of educational management

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Resumen

La investigación es relevante por la necesidad de reformas fundamentales en el campo de la gestión educativa. El problema de la adquisición de competencias innovadoras por parte de los estudiantes surge en el contexto de la transformación continua de las relaciones sociales. Los futuros especialistas que actualmente son estudiantes de instituciones de educación superior (IES) deben enfrentar todos los desafíos socioeconómicos en el futuro. Se utilizó un cuestionario adaptado para evaluar el nivel de habilidades en estudiantes de IES pedagógicas y el método de diagnóstico de la medida individual de reflexividad, la Encuesta de Valor de Rokeach. Asimismo, se usaron métodos de recopilación y coordinación de datos, procesamiento estadístico y matemático de resultados a través de fórmulas de Pearson. En los grupos experimental y de control, el 7,6% de los encuestados tiene un nivel bajo, el 82,6%, un nivel medio, y el 9,8%, un nivel alto. El grupo experimental (45%) mostró un mayor nivel de resultados de alta reflexividad que el grupo de control (30%). Con base en el procesamiento de los resultados obtenidos, se concluye que el desarrollo de competencias innovadoras en estudiantes de IES pedagógicas luego de la aplicación de condiciones pedagógicas aumenta cuantitativamente. La investigación adicional debe tener como objetivo identificar las competencias clave de innovación relevantes.

Palabras clave: Competencias innovadoras, gestión educativa, educación innovadora, educación superior.

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Abstract

This research is pertinent due to the need for fundamental reforms in the field of educational management. The problem of acquiring innovative competencies by the students arises against the background of the continual transformation of social relations. Future specialists who are currently students of higher educational institutions (HEIs) must meet all socio-economic challenges in the future. An adapted questionnaire was used to assess the level of skills in students of pedagogical HEIs and the method of diagnosis of the individual measure of reflexivity, the Rokeach Value Survey. Likewise, methods of data collection and coordination, and statistical and mathematical processing of results through Pearson's formulas were used. In the experimental and control groups, 7.6% of respondents have a low level, 82.6% — a medium level, and 9.8% — a high level. The experimental group (45%) showed a higher level of high reflexivity results than the control group (30%). Based on the processing of the results, it was concluded that the use of pedagogical conditions for the introduction of innovative educational tools promotes the development of innovative competencies in students of pedagogical universities. Further research should be aimed at identifying key relevant innovation competencies.

Keywords: Innovative competencies, educational management, innovative education, higher education.

Introduction

This study is relevant due to the following reasons. As humanity moves into the modern era, it turns out that the models of competencies that exist today no longer meet the global challenges of the world economy and require renewal through the mechanism of transformation. Knowing the benefits of finding patterns and understanding the limits of our innate feelings, the world has developed and continues to develop methods and tools for gathering information that is beyond the capabilities of our consciousness (Pronina, 2018). Now humanity is a few generations ahead and uses satellites, particle accelerators, DNA sequencers, electron microscopes, medical diagnostic equipment of all types, and these are just some of them.

Humanity continues to collect information about the world at an impressive pace through nanotechnology and digitization tools (IIoT and AI, low-code tools, predicative functions, application of Agile principles, etc.). The obtained information is used to extrapolate the laws of the world and to indicate the steps required to achieve in each of the considered technologies. Modern educational management is seen as an interdisciplinary field of knowledge, which integrates productive ideas, principles, methods, approaches and mechanisms that reveal the social, economic, pedagogical, legal, psychological and acmeological aspects of management theory and practice of innovative education (Vansieleghem et al., 2019).

In this context, there are two complementary conceptual positions on innovative educational management. The first concept focuses on education management, which includes a set of management measures and decisions related to the management of educational institutions and educational systems. This understanding is often called “pedagogical management” (Tolmachova, 2021). In this case, the structure of pedagogical management includes the following levels: 1) management of the teaching staff; 2) management of the teacher’s activity; 3) management of students’ activities (Roh et al., 2017). Based on this position, we can conclude that the management of teacher innovation activity is an element of educational management (Wyrwa, 2020).

The second conceptual position brings educational management into the plane of development of the organization through the education of its employees, the expansion of pedagogical functions of the organization, the formation of its corporate culture, staff involvement in innovation. Therefore, the involvement of teachers in innovation can be the subject of research in the field of educational management (Tomasova, 2020).

In management, the ability of the organization to continuous training and development of all its members with a focus on leadership in the market of goods and services is considered as a factor of the company’s success and competitiveness. Many authors, referring to the specifics of higher education management, note that the human resources of the organization in contrast to other types of resources are long-term, so it is necessary to use the opportunity for transformation in the HEI management (Turabova, 2021).

This is achieved through the elaboration and implementation of priority strategic directions for the development of pedagogical staff of the HEI, which include purposeful systemic motivation for professional development and career growth both directly in the organizational environment and in the scientific environment as a whole. Thus, we can conclude that the strategic goal of educational management of the teacher’s innovative activities is his/her personal and professional self-improvement (Yunisov & Satib-Aldiev, 2021).

The innovation environment of the HEI should include the spiritual and material environment in which complex activities for the creation, development and use of innovations take place. The theoretical basis of the innovation-oriented environment of an educational institution is a set of principles: openness; systematicity; advanced development of growing professional, social and personal needs. An important condition for the development of students' innovative competence is participation in research work (RW). RW constantly puts the student in a problematic situation, allows you to see the contradictions in the studied objects, feel the problems, intensifies the work of the intellect, developing creative thinking, the ability

to self-reflection. One of the priority forms of students' acquisition of innovative competence is the creation of pedagogical conditions through the introduction of innovation management.

The aim of the research is to study the pedagogical conditions under which the development of innovative competence of students of pedagogical HEIs in the course of independent work becomes effective. Three research objectives are pursued here:

- 1) study the initial level of innovative competence of students;
- 2) verify the pedagogical conditions for the model of development of innovative competence in students of pedagogical HEIs in the course of their independent work;
- 3) identify changes in the level of innovative competence of students of pedagogical HEIs.

Literature review

A number of domestic and foreign scientists dealt with issues of educational management and students' innovative competencies. Koroban (2020) addresses the application of Smart-technologies for the development of competencies in students of HEIs. Vazhenina and Zub (2021) consider the intellectual environment of the master studies as a context of personal and professional development of the future manager. However, the works do not consider the general picture of the level of competence of students. Shevyakova et al. (2019) in their article consider the principles of building an innovative economy of the 21st century and the competencies that need to be assimilated.

By its part, Roh et al. (2017) examine the impact of open innovation on the productivity of the Korean economy. It should be noted that the article pays special attention to the mechanisms of developing innovative competencies in students of HEIs. Pöntinen and Rätty-Záborszky (2020) cover the pedagogical aspects of students' acquisition of innovative competencies. The authors consider and compare different methods of developing competencies in students. Park and Lee (2017) study the impact of technological innovation on innovation efficiency. Pulatova (2021) considers the issue of improving the methodological model of innovative managerial competence of secondary school principals.

In other context, Muhammadiyeva and Mamadaliyeva (2021) cover issues of teacher competence in the organization of art activities. They consider general characteristics of the acquisition of innovative competencies against the background of this process. Lindsey et al. (2014) consider the long-term improvement of the level of students' knowledge. Gudmundsdottir and Hatlevik (2018) consider the acquisition of innovative technological competencies by students of different qualification and educational levels. Bozic Yams (2018)

consider the importance of readiness for innovative activity in undergraduate programmes, while the general tendencies of development of innovative competences in students are not considered.

The analysis of scientific works shows that the purposes and tasks of high school are developed according to world tendencies of development of education. Innovative activity of HEIs as an interdisciplinary category is currently the subject of economic (management mechanisms, incentives, evaluation of innovation), sociological (the role of innovation in social development, perception and resistance to innovation), pedagogical (training, participation of teachers in innovation processes) research. Therefore, the innovative activity of HEIs, due to its systemic multifactorial nature, complexity, and dynamic should be studied from the perspective of an interdisciplinary approach. Educational management has the greatest potential due to these reasons.

Methods

Research Design

The pedagogical experiment is based on the hypothesis that the development of innovative competencies of students of pedagogical HEIs in the process of independent work will be effective if the following pedagogical conditions are met: introduction of motivational ways to intensify independent work aimed at developing innovative competence of students of pedagogical HEIs; ensuring the organization of independent work of students of pedagogical HEIs through the information and educational environment; inclusion of students of pedagogical HEIs in independent work through performance of competence-oriented multilevel educational assignments. The respondent was presented two lists of values (18 in each) in alphabetical order. The subject assigned each value provided in the lists a rank number, and the cards were arranged in order of importance. A set of terminal values is presented first, followed by a set of instrumental values.

Table 1
Research plan

Stages of research and their objectives	The term of the stage	Diagnostic methods	Subjects
SUMMATIVE STAGE: - Development of a plan for the experiment; - Development of pedagogical conditions for acquiring innovative competencies; - Determining the initial level of innovative competence of students on the basis of selected methods.	September 2019 – December 2019	Methods of diagnosis of individual degree of manifestation of reflexivity.	125 second-year students
FORMATIVE STAGE - Verification of pedagogical conditions of effective functioning of the model for the development of innovative competence in students of pedagogical HEIs in the course of independent work.	January 2020 – December 2021	Method of organizing independent work of students.	125 second-year students
CONTROL STAGE: - Estimating efficiency of pedagogical conditions of functioning of the model and carrying out the analysis of the final level of innovative competences of students of pedagogical HEIs in the course of independent work. - Processing the results of the questionnaire, summarizing and developing recommendations and a plan for further research.	January 2021 – May 2021	Adapted questionnaire to assess the level of skills in students of pedagogical HEIs	125 second-year students

Source: compiled by the author

Sample

Experimental research was carried out from 2019 to 2021 at the National Pedagogical Dragomanov University (Kyiv). The study involved 125 second-year students majoring in Pedagogical Education, bachelor degree at the Faculty of Pedagogical Education. The experimental work covered students of six academic groups, which were divided into experimental (EG) and control (CG) groups. All respondents were warned about the need for an honest and impartial approach to the survey. The study was conducted on the general rules and principles of ethics. All respondents agreed to the processing of their personal data and the use of research results for the publication of the article. GoogleForm tools were used to conduct the survey. This stage involved 25 experts from among the teachers of the Faculty of Education and Science Management and the Faculty of Pedagogy.

Instruments

Google Forms were used for the survey. The data was entered and processed in Microsoft Excel and SPSS Statistics 18.0. All data are given in relative (% of the number of respondents) values. Respondents in the experimental and control groups were asked to

evaluate the judgments presented in the form, projecting the level of didactic skills necessary for the successful professional and pedagogical activities on a 9-point scale. The same judgments were proposed to the expert commission of teachers of educational organizations in order to assess the level of students' skills in practice (Foil, 2017).

To create an integrated view of the innovative potential of students, an adapted questionnaire was used to assess the level of skills in students of pedagogical HEIs and the method of diagnosing the individual level of reflexivity. The method of the Rokeach Value Survey (Foil, 2017) was used in order to identify the personal and professional values of students of pedagogical HEIs.

Statistical analysis

To determine the reliability of the coincidences and differences of the control and experimental groups, a quantitative analysis of the data was performed using Pearson's chi-squared test (χ^2) which is calculated by the formula:

$$\chi^2 = \frac{1}{n_2 n_1} \sum_{i=1}^m \frac{(x_i n_2 - y_i n_1)^2}{x_i + y_i} ;$$

where n_1, n_2 – the number of students in the first and second compared series;

m – the number of levels in the compared data series;

x_i, y_i – frequency values at the i th level in the first and second data series;

χ^2_{emp} – empirical value of the level of didactic competence.

Pedagogical conditions were created for the students of the experimental group, which consisted in the introduction of innovative teaching methods. In the conditions of distance education the comprehensive use of multimedia means, innovative methods of teaching and assessment of educational achievements are offered. Students from the control group gave traditional lectures, which were broadcast remotely via Viber and GoogleClass. The generalized characteristic of the levels of cognitive criterion of innovative competence of students of pedagogical HEIs in experimental and control groups is presented below:

High level — the student is able to transform the conditions for the purposes of professional educational activities and create the missing ones, which allows seeking and finding a way out of problematic situations. Knowledge is conscious, transferred to the internal reserve, that is it becomes a value for the student.

Medium level — the student tries to analyze and summarize the acquired knowledge,

to apply them in practice. He/she is fully aware of his/her actions and capabilities, the ability to set goals, determine ways to achieve them, make decisions and take some responsibility. The integrity of knowledge is not manifested.

Low level — a student has knowledge of the substantive and procedural foundations of the essence of the learning process, but he/she does not see the possibility of applying this knowledge in practice. A student acts intuitively and stereotypically in difficult situations. The system of value orientations determines the content of the orientation of the individual and is the basis of his/her attitude to the world, to other people, to himself/herself, the basis of worldview and the motivation of life activity, the basis of life concept and “philosophy of life”. In this case, Rokeach distinguishes two classes of values: terminal — beliefs that the ultimate goal of individual existence is worth striving for; and instrumental — beliefs that any course of action or personality trait is best in any situation (Abele et al., 2017). All research methods and tools are proven and reliable. The proposed questionnaires have been repeatedly used in pedagogical research and have shown high results.

Ethical criteria

The study is based on the principles of respect for the individual, gender equality, anti-discrimination on all grounds. All stages of the pedagogical experiment correspond to the generally accepted academic ethical principles of research work. All respondents were warned about the need to answer testing questions honestly. Respondents previously agreed to the processing of personal data and the publication of research results in scientific papers.

Results

The results of the diagnostic study at the stage of the summative experiment are shown in Tables 2 and 3.

Table 2
Terminal values of students

Rank	Value	Result (%)
PROFESSIONAL ACOMPLISHMENT		
1	A Comfortable Life	25.9
2	Interesting work	21.43
3	Health	12.50
4	Family Security	11.60
5	<u>Pleasure</u>	10.71
6	True <u>Friendship</u>	7.15
7	A Sense of Accomplishment	6.24
8	<u>Happiness</u>	4.47
STUDENT'S PERSONAL LIFE		
1	Mature <u>Love</u>	16.96
2	Social Recognition	12.50
3	Development	12.50
4	<u>Freedom</u>	10.70
5	Productive life	10.72
6	Activity	9.82
7	Creativity	8.92
8	Learning	8.03
9	<u>Wisdom</u>	6.24
10	A World of <u>Beauty</u>	3.57

Source: compiled by the author based on the survey results

Table 3
Instrumental values of students

Rank	Personal values	Result (%)
1	Independence	13.32
2	Intellect	10.71
3	Broad-mindedness	9.82
4	Cheerfulness	8.03
5	Intolerance of shortcomings	8.03
6	Ambition	7.15
7	Capability	6.24
8	Courage	6.24
9	Self-control	5.36
10	Manners	2.68
11	Responsibility	3.57
12	Strong will	3.57
13	Honesty	3.57
14	Rationalism	3.57
15	Tolerance	2.68
16	Diligence	1.79
17	Cleanliness	0.90
18	Politeness	0.90

Source: compiled by the author based on the survey results

According to the level of the cognitive criterion of innovative competence of students, the results in the experimental and control groups were almost the same (Figure 1).

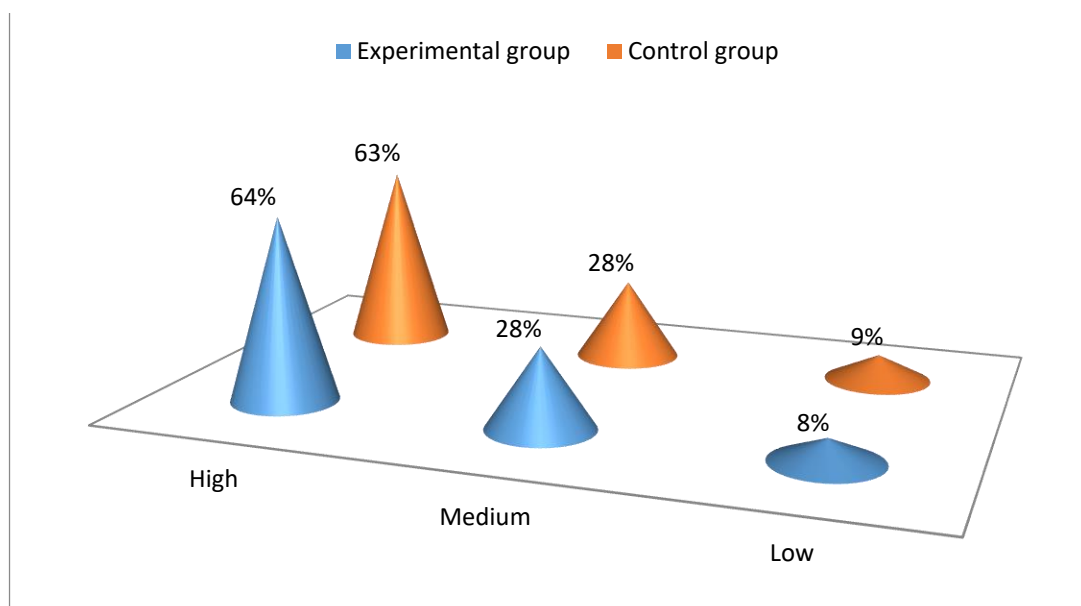


Figure 1. The level of the cognitive criterion of innovative competence of students, %
 Source: Compiled by the author based on the survey results

The analysis of the results allows us to conclude that the cognitive criterion of innovative competence of students of pedagogical HEIs is mostly at a high level. The level of operational and technological criteria of didactic competence of students of pedagogical HEIs is determined by means of the methods directed on revealing various professional skills (gnostic, design, constructive, communicative, organizational). Students were asked to determine the degree of agreement or disagreement with the above statements on a 9-point scale. Then the key was used to determine the sum of points on each of the subscales. The results of the diagnosis are presented in Figure 2.

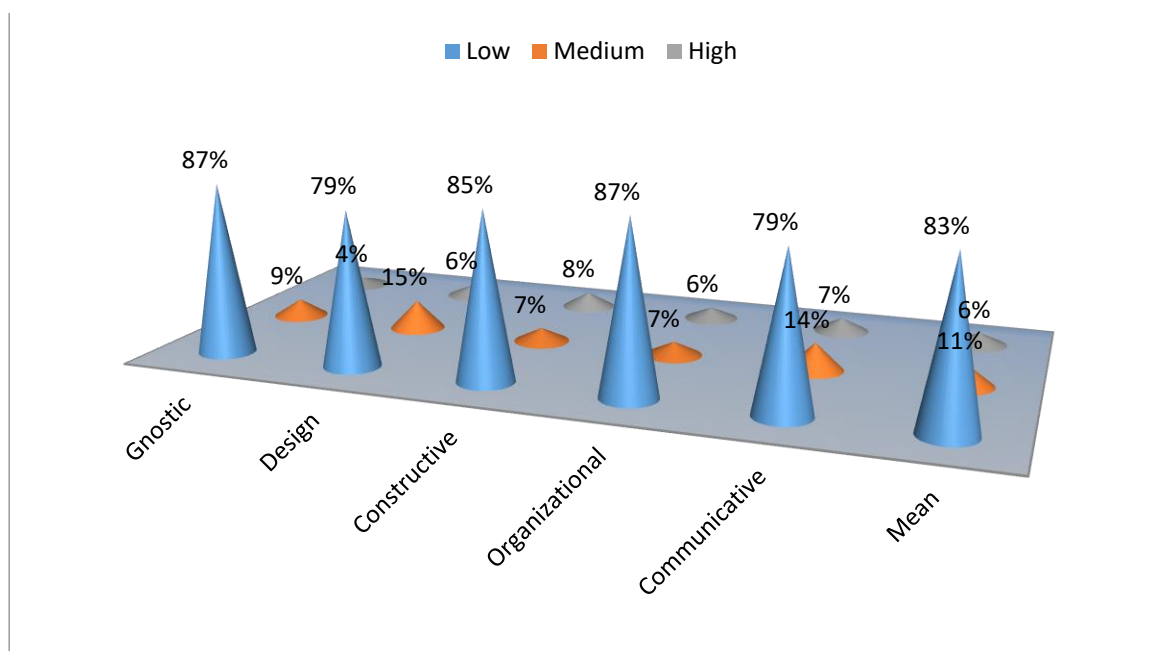


Figure 2. The level of pedagogical skills of students in the experimental group, %
Source: Compiled by the author based on the survey results

Based on the results of the diagnosis, it was concluded that the students were distributed according to the level of pedagogical skills as follows. High level - 6%. The student believes that he/she has enough internal resources to support, provide and implement educational activities. Medium level — 10%. Educational activity for a student is the performance of a series of interrelated pedagogical functions to resolve theoretical situations and solve practical problems. The student already has the knowledge for educational activities, but is not able to fully apply it. Low level — 83%. The student is characterized by “closed” professional position, in which the student is considered as a subject of pedagogical influence, that is relations with students are strictly regulated, formal. Students have no interest in educational activities. The student cannot set goals, make free choices, does not want and cannot take responsibility for making didactic actions and decisions.

Respondents in the experimental and control groups were asked to evaluate the judgments presented in the form, projecting the level of didactic skills necessary for their successful professional and pedagogical activities on a 9-point scale. The same judgments were proposed to the expert commission of teachers of educational organizations in order to assess the level of didactic skills of students in practice (Figure 3).

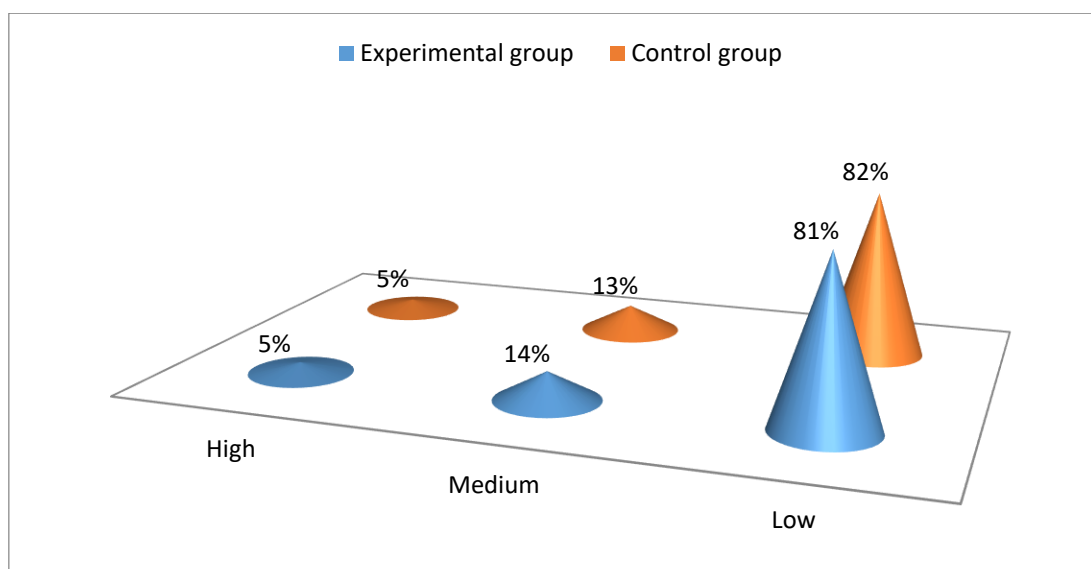


Figure 3. The level of operational and technological criteria of students in the experimental and control groups, %

Source: Compiled by the author based on the survey results

The analysis of the averaged results allows us to conclude that the level of operational and technological criteria of didactic competence of students of pedagogical HEIs in the experimental and control groups is mostly at a low level. The share of high level is insignificant. Based on the survey results, we present the levels of reflexivity of the respondents in the experimental and control groups (Figure 4).

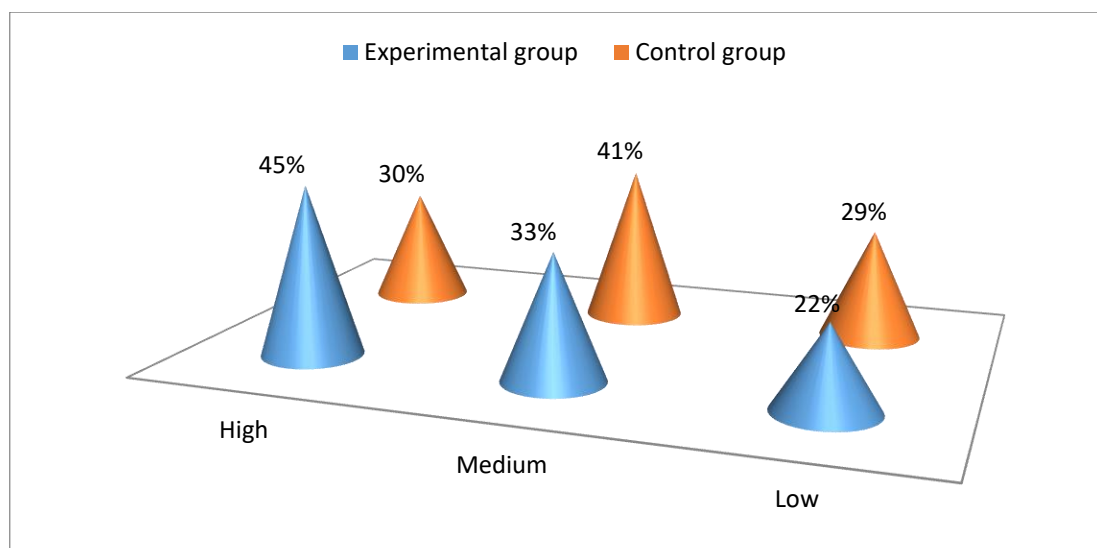


Figure 4. The level of reflexivity of students in the experimental and control groups, %

Source: Compiled by the author based on the survey results

As can be seen from Figure 4, the experimental group shows higher results in the level of reflexivity than the control one. The results of the survey according to the selected method in the experimental and control groups showed that the majority of respondents have a medium level of individual measure of expression of reflexivity. This fact indicates the correct personal development, a stable position in their socio-cultural group and the absence of pronounced conflicts with the team. This has a beneficial effect on the students' ability to carry out effective pedagogical activities, as reflection is an integral part of the personality of a professional.

We will compare this value with the critical value of χ^2 . In this paper, $L=3$ (there are three levels of knowledge — low, medium and high). Therefore, $L-1=2$. The critical value of the criterion χ^2 for $L-1=2$ at a significance level of 0.05 is equal to $\chi_{20.05}^2=5.99$. If $\chi^2_{\text{empirical}} > \approx 2 \cdot 0.05$, we can conclude that there is a difference between the compared results. Otherwise, we cannot talk about significant changes. To determine the coincidences and differences of the survey results in the control and experimental groups, we conducted a quantitative analysis of the obtained data using the statistical criterion — Pearson's chi-squared test (χ^2). The results of calculations and comparison of the values Pearson's chi-squared test before and after the experiment in CG and EG are presented in Table 4.

Table 4

Comparison of the values of Pearson's chi-squared test before and after the experiment in CG and EG

Criterion	Group	The value of χ^2 when comparing the states of the group before and after the experiment	Does the value of χ^2 exceed the critical threshold ($\chi_{\text{critical}} = 5.99$ at $df = 2$ and error levels 0.05)?	Can we talk about changes before and after the experiment?
Motivational and value	CG	0.2124	-	-
	EG	38.707	+	+
Cognitive	CG	0.3892	-	-
	EG	57.343	+	+
Operational and technological	CG	0.3301	-	-
	EG	77.345	+	+
Evaluative	CG	0.2444	-	-
	EG	6.1958	+	+
Initial innovation component	CG	0.24469	-	-
	EG	40.696	+	+

Source: compiled by the author based on the survey results

For the control group, the value of χ^2 when comparing the state of the group before and after the experiment does not exceed the critical threshold, therefore, we cannot talk about the radical changes before and after the experiment ($\chi^2_{\text{empirical}}=2.20 < \chi_{\text{critical}}=5.99$). For the

experimental group, on the contrary, the criterion χ^2 exceeds the critical threshold, therefore, we can say that there were significant changes in this group ($\chi^2_{\text{empirical}} = 9 > \chi^2_{\text{critical}} = 5.99$).

Discussion

The purpose of the study was to test the pedagogical conditions aimed at developing innovative competencies of students. When analysing the results of the study in the experimental group, it was found that χ^2 calculated for the results of the survey before and after the experiment, exceeds the critical threshold. For the control group, Pearson's criterion, on the contrary, is small. This suggests that the approach to the organization of independent work on the development of innovative competence in students of pedagogical HEIs within the verified pedagogical conditions shows a positive effect. This coincides with the results of Anderson (2019), who showed high efficiency of independent work. Instead, the study of Bautista García-Vera (2021) shows the low efficiency of independent work in the development of innovative competencies. In the control group, significant changes in the comparison of results before and after the experiment are not observed.

So, in the course of experimental work on verification of pedagogical conditions of effective functioning of the model of development of innovative competence in students of pedagogical HEIs, its diagnostics at the summative and control stages of experiment it was established that students of experimental group achieved more significant results on all selected criteria. That was confirmed by quantitative analysis of the obtained data of the control and experimental groups using the statistical criterion — Pearson's chi-squared test (χ^2). These results coincide with the data of the study conducted by Khimmataliev et al. (2021), which showed the high efficiency of the development of innovative competencies. Instead, studies by Dustnazar et al. (2021) and Ellingsen et al. (2021) note the existence of significant problems in the development of innovative competencies of students.

The positive motivation of students of pedagogical HEIs for independent work was formed through a system of influences organized in the course of formal and informal education and aimed at increasing interest in independent work, which contributes to the development of didactic competence as an effective means of success in the pedagogical profession; the development of a positive attitude to independent work of students, as well as the support of the desire to improve their professional activities. This statement is confirmed by studies of Ghadge et al. (2020) and Li-Wei et al. (2021), who note the important role of motivation in the development of innovative competencies.

The classes with the use of computers were the most relevant and useful. Distance

learning technologies have offered several ways to intensify motivational activity. Web quest is one of the effective dynamically developing forms of distance learning technologies in the context of providing everyone with the opportunity to master the subject to the extent that is relevant to his/her professional activities, and the orientation of professional education on the development of didactic competence of students of pedagogical HEIs. Pavelkiv and Korchakova (2021) note the need to use the latest forms and methods of teaching.

The obtained data allow us to conclude that significant changes are taking place at all levels of the development of innovative competence in students of pedagogical HEIs in the course of independent work in the experimental group. The study of the problem of the development of innovative competence in students of pedagogical HEIs in the course of independent work established that it is one of the most urgent in pedagogical science. These data coincide with the results of Skrypnyk (2021) and of Stetsenko and Tkachuk (2021), which indicate the effectiveness of the organization of independent work in the development of professional innovative competencies in students of HEIs.

The most important methodological prerequisites for the development of didactic competence in students of pedagogical HEIs in the course of independent work are systemic, personality-oriented and activity-competence approaches, which were the basis for the development of conceptual provisions of this process in the study. It is reasonable to assume that innovative competence is a key component of a teacher's professional competence. Innovative competence of students of pedagogical HEIs is an integrative quality of personality, which includes a set of personal and professional values and motives, knowledge of the substantive and procedural foundations of the learning process, as well as innovative skills that contribute to the implementation of educational activities.

The theoretical consequences of the study are the formation of a base for improving the educational and professional training of students to increase the effectiveness of training of future professionals. The purpose and content of improving the development of innovative competencies of students is expanding. The practicality of the results of the study is the formation of a system of educational and cognitive tasks for the formation of innovative professional competencies of future professionals.

The main limitations of the study are the difficulty of identifying the results of the study due to the limited sample of students. The difficulty also lies in the development and use of modern multimedia technologies, the adequacy of the methods used for the task of research, taking into account the needs of modern education. Due to the quarantine caused by COVID-19 pandemic, it was difficult to test the research materials in the real educational process. Future

research should be aimed at developing various competencies of future professionals. Particular attention should also be paid to the formation of separate, specialized competencies that are necessary for the training of specialists in various fields.

Conclusions

The research is topical due to the versatility and inexhaustibility of the issue of the development of professional competencies in students. In the 21st century, technological changes are constantly taking place, which requires future professionals to be in line with all current innovations. The educational management of HEIs must be the first to meet all the latest challenges of the changing technological world. That is why the need to constantly improve the methods of acquiring innovative competencies will never lose its topicality and scientific novelty. Based on the processing of the obtained results, it was concluded that the motivational and value criterion of the development of innovative competencies in students of pedagogical HEIs in the experimental and control groups are at a low level in 7.6% of respondents, at a medium level in 82.6%, and 9.8% of respondents have a high level.

The experimental group (45%) showed a higher level of reflexivity results than the control group (30%). So, the research hypothesis was confirmed: the level of innovative competencies increases under the pedagogical conditions described in the study. The results of the study may be of interest to both students of HEIs and teachers who are involved in improving the level of education. Further research should be aimed at identifying the main relevant innovative competencies. It will also be appropriate to study the most effective methods of developing innovative competencies in students of HEIs. Another direction for further research is studying the necessary and sufficient pedagogical conditions for the development of innovative competencies.

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