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METHODOLOGY OF SITUATIONAL MODELING IN THE EDUCATIONAL PROCESS OF HIGHER EDUCATION

METODOLOGÍA DE MODELACIÓN SITUACIONAL EN EL PROCESO EDUCATIVO DE LA EDUCACIÓN SUPERIOR

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ABSTRACT

The article substantiates the content of the methods of situational modeling. Situational modeling is considered as an imitation of a situation or process, a specific real thing, which involves reproducing the behavior of participants in the educational process by the selected situation of some key properties in other words, these are role-playing games with clearly defined roles, where the model of learning in the game is the basis of the methods of situational modeling, that is, the educational process is built as a model of processes, situations, phenomena being studied. The main methodological approaches and progressive situations when using situational modeling methods in the educational process of higher education are considered. Such main methodological approaches and progressive situations were applied in the development and use of the situational modeling method in the educational process of higher education. Implementing the situational modeling method in the educational process of higher education was preceded by compliance with the developed pedagogical conditions. At the formative stage of the experiment, the developed situational modeling methodology (compared to the traditional teaching methodology) for the formation of students' knowledge and skills showed significant effectiveness.

Keywords:

Situational modeling methodology, Higher education institutions, Situational modeling methods, Methodological approaches, Progressive situations.

RESUMEN

El artículo fundamenta el contenido sustantivo de los métodos de modelado situacional. El modelado situacional se considera como una imitación de una situación o proceso, una cosa real determinada, que implica reproducir el comportamiento de los participantes en el proceso educativo de acuerdo con la situación seleccionada de algunas propiedades clave, o en otras palabras, estos son juegos de rol con roles claramente definidos, donde el modelo de aprendizaje en el juego es la base de los métodos de modelado situacional, es decir, el proceso educativo se construye como un modelo de procesos,

situaciones, fenómenos en estudio. Se consideran los principales enfoques metodológicos y situaciones progresivas en el uso de métodos de modelado situacional en el proceso educativo de la educación superior. Estos enfoques metodológicos básicos y situaciones progresivas se aplicaron en el desarrollo y uso de la metodología de modelado situacional en el proceso educativo de la educación superior. La implementación de la metodología de modelado situacional en el proceso educativo de la educación superior fue precedida por el cumplimiento de las condiciones pedagógicas desarrolladas. En la etapa formativa del experimento, la técnica de modelado situacional desarrollada (en comparación con los métodos de enseñanza tradicionales) mostró una eficacia significativa en la formación de conocimientos y habilidades de los estudiantes.

Palabras clave:

Metodología de modelado situacional, Instituciones de educación superior, Métodos de modelado situacional, Enfoques metodológicos, Situaciones progresivas.

INTRODUCTION

The rapid growth of information and global transformations in society requires higher education to have a wide range of skills, knowledge, developed student intelligence, the ability to self-development, and continuous self-education of each individual. Real prerequisites for updating the higher education system have created socio-economic transformations on a global scale, which is reflected in the professional training of future specialists in the use and creation of innovative technologies. Among pedagogical technologies, it is the technologies of situational modeling that meet the needs of participants in the learning process and the modern educational situation in higher education, because they help students use and search for new forms of educational interactions (Kobiuk, 2015).

Rapid, profound, socio-economic, innovative, and educational transformations in the life of society encourage reformative actions in the educational process, modernization of vocational education in higher education to train competitive specialists in all fields, form in their creative professional activity, the ability to self-education, build a successful career, and flexible adaptation to the conditions of the professional environment (Volkova & Tarnopolsky, 2013). Modeling the professional activity of a future specialist is one of the ways to solve innovative problems in teaching academic disciplines to students of higher education institutions, and the use of situational modeling methods in the educational process of higher education is a relevant and necessary issue of today.

Materials and methods

The essence of the situational method of teaching, its features, and its processes are revealed by Lobachuk (2018). When preparing students for foreign language communication, the scientist substantiated the feasibility of using the situational method and proved that the formation of the necessary communicative competence involves the situational method in the areas of professional communication in written and oral form, which is implemented through the use of role-playing games. When applying the situational method of teaching, the importance and role of the effective use of role-playing communicative games in teaching a foreign language were determined. The scientist Kashynska (2011) defines the concept of role-playing games, and role-playing communicative games and characterizes the model of learning in the game. In the educational process of higher education, the conditions for using situational modeling technology are considered and a clear example of the use of such technologies is given during the teaching of professional disciplines.

The study of situational modeling methods is devoted to the study of Kobiuk (2015), as a type of interactive technology. In the development of the modern system of higher education and priority areas of society, the importance of situational modeling methods, as well as interactive technologies, games, and business games, is shown. It is determined that situational modeling methods “are capable of forming an active, creative, self-sufficient personality capable of self-development and self-education” throughout life.

Theoretical and practical issues of situational modeling are considered as modeling of professional activities of students of higher educational institutions in teaching professional disciplines by Volkova (2013). The author conducted a practical, theoretical, detailed analysis of the main types of educational activities that provide modeling of professional activities of students (collective creative works, project work, brainstorming, debates, cases, business and role-playing games, discussions).

However, despite scientific research, the issue of using situational modeling methods in the professional training of future specialists has not been sufficiently studied.

RESEARCH PURPOSE: development and use of situational modeling methods in the educational process of higher education to train competitive specialists in all fields, form their creative professional activity, ability for independent education, build a successful career, and flexible adaptation to the conditions of the professional environment.

To achieve the research goal, the following methods were used:

search and bibliographic method – to study the pedagogical experience of professional training of future specialists and to process scientific and methodological sources;

generalization, analysis, systematization, synthesis – to reveal the theoretical provisions of the study and determine the degree of development of the problem of using situational modeling methods in the educational process of higher education;

interview, questionnaire of future specialists – to determine the feasibility of using situational modeling methods in the educational process of higher education and to correct the content of methodological materials;

observation of the educational process of higher education – to obtain high-quality empirical material;

ascertaining and formative stages of the pedagogical experiment – to verify the effectiveness of the proposed methodology and pedagogical conditions of situational modeling in the professional training of future specialists;

methods (Student's criterion) of mathematical statistics – to verify the reliability and comparison of the results of the study;

generalization methods – to formulate conclusions.

Verification of the proposed hypothesis became the goal of the pedagogical experiment. According to the hypothesis, in the context of student-centered and competency-based approaches to organizing a high-quality educational process, to train competitive qualified specialists, it is necessary to introduce the situational modeling methodology into the educational process of higher education.

The organization of the experimental stage of the study provided for:

formation of control and experimental groups;

determination of the basis for conducting a pedagogical experiment;

establishment of the initial state (level) of the quality of professional training of future specialists and statistical verification of their similarity in the experimental and control groups;

introduction of the situational modeling methodology (formative stage of the pedagogical experiment) into the process of professional training of students in the experimental group;

after the completion of the formative stage of the experiment – final quality control (in the control and experimental groups) of professional training of future specialists.

Statistical verification, analysis of the results of the pedagogical experiment, and formulation of conclusions regarding the need to introduce the situational modeling methodology in the professional training of students were carried out at the generalization stage of the study.

A control group and an experimental group of students were selected for the study. The total number of participants in the experiment was 112 people: 52 participants in the control group and 60 participants in the experimental group. This number met the conditions for the representativeness of the results and statistical reliability of the pedagogical experiment.

Full-time students and only second-year students were involved in the experiment, therefore, additional clarification of the demographic characteristics (age and gender) of the sample was not carried out in the context of this study because we consider it insignificant. To ensure the psychological comfort of the participants in the pedagogical experiment, the anonymous division of higher school students into the experimental group and the control group, surveys, and questionnaires were carried out.

On the quality of the educational process, reliable detection of the influence of a new factor is possible only in the case of equality of the initial conditions for the experimental group and the control group. The statistical criterion for checking the similarity of the experimental group and the control group – participants in the pedagogical experiment – was chosen as the Student criterion.

Using MS Excel software, intermediate calculations were made (variance values and arithmetic mean values of indicators).

By confirming one of the formulated hypotheses, a comparison of two groups was carried out:

H0 hypothesis – the groups are similar in terms of the level of formation of skills, the level of knowledge acquisition, and the level of professionally oriented motivation.

H1 hypothesis – the groups have significant differences in terms of the level of formation of skills, the level of knowledge acquisition, and the level of professionally oriented motivation.

The calculation of t_e involved testing the hypotheses and comparing them with the tabular critical value t_{table}. Further comparison of the control and experimental groups would be appropriate in the case of confirmation of hypothesis H0 ($t_e \leq t_{table}$). Such a comparison would be unacceptable in the case of confirmation of hypothesis H1 ($t_e \geq t_{table}$).

Criteria and indicators of the quality of professional training of students at the bachelor's level were proposed.

During the diagnosis of students, we previously identified the levels of quality of professional training of students.

The verification of the hypotheses H0 and H1 and the calculation of the Student criterion values were carried out for each criterion separately for the results of the quality of professional training of students.

The results of determining the quality of professional training of students of the experimental group and the control group at the beginning of the experiment showed that students of both the control and experimental groups were characterized by low levels of both the formation of skills and the assimilation of knowledge and an average level of professionally-oriented motivation. The low level of assimilation of knowledge is justified, since at the time of the study, students had not yet mastered the method of situational modeling in the educational process of higher education.

The implementation of the method of situational modeling in the educational process of higher education was preceded by compliance with the developed pedagogical conditions.

The ascertaining stage of the experiment allowed the development of all pedagogical conditions for the implementation of the developed method of situational modeling. After this, it became possible to introduce the situational modeling tools we developed into the training of EG students.

In the educational process of higher education, the situational modeling methodology was implemented by students of the experimental group, and the training of students of the control group took place using traditional teaching methods and did not undergo any changes.

At the formative stage of the experiment, the developed situational modeling methodology (in comparison with the traditional teaching methodology) for the formation of students' knowledge and skills had significant effectiveness.

In the experimental group, the average values of the indicators for each of the identified criteria increased more significantly. The reliability of the obtained results was checked using the Student's criterion. Statistical verification of the data revealed that the results of the formative stage of the experimental study were not random, i.e. $t_e > t_{table}$, and significantly differed for the two groups for each criterion with a reliability of 95%. The obtained results gave grounds to show the importance of the developed situational modeling methodology in preparing students for professional activity; to confirm the main and additional working hypotheses of the study; and to develop practical recommendations for higher education institutions.

RESULTS AND DISCUSSION

The content of situational modeling methods.

We consider situational modeling methods as ways of including higher education students in the game educational activity in the process of using games or situations created by the teacher, in the process of which higher education students model situations with step-by-step execution in a certain professional activity and a clear distribution of roles; play out a public hearing in the process of a certain production situation to resolve the conflict with a minimum number of participants; to form the skills of performing functional duties, students imitate the roles of a specific specialist (Panchenkov et al., 2018).

Situational modeling is an imitation of a situation or process, a certain real thing, which involves reproducing the behavior of participants in the educational process by the selected situation of some key properties or, in other words, these are role-playing games with clearly defined roles.

The model of learning in the game is the basis of the methods of situational modeling, that is, the educational process is built as a model of processes, situations, and phenomena being studied (Semenikhina et al., 2020).

Increasingly, the term «game» is replaced by the terms: «imitation», «simulation», which is explained by the fact that it is the game, in educational activities, that is associated with recreation, and entertainment, while in didactics, certain roles are performed, modeling of the situation.

The modern educational process of higher education is represented by a wide list of interactive games: simulations, modeling, and role-playing games. Among them, situational modeling is more common in practice. In the process of such game methods, students are introduced to the situation according to a clear scheme, based on which they receive a game task for the performance of which the proposed roles are distributed and divided into groups (Plakhotnik et al., 2022).

Imitative or simulation games are another type of interactive game. When simple, specific actions are performed that imitate phenomena, processes, or situations in the surrounding reality, then the game will be an imitation game. The teacher provides clear step-by-step instructions, and the participants in the simulation follow the instructions. Students can work in small groups or individually. As a rule, the final result is similar for everyone, but its difference lies in the composition of the group, individual characteristics, resources used, etc. Reflection is an important stage of imitation (Kobiuk, 2015).

Main methodological approaches and progressive situations when using situational modeling methods in the educational process of higher education.

When implementing the educational process in higher education, to ensure high-quality training of students for the implementation of innovative future professional activities, we take the following methodological approaches as a basis:

Systemic. Allows you to harmonize the requirements of the individual and society, integrate all methodological approaches into a single whole to master the future profession;

Competency-based. Provides for the orientation of the pedagogical process in higher education to the development and formation of students' subject competencies, which are laid down in the educational and qualification characteristics of a specialist; basic key concepts;

Personal. Requires the teacher to always focus on the individuality of a person, originality, uniqueness, and experience. Highlights essential features: humane subject-subject cooperation of participants in the educational process in higher education; activity-communicative activity of students, diagnostic-stimulation method of educational cognition; development and self-development of a person; design by the teacher of individual achievements of sensitive development of students in all types of activity (later also by students); consideration in the methods of the range and content of personal capabilities and needs of a person in obtaining a quality education. The formation of the ability and desire of students to learn independently is the result of a personally oriented type of learning, as well as striving for creativity and self-development, finding various sources of information and applying new knowledge, developing the ability to act;

Activity. Activity determines the formation of consciousness and all mental processes in the student, which are a condition for further improvement of a person, as regulators of activity. The combination of various complexity and numerous components leads to the involvement of the subject in the activity in a functional psychological system of activity. The active creative professionally directed activity becomes a means of development and training of the personality, where the student not so much acquires ready-made skills, abilities, and knowledge, but masters the methods of this assimilation, develops his own creative potential, forms thinking, and activity, relationships with the objective world, professional qualities, with himself and with other people;

Humanistic-culturological. Education is carried out under this approach in the context of national and world culture; as the main subject and goal, the content of education is saturated with personality problems, supporting the student's identity and individuality, returning the educational process to the person; organization of learning as a vital activity of students and teachers, promoting the development of the student's subjective properties;

Integration. This approach applies to different levels: isolation of leading concepts of an interdisciplinary nature; to form a single picture of the world in students – integration of the content of academic disciplines; determination of ways to develop concepts of the educational space; integration by strengthening the connections of practical and theoretical material. The approach is implemented through the organization of training, and principles of education, which ensure the convergence of the educational process in higher education with the professional activities of future graduates through modeling in the teaching of such activities;

Synergistic. Contributes to the substantiation of the phenomena of self-organization; substantiation of the phenomena of global evolution, processes of evolution, and processes of instability as a fundamental characteristic of evolution.

The methodological foundations are these approaches, which create the opportunity for the direct implementation of methods for modeling the professional activities of future specialists into the educational process (Volkova & Tarnopolsky, 2013).

Let's consider the main situations that we use in the process of situational modeling:

Educational situation. Higher education students learn to solve diverse tasks of future professional activity by playing a simulated professional situation in classes;

Situation-presentation of the material. Higher education students implement the introduction of a new professional model in the conditions of a professional activity situation (Tsymbrovska, 2015).

Within the educational environment, the main component of interaction between students and the teacher is the process of modeling learning situations, which involves the transformation of the components of the learning process into their own parameters and the establishment of its objects. At the same time, when modeling situations as a means of learning, the teacher must take into account the following factors: the purpose of the lesson, the professional preparedness of students, and the tasks of the lesson (Bernatska, 2004).

In the future real pedagogical activity and target orientation, the selection of situations should be carried out taking into account the probability of similar situations. With their help, certain vocabulary, grammatical phenomena, samples, formed knowledge from psychological and pedagogical disciplines, skills, and abilities to use them can be activated. At the same time, the process of modeling educational situations itself takes place in a certain sequence (step by step) (Kuchai et al., 2022).

We distinguish three stages of the process of modeling educational situations:

preparatory, which is associated with the methodical development of a fragment of the lesson and planning methods, forms, and means of modeling educational situations;

analytical, which consists in the formation of the situation itself, which needs to be solved, the teacher's assessment and analysis of the educational process, in interaction with students regarding the task;

executive, associated with the practical reproduction of the situation developed by the teacher and with the implementation of the plan, as well as its solution by students (Puhach et al., 2021).

Situational modeling of the educational process involves immersing students in a specific situation, where they can practically apply their knowledge. The basis of this methodology is situational modeling – modeling of specific situations, during interaction with which the participant makes a choice, makes personal decisions, and learns the material (Biletska et al., 2021).

Situational modeling allows the participant of the educational process to check their reactions in certain life circumstances, and their own behavior models, which is especially relevant in professional situations. The use of the method of situational modeling of the educational process gives the entire development of the group process an exceptionally strong impetus, since, having comprehended, experienced, and gone through various situations, the participant is interested in sharing his experiences with the group, his observations or discussing behavior models with others, hearing the comments of others and the reflections of the participants (Shuliak et al., 2022).

For specific situations, the essence of the teaching methodology is reduced to the widespread use of a bank of ready-made solutions, and practical situations and is focused on solving situational problems.

The use of the situational modeling technique contributes to the ability to build a reasoned response, the acquisition of cooperation skills, creative communication in a team, the formation of a sense of responsibility for completing tasks, and effective and rapid assimilation of grammatical and lexical material. When teaching with a problem-based approach, the teacher will focus on presenting the material that will be most useful to students in their future professional activities, and students have the opportunity to practice the practical application of knowledge close to real life in certain situations (Lobachuk, 2018).

Such basic methodological approaches and progressive situations were applied to us when using the situational modeling methodology in the educational process of higher education.

Organization of the experimental stage of the study.

Verification of the hypothesis put forward became the goal of the pedagogical experiment. According to the hypothesis, in the context of student-centered and competency-based approaches to the organization of a high-quality educational process, to train competitive qualified specialists, it is necessary to introduce the situational modeling methodology into the educational process of higher education.

The organization of the experimental stage of the study provided for:

formation of control and experimental groups;

determination of the basis for conducting a pedagogical experiment;

establishment of the initial state (level) of the quality of professional training of future specialists and statistical verification of their similarity in the experimental and control groups;

introduction of the situational modeling methodology (formative stage of the pedagogical experiment) into the process of professional training of students of the experimental group;

after the completion of the formative stage of the experiment – final quality control (in the control and experimental groups) of the professional training of future specialists.

Statistical verification, analysis of the results of the pedagogical experiment, and formulation of conclusions regarding the need to implement the situational modeling methodology in the professional training of students was carried out at the generalizing stage of the study.

A control group and an experimental group of students were selected for the study. The total number of participants in the experiment was 112 people: 52 participants in the control group and 60 participants in the experimental group. This number met the conditions for the representativeness of the results and statistical reliability of the pedagogical experiment.

Full-time students in the second year of education were involved in the experiment, therefore, additional clarification of the demographic characteristics (age and gender) of the sample was not carried out in the context of this study because we consider it insignificant. To ensure the psychological comfort of the participants of the pedagogical experiment, the anonymous division of high school students into the experimental group and the control group, surveys, and questionnaires were carried out.

Reliable detection of the influence of a new factor on the quality of the educational process is possible only in the case of equality of the initial conditions for the experimental group and the control group.

The Student criterion was chosen as the statistical criterion for checking the similarity between the experimental group and the control group – participants of the pedagogical experiment.

Using MS Excel software, intermediate calculations were made (variance values and arithmetic mean values of indicators).

By confirming one of the formulated hypotheses, a comparison of two groups was carried out:

H0 hypothesis – the groups are similar in terms of the level of formation of skills, the level of knowledge acquisition, and the level of professionally oriented motivation.

H1 hypothesis – the groups have significant differences in terms of the level of formation of skills, the level of knowledge acquisition, and the level of professionally oriented motivation.

The calculation of t_e involved testing hypotheses and their comparison with the tabular critical value t_{table}. Further comparison of the control and experimental groups would be appropriate in the case of confirmation of hypothesis H0 ($t_e \leq t_{table}$). Such a comparison would be unacceptable in the case of confirmation of hypothesis H1 ($t_e \geq t_{table}$).

Testing of the hypotheses H0 and H1 and calculation of the values of the Student criterion were carried out for each criterion separately for the results of the quality of professional training of students.

The criteria and indicators of the quality of professional training of students at the bachelor's level are proposed:

Criterion – the level of professionally oriented motivation (indicator – the level of professional orientation);

Criterion – the level of knowledge acquisition (indicator – the coefficient of knowledge acquisition);

Criterion – the level of skills formation (indicator – the coefficient of skills formation).

The value of the t_{table} was 3.29 at a significance level of 0.001 for the calculated number of degrees of freedom. At the levels of – professionally oriented motivation, knowledge acquisition, and level of skills formation – the value of t_e calculated by us for comparing the samples was 0.67; 1.89, and 1.15, respectively. Therefore, $t_e \leq t_{table}$ in all three cases, and therefore, we are talking about confirmation of the H0 hypothesis, that is – the groups did not differ significantly according to the listed criteria, so it was legitimate to further compare them with each other.

During the diagnosis of students, we previously identified the levels of quality of students' professional training:

high level of professionally oriented motivation – students who scored 13 – 18 points were included;

average level of professionally oriented motivation – students who scored 7 – 12 points were included;

low level of professionally oriented motivation – students who scored 1 – 6 points were classified. Students who scored 0 points were classified as having a low level of professionally oriented motivation.

During the diagnosis of students, we previously identified the levels of quality of professional training of students:

Results of determining the quality of professional training of students of the experimental group and the control group at the beginning of the experiment.

The results of determining the quality of professional training of students in the experimental group and the control group at the beginning of the experiment by the level of professionally oriented motivation were as follows:

interest in the chosen profession and conscious choice of the specialty by students in the experimental group are seen in – 76% of respondents (high and medium level);

interest in the chosen profession and conscious choice of the specialty by students in the control group are seen in – 80% of respondents (high and medium level).

The general similarity of both groups was evidenced by the results of the study. We deliberately assigned students to the control group who had a higher level of professionally oriented motivation. This, in more stringent conditions, contributed to testing the effectiveness of the developed situational modeling methodology.

Based on the results of the study, we say that the low level of quality of professional training of students indicates an unsatisfactory state of preparation for professional activity, that is, on a 100-point scale:

a low level of quality professional training has a value within 0 – 59 points;

an average level of quality of professional training has a value within 60 – 81 points and indicates the formation of competencies and the achievement of learning outcomes by the applicant that meet the minimum requirements for professional activity, however, are insufficient for full-fledged autonomous activity;

a high level of quality of professional training has a value within 82 – 100 points and indicates a conscious decision since this result corresponds to the level of "above average".

After returning to the values of the coefficients from the 100-point scale, the correlation between the levels of knowledge acquisition and skills formation and the values of the coefficients of knowledge acquisition and skills formation, respectively, was found: 0.82 – 1.0 – high level; 0.6 – 0.81 – average level; 0 – 0.59 – low level.

The results of the study revealed a low level of knowledge acquisition in both study groups in the EG and CG, which is justified, since at the time of the study, students had not yet mastered the situational modeling methodology in the educational process of higher education. Some respondents showed an average level of knowledge acquisition.

Implementing the situational modeling methodology in the educational process of higher education was preceded by compliance with the developed pedagogical conditions.

Students' compliance with the pedagogical condition: "In the process of implementing the situational modeling methodology, taking into account the nature of the professional material" contributed to the implementation of the necessary developed methodological support, the choice of situational modeling methods by the content of the specialty, the use of cases, business games, and situational tasks.

To comply with the pedagogical condition «Ensuring the readiness of teachers to implement the situational modeling methodology in higher education through the use of innovative methodological support», a special course «Situational Modeling» was developed and conducted, on the implementation of the situational modeling methodology, contained general recommendations for the professional training of students: requirements for developing tasks, general principles, the choice of appropriate methods, an algorithm for organizing the classroom, preparatory, independent work of students and its assessment. The developed methodological support was proposed for teaching in experimental groups.

By surveying students of the control and experimental groups, at the ascertaining stage of the experiment, it was established that teachers in the educational process of higher education used little situational modeling methods and tools (professionally oriented tasks using situational tasks, cases, business games).

Therefore, for the implementation of the developed methodology, the following pedagogical condition was formulated: "To form students' readiness to work with situational modeling tools, it is mandatory to organize interactive interaction of participants in the educational process in higher education," which provided for the disclosure of the specifics of situational modeling methods (their algorithm, essence, analysis of tasks created based on situational modeling) and encouraging students and teachers to active classroom work and independent work.

So, the ascertaining stage of the experiment allowed the development of all pedagogical conditions for the implementation of the developed situational modeling methodology. After that, it became possible to introduce the situational modeling tools we developed into the training of EG students.

In the educational process of higher education, the situational modeling methodology was implemented by students of the experimental group, and the training of students of the control group took place using traditional teaching methods and did not undergo any changes.

The formative stage of the experiment.

Students in both the control and experimental groups were characterized by low levels of both skill development and knowledge acquisition and an average level of professionally oriented motivation at the beginning of the formative stage of the experiment.

Analysis of the results of the study at the formative stage of the experiment revealed a positive overall dynamics of increasing the level of professionally oriented motivation of students in the control group and the experimental group.

However, we observe significant differences like the positive overall dynamics for the control group and the experimental group.

So, in the experimental group, we have the following distribution (Figure 1):

the share of students in the experimental group who had a low level decreased by 14.8% (from 24% to 9.3%);

the share of students with an average level decreased by 14.7% (from 37% to 22.2%);

the share of students with a high level of professionally-oriented motivation increased significantly by 29.8% (from 39% to 68.5%).

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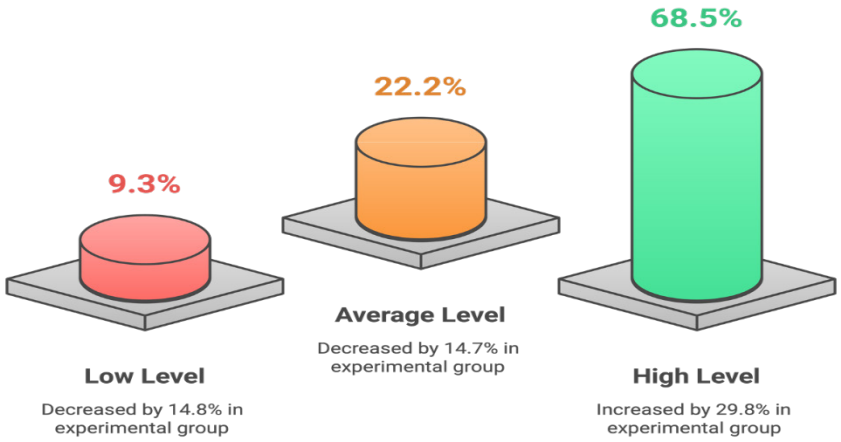
Fig 1: Distribution of Professionally-Oriented Motivation Levels in Experimental Group



Source: Own elaboration

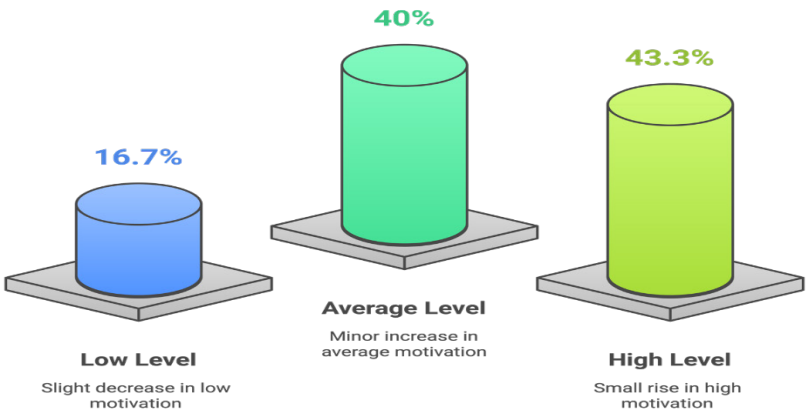
In the control group, we are talking about the following distribution of the research results (Figure2):

the share of students with a low level of professionally-oriented motivation decreased insignificantly, by 3.3% (from 20% to 16.7%);

the number of students with an average level increased insignificantly, by 1.8% (from 38.3% to 40%);

the number of students with a high level increased insignificantly, by 1.5% (from 41.7% to 43.3%).

Fig 2: Distribution of Professionally-Oriented Motivation Levels in Control Group



Source: Own elaboration

For both groups, the results obtained provided grounds for determining the following pattern: the experimental group students' interest and motivation in the chosen profession increased, which had a positive effect on the level of their professionally oriented motivation, increasing such motivation from average to high level and from low to average level, while the dynamics of growth of the level of professionally-oriented motivation in the control group students underwent insignificant changes.

The average values of the level of professionally oriented motivation were calculated using MS Excel for the control group students and the experimental group (by determining the average values of the level of professional orientation).

Thus, the average generalized value of the level of professional orientation of the experimental group increased to 12.8 points from 10.4 points (average level of professionally oriented motivation), which is close to a high level.

And, the average generalized value of the level of professional orientation of the control group increased less significantly: to 10.9 points at the end of the experiment from 10.8 points at the beginning of the experiment, which in general is close to the average level of professional-oriented motivation.

The results of the study, in general, revealed the similarity between the control group and the experimental group, which was additionally confirmed during the statistical verification of the data using the t criterion (Student's test). Since the results for each criterion $t_e < t_{table}$, with a reliability of 95%, the similarity of the control group and the experimental group was proven, this made it possible to involve respondents in further participation in the formative stage of the experiment.

Thus, during the statistical verification of the results obtained, two hypotheses were formulated:

H0 (null hypothesis) – the control group and the experimental group were similar in terms of levels of professional-oriented motivation.

H1 – the control group and the experimental group had significant differences in the levels of professionally oriented motivation.

The critical value of the t_{table} at a significance level of 0.05 is 1.98.

It was established that 2.6 > 1.98 (comparing t_{table} and t_e), i.e. $t_e \geq t_{table}$, which confirms the alternative hypothesis and proves that with a probability of 95%, the control group and the experimental group after completing the formative stage of the experiment had significant differences in the levels of professionally-oriented motivation of students.

Let us analyze the results of the study of the quality of professional training of students in the control group and the experimental group after completing the formative stage of the pedagogical experiment by the level of knowledge acquisition after using the situational modeling technique in the experimental group.

When analyzing the results of the study, we observe a general positive dynamics of increasing the level of knowledge acquisition in students in the control group and the experimental group. However, the nature of the dynamics of the control group and the experimental group had significant differences.

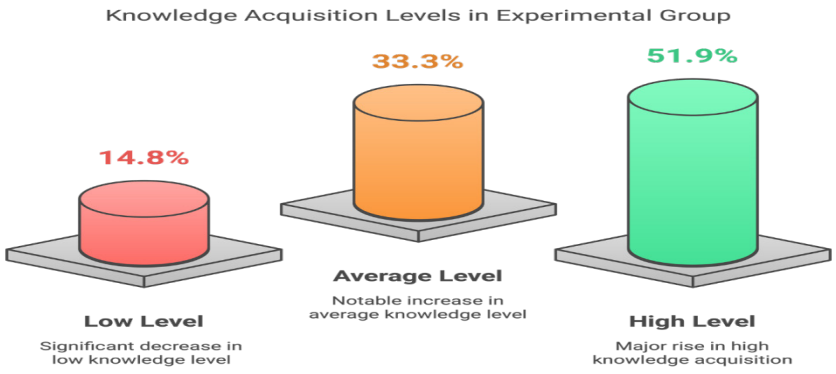
In the experimental group, the results of the experimental study had the following distribution (Figure 3):

the low level of knowledge acquisition among students decreased by 75.9% (from 90.7% to 14.8%);

the average level of knowledge acquisition among students increased by 25.9% (from 7.4% to 33.3%);

the share of students with a high level of knowledge acquisition increased by 50% (from 1.9% to 51.9%).

Fig 3: Knowledge Acquisition Levels in Experimental Group



Source: Own elaboration

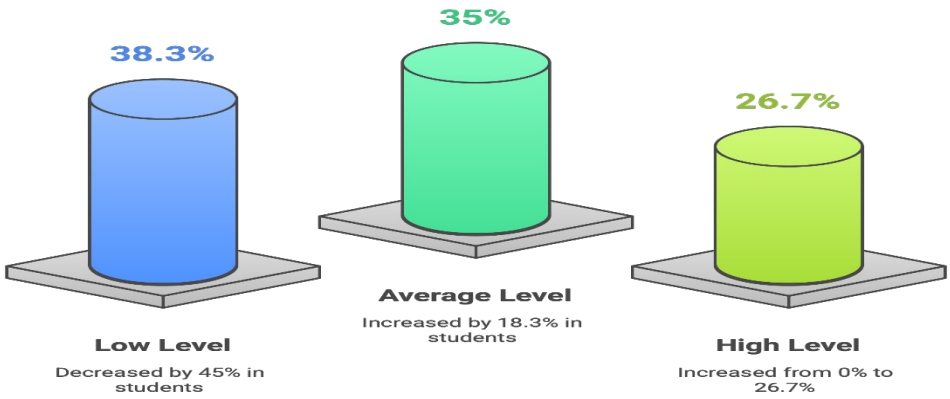
In the control group, the results of the experimental study had the following distribution (Figure 4):

the low level of knowledge acquisition among students decreased by 45% (from 83.3% to 38.3%);

the average level of knowledge acquisition among students increased by 18.3% (from 16.7% to 35%);

the share of students with a high level of knowledge acquisition increased by 26.7% (from 0% to 26.7%).

Fig 4: Knowledge Acquisition Levels in Control Group



Source: Own elaboration

Let us consider the dynamics of changes in the levels of knowledge acquisition of the control group and the experimental group. The share of students with a low level of knowledge acquisition in the experimental group showed a decrease of 75.9%, and for the control group, this indicator is – 45%. So, the use of the situational modeling technique in the experimental group, compared to the control group, allowed to reduce the number of students in the experimental group with a low level of knowledge acquisition by 30.9%.

As for the average level, the share of students in the experimental group increased by 25.9% instead of 18.3%. We see a slight increase in the control group in the number of students with an average level – the increase in the experimental group, compared to the control group, was 7.6%.

The share of students with a high level increased:

in the experimental group by 50%;

in the control group by 26.7%.

Thus, the situational modeling technique used in the training of students in the experimental group contributed (in comparison with the results of the control group) to an increase in the share of respondents with a high level of knowledge acquisition by 23.3%. This gave us grounds to speak about the effectiveness of the situational modeling technique developed by us in the professional training of students.

Further, calculations were made in the control and experimental groups of the average value of the quality of professional training of students (by determining the average values of the knowledge acquisition coefficient) by the level of knowledge acquisition.

The generalized average value of the knowledge acquisition coefficient for the experimental group increased – an increase in the studied indicator by 0.38 – from 0.42 (before the experiment) to 0.8 (after the experiment), which indicates a general increase in the level of knowledge acquisition from a low level to an average level. In the control group, we observe an increase from 0.45 at the beginning of the experiment to 0.67 at the end of the generalized value of the knowledge acquisition coefficient, which indicates an increase in the students' level of knowledge acquisition from low to medium (an increase of 0.22). The increase in the indicator in the experimental group is more significant.

To verify the statistical significance of the results obtained, a comparison of the experimental and control groups was carried out using the parametric t criterion.

The formulated hypotheses for comparing the two groups were as follows:

H0 (null hypothesis) – indicates similarity in the levels of knowledge acquisition of the experimental group and the control group;

H1 – there were significant differences in the levels of knowledge acquisition between the experimental group and the control group.

U = 112 – for this study, and at a significance level of 0.05, the critical value of the t table is 1.98.

Comparing t_{table} and t_e, we see that: 4.0 > 1.98, i.e. $t_e \geq t_{table}$. Therefore, the alternative hypothesis is confirmed.

The experimental and control groups with a probability of 95% in terms of the level of knowledge acquisition had significant differences.

Thus, we argue that the developed situational modeling technique (compared to the traditional teaching method) was more effective in forming knowledge in students.

The results of the study of the quality of professional training of students by the level of development of skills of the experimental and control groups after the completion of the formative stage of the experiment showed general positive dynamics. However, the nature of the dynamics for the experimental and control groups had significant differences.

Experimental group:

low level of skills formation decreased (from 100% to 16.7%) by 83.3%;

average level of students' skills formation increased by 53.7%;

high level of students' skills formation increased by 29.6%.

Control group:

low level of skills formation decreased by 56.7% (from 100% to 43.3%);

average level of students' skills formation increased by 41.7%;

high level of students' skills formation increased by 15%.

The dynamics of changes in the quality of students' professional training by the level of skills formation of the experimental group shows that here the low level of skills formation decreased by 83.3% among students, and by 56.7% among students of the control group. Thus, we see the difference between the indicators of the experimental and control groups, which is 26.6% in favor of the experimental group. That is, compared to the control group, the increase in the level of formation of skills of students in the experimental group was facilitated by the use of the developed situational modeling technique.

The share of students in the experimental group increased by 53.7% with an average level compared to the control group (by 41.7%). We see that the positive dynamics for the experimental group is 12% greater.

In students in the experimental group, a high level of formation of skills increased by 29.6%, and in students in the control group this indicator increased by 15%. Therefore, there are 14.6% more students with a high level in the experimental group than in the control group.

So, in the experimental group, the average values of the indicators for each of the criteria increased more significantly. The reliability of the results obtained was checked using the Student's t-test. Statistical verification of the data revealed that the results of the formative stage of the experimental study were not random, i.e. $t_e > t_{table}$, and significantly differed for the two groups for each criterion with a reliability of 95%. The results obtained provided grounds to show the importance of the developed situational modeling methodology in preparing students for professional activity; to confirm the main and additional working hypotheses of the study; to develop practical recommendations for higher education institutions:

take into account the results of the study at the methodological level when creating methodological support for the educational process in the preparation of future specialists of various specialties;

use the developed situational modeling methodology at the practical level during the professional training of students.

CONCLUSION

The substantive content of the methods of situational modeling is substantiated. Situational modeling is considered as an imitation of a situation or process, a certain real thing, which involves reproducing the behavior of participants in the educational process by the selected situation of some key properties in other words, these are role-playing games with clearly defined roles, where the model of learning in the game is the basis of the methods of situational modeling, that is, the educational process is built as a model of the processes, situations, phenomena being studied.

The main methodological approaches and progressive situations when using situational modeling methods in the educational process of higher education are considered. Such main methodological approaches and progressive situations were applied to us when using the situational modeling method in the educational process of higher education.

The results of determining the quality of professional training of students of the experimental group and the control group at the beginning of the experiment showed that students of both the control and experimental groups were characterized by low levels of both the formation of skills and the assimilation of knowledge and an average level of professionally oriented motivation. The low level of knowledge acquisition is justified, since at the time of the study, students had not yet mastered the situational

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modeling methodology in the educational process of higher education.

Implementing the situational modeling methodology in the educational process of higher education was preceded by compliance with the developed pedagogical conditions.

The ascertaining stage of the experiment allowed the development of all pedagogical conditions for the implementation of the developed situational modeling methodology. After this, it became possible to introduce the situational modeling tools we developed into the training of EG students.

In the educational process of higher education, the situational modeling methodology was implemented by students of the experimental group, and the training of students of the control group took place using traditional teaching methods and did not undergo changes.

At the formative stage of the experiment, the developed situational modeling methodology (in comparison with the traditional teaching method) was significantly effective in forming students' knowledge and skills.

In the experimental group, the average values of indicators for each of the identified criteria increased more significantly. The reliability of the obtained results was checked using the Student criterion. Statistical verification of the data revealed that the results of the formative stage of the experimental study were not random, i.e. $t_e > t_{table}$, and significantly differed for the two groups for each criterion with a reliability of 95%. Statistical verification, analysis of the results of the pedagogical experiment, formulation of conclusions regarding the need to introduce the situational modeling methodology in the professional training of students in the preparation of students for professional activity to confirm the main and additional working hypotheses of the study; to develop practical recommendations for higher education institutions. We consider the search for ways to create a favorable innovative educational environment for high-quality training of specialists to be promising for further research; to study the world experience of professional training of students for its implementation in the practice of higher education institutions.

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