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Development of Students' Creativity: Results of Practical Testing of the Learning Model during the Pandemic

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Abstract

The effective implementation of the goals of solving modern problems in the field of education depends on the creative indicators of the student and the degree of independent development of the personality. The purpose of this study is the theoretical development and practical testing of a model for the development of creativity of students in the educational process, including identifying the prerequisites and pedagogical features of the studied process. To achieve this goal, we organized and conducted experimental work with students of various intellectual schools. A total of 164 people took part in the study at different stages of experimental work: 14 teachers, 150 students (75 each in the experimental and control groups). As a result of the study, the effectiveness of the potential of the study group as a prerequisite for preparing students for a socio-cultural environment was proved. A model for the development of students' creativity indicators has been developed and theoretically substantiated. The model was tested, the prerequisites for the development of students' creativity in the author's version were identified and the criteria for the formation of students' creativity were selected and proved. To determine them, along with qualitative indicators, the results of the assessment of competent specialists, standardized tests and methods are used. The correctness of the studies carried out was confirmed by the possible duplication of the results of the experimental study, statistical indicators confirming the objectivity, reliability of scientific conclusions.

Keywords: creativity, development, experimental work, learning model, social education, the process of teaching students.

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1. Introduction

Modern society, as a complex, differentiated social education, puts forward increasingly complex requirements for the education and upbringing of young people (Liang et al., 2022).

The results of the analysis of psychological and pedagogical literature on the topic of the study show that, although there are many publications on the issue close to our study (Nizaar et al., 2020; Tubb et al., 2020; Durkalevych, 2022; Ramankulov et al., 2019), it shows that the process of social education in the research group in the context of the development of students' creativity is still little studied. As we can see from the scientific literature, in domestic and foreign Science, the development of the concept of creativity is perceived as a concept that has taken an important place in the context of the educational process. In addition, the results of the analysis of the scientific literature showed that this problem has not been adequately studied on the formation of social practices and the necessary presentation to students. For example, a meta-analysis of a large number of literature shows that the practical experience of developing students' creativity in the aspect of social education has been studied at a low level.

The above conclusions and the results of literary reviews have shown us that the problem of studying the development of students' creativity in social education should be in the first place. It also allowed us to conclude that the study is distinguished by the determination of the solution of the following problems:

- insufficient use and implementation of the capabilities of advanced technologies in the field of education for the development of students' creative abilities in educational institutions;
- professional requirements for students in the field of education and the fact that the development of their creative abilities is at a low level.

We will be looking for a clear answer to the research question about what are the pedagogical conditions for the development of students' creativity in the educational process, what are the pedagogical characteristics of the development of creativity.

These questions and research questions formed the basis for determining the purpose of the research from theoretical and practical perspectives – both the development of a model for the development of students' creative abilities in a learning process that includes the prerequisites and pedagogical features of the research process, and the evaluation of the effectiveness of the pedagogical experiment. Human uniqueness and personality are closely related to the problem of creativity.

Today, Research in the field of pedagogy involves a comprehensive knowledge of the problem, the solution of which needs to be determined. Therefore, these studies require an objective study in terms of their systemic basis and structural components and a search based on interdisciplinary communication (Shubina, Kulakli, 2019).

In addition, currently, cognitive approaches and psychometric approaches are found in the psychological and pedagogical concepts of creativity. However, it should be borne in mind that mystical, motivational, personal, social approaches are also used in a special way, and on their basis there are many approaches that characterize the concept of "creativity".

So, according to the concept of reduction creativity to the intelligence level of creative abilities is determined by the level of intelligence (Koval, 2020).

There are four aspects to the phenomenon of creativity:

- The creative environment;
- Creative product
- Creative process
- Creative personality (Antopolskaya, Silakov, 2021).

The question of the development of creativity in pedagogical terms has an important age aspect. An analysis of the literature shows that researchers offer many options for favorable times (sensitive periods) for the development of personal creativity (Hidajat, 2021; Cheung, 2018; Herzog, 2020; Hart et al., 2022).

It is logical to assume that students, as a special social category of young people, are most capable of manifesting and choosing original solutions, to begin independent creativity.

Based on the above conclusions and characteristics, we took the development of students' creativity in the context of social education in the study group as the idea of the main study. This is because it is important to enrich subjective experience such as creativity, organize students' creative communication and teach them teaching skills on this basis, develop the student's creative qualities and create resources for self-improvement.

2. Materials and methods

In the course of the study, theoretical methods, including analysis and generalization, are used to solve the main problems of the study, methods of generalization and systematization of scientific works and provisions on the research problem were used. In addition, a survey of empirical methods, testing of students, observation, pedagogical experiment, statistical methods of processing research results were used.

The reliability and validity of the results obtained in the course of the study is ensured by the identification of the initial methodological prerequisites and the selection of a complex of scientific, theoretical, empirical methods. The use of the evaluative opinions of competent experts necessary for the study, the use of evidence-based tests and standardized methods (Torrens, Mednik, Tunik, etc.), their confirmation by statistical indicators confirm the objectivity and validity and reliability of scientific results and conclusions (Ramankulov et al., 2020).

To obtain an objective and complete picture of the study according to R. B. Kettel's classification, three data sources were used according to L -, Q -, T-in the diagnostic part of the experimental work on the development of students' creativity in the study group.

«The first source is L» – data, obtained by registering a person's life mainly as a result of observation.

«The second source is Q» – data, obtained on the basis of questionnaires and other self-assessment methods.

«The third source T» – data – is the data of objective tests obtained under strictly controlled conditions, when the subject does not know which characteristic the diagnostic procedure is aimed at evaluating.

In total, 164 people took part in the study at different stages of experimental work: 14 teachers, 150 students (75 each in the experimental and control groups) from the Nazarbayev Intellectual School of Physics and Mathematics in Astana, Almaty, Shymkent.

The determination of decisions on the research issues was carried out in 4 stages:

At the first stage, the scientific and methodological literature on the formation and development of students' creativity was analyzed. The initial state of the research problems is determined.

The second stage in the course of the study made it possible to identify the leading conceptual idea of the problem. Diagnostic methods aimed at solving research tasks have been identified. In addition, methods and techniques for the development of students' creative performance were identified. At this stage of the study, the results were mathematically processed and the data obtained were clarified.

At the 3rd stage, called formative, the main experimental work in the study was implemented and the effectiveness of the model developed by us for the formation of creativity was tested.

The experts were teachers and an experimenter. The main characteristics of students' creativity with such basic criteria as "performance", "flexibility", "originality", "development", the indicators of creativity selected by us were taken as a basis (Table 2).

In accordance with our study, during the pedagogical experiment, the evaluation experts were recommended to use the following guidelines:

"Dear expert, it is recommended that you determine the level of formation of three indicators for assessing the student's creativity (a. performance (P) – inefficiency (irrationality); b. flexibility (F) – rigidity (inertia); c. originality (O) – simple (medium))."

Take a closer look at these indicators. Then, on the scale below, rate the student for each indicator:

5 points-according to the evaluated indicator, the personality trait is well developed, achievements are often manifested;

4 points-the personality trait according to the indicator is clearly manifested, even if it is not constant.

3 points-will be in rare manifestations on assessed and opposite personal qualities.

2 points-the trait of the personality according to the evaluated indicator is often not manifested;

1 point-the trait of the personality according to the evaluated indicator is completely invisible;

0 points-there is no information for assessing this quality (I do not have it).

A simplified version: the evaluation of indicators is done on a five-point scale, where the lowest score is 0, and the highest is 5."

According to the proposed method, the total final assessment of creativity is defined as the sum of the points scored according to four indicators (criteria) of creativity. There are 3 indicators for each criterion, a total of 11. The minimum score is 20 points or lower, the maximum score is 80 points. Below is the correspondence of the sum of points to the levels of formation of students' creativity:

Productive (high) level: 80-61;

Reconstructive (average) level: 60-29;

Reproductive (low) level: 29-20 (and below).

The degree of external validity of the method of expert assessment of creativity (EOC) was determined using the Spearman rank correlation coefficient. The data obtained by the J. Johnson creativity method were used as an equivalent form.

3. Results

A model for the development of students' creativity in the process of learning and social education.

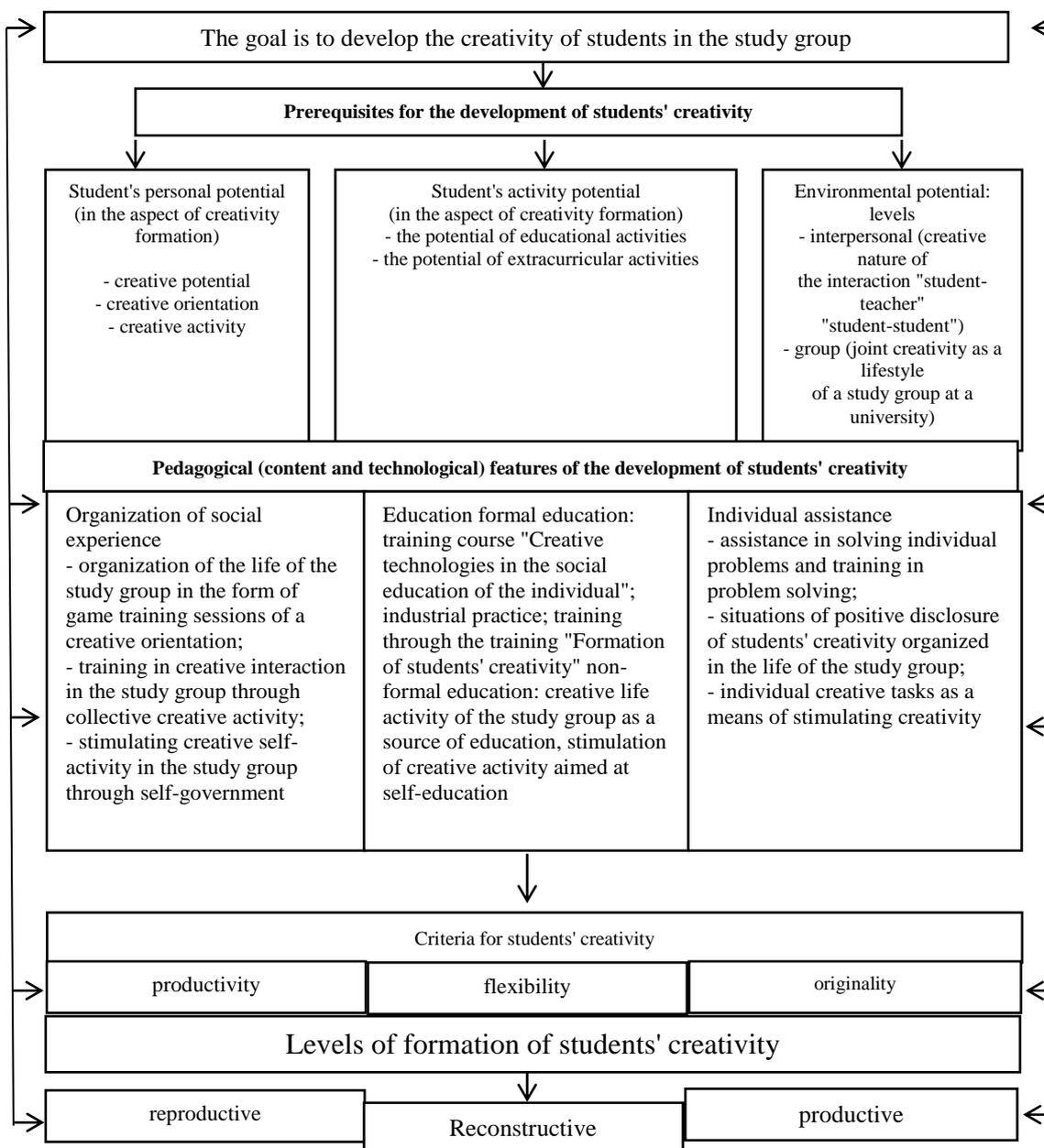


Fig. 1. Structural model of the development of students' creativity in the process of social education in accordance with the pedagogical experiment

Secondary educational institutions provide the formation of a future specialist with a certain set of knowledge, skills and abilities, but the current education system does not create the proper conditions for the development and realization of the creative potential of students. Based on the research of the problem of creativity development in the scientific literature, in accordance with the socio-pedagogical concept, we have developed a model for the development of students' creativity in the process of social education in the study group (Figure 1).

Modeling of the development of students' creativity was carried out based on the provisions of humanistic, activity-based, systematic approaches.

Representatives of humanistic psychology (Elkins, 2022; Sukawi et al., 2021; Holm-Hadulla et al., 2021) consider the healthy creative personality of a person to be the subject of research.

The model for the development of students' creativity in a social study group includes the following components: the purpose of training, the tasks of training; principles of social education; pedagogical prerequisites for the development of students' creativity; pedagogical (substantive and technological) features of the development of students' creativity. In addition, the criteria and levels of creativity of students are also the structure of the model.

So, the effective development of students' creativity in the process of social education in the study group hypothetically contributes to the full use of the resources of personal potential, the direct inclusion of students in the activity potential (active, creative activities), with indirect influence, "immersion" in the environmental potential. Let us illustrate the identified and theoretically justified prerequisites for the development of students' creativity through graphical modeling (Figure 2).

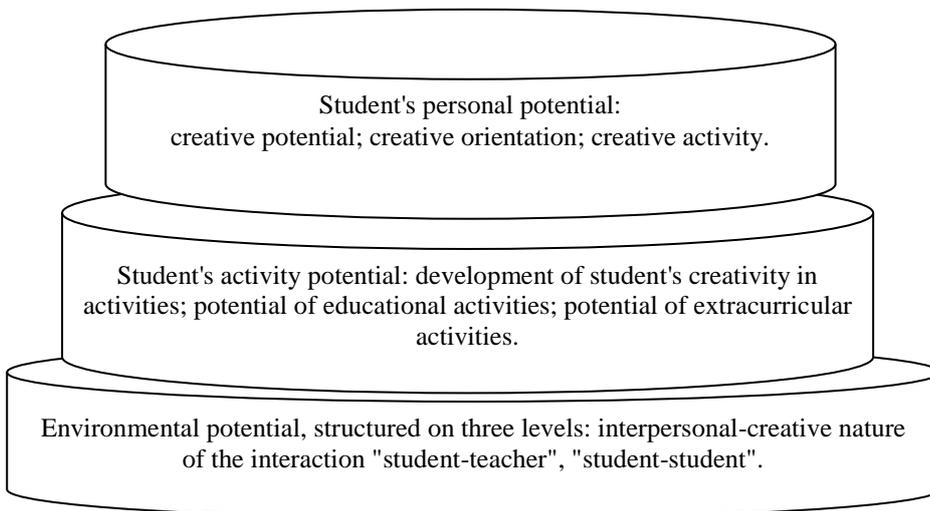


Fig. 2. The model of prerequisites for the development of students' creativity

The wide variety of problems that students face in the educational process, the variety of life activities and the use of their abilities at UII, the limited resources required to fulfill their tasks, require the use of innovative pedagogical technologies depending on the activity and intensity of students (Mukhametshin et al., 2021).

The technological components (forms, methods, techniques, means) of developing students' creativity in the process of social education in the study group are presented in Table 1.

Table 1. Forms, methods, tools to increase students' creativity in the process of social education in the Study group

1	2
Forms of educational and extracurricular activities of a creative orientation	- author's training course "Creative technologies in the social education of the individual"; - author's training "Formation of students' creativity"; - industrial practice; - collective creative activity (KVN, ritual "Student wedding", "Creative day", etc.);

Technologies for the development of students' creative performance	<ul style="list-style-type: none"> - the technology of active learning (group discussion, brainstorming and its types; the method of synectics, the method of morphological analysis, etc.); - creative design technology; - technology of collective creative activity (I.P. Ivanov); - interactive game technologies (trainings);
Methods for the development of students' creative performance	<ul style="list-style-type: none"> - methods of organizing creative life activity (partially-search, research, methods of group solution of creative tasks, methods of active learning, etc.); - methods of stimulating creativity (creating success situations, the method of inversion, heuristic questions, focal objects, mental maps, "six hats", "bouquet of problems", etc.
Tools for the development of students' creative performance	<ul style="list-style-type: none"> - Different performers; - Teaching aids; - Computer courses;

The main provisions of the pedagogically expedient organization of the social experience of students in the study group, on which the development of creativity depends, are as follows:

- 1) Understanding the perspective of all members of the team participating in the pedagogical experiment aimed at group activity;
- 2) Implementation of the principle of complementarity, mutual enrichment of knowledge of participants in the pedagogical experiment to solve problems in the educational process;
- 3) Improving students' activities through the use of types of content and creative nature of the educational process;
- 4) Participation in activities aimed at improving the microenvironment around students, exceeding the interests and needs of the team, including addressing broader social problems;
- 5) Self-confidence and the ability to control and improve oneself.

Implementation of the program of experimental work on the development of students' creativity:

In an experimental study, we separated dependent (affective) and independent variables (affective factor). In our case, there is student creativity in the form of the ability to create a dependent range, an independent range is the requirements (personal, activity, environmental capabilities) and pedagogical (material and technical) characteristics of the creative development of students in the process of social education in the research group. We thought:

1. If the process of social education in the research group takes into account the requirements, that is, individual, active, environmental abilities, then the effectiveness of the creative development of students is possible.

2. If in the process of social education the following pedagogical (material and technical) information is taken into account in the research group, namely:

- In the course of the pedagogical experiment, the organization of social practice will be carried out by teaching interaction through creative activities in a joint research group, organizing training through creative games, encouraging creative independence in the research group through individual management;

- The training will consider the educational course "innovative technologies in the social education of the individual", the training "creative formation of students", as well as the life of the research group as a source of knowledge that stimulates creative activity aimed at self-education;

- If in the course of a pedagogical experiment tasks of a creative nature are used as a means of developing creativity, then the plan for the development of students' creativity is effectively implemented.

Currently, most researchers use the E.P. Torrens test to measure three indicators of creativity: productivity, flexibility, and originality. In our research work, these indicators were adopted as criteria for the formation of creative indicators of students participating in the process of social education.

During the implementation of the pedagogical experiment, the selected and evidence-based criteria for the formation of creativity of students participating in the study are shown in [Table 2](#).

Table 2. Criteria and indicators of students' creativity formation

Criteria for the formation of students' creativity	Indicators of the formation of students' creativity
1	2
Productivity. It is measured by the number of results (selected and successfully completed creative tasks), determined by the number of general responses. It is evaluated by the speed and ease of performing creative tasks.	<ul style="list-style-type: none"> - opportunities for students to create many ideas on their own; - opportunities for creative product development according to the pre-given model; - sensitivity to creative activity and independence in new situations; - mobility in performing tasks of a creative nature.
Flexibility. It is measured by the number of switches (categories) from one class of objects or phenomena to another during the response. The speed and efficiency of switching is important.	<ul style="list-style-type: none"> - the ability to quickly find new (alternative) solution strategies; - the ability to establish a wide range of associative connections and freely move from phenomena of one class to others, often distant in content; - the ability to transform the functions of an object and offer its new use; - the ability to overcome stereotypes.
Originality. It is measured by the number of extraordinary, non-repeating answers (images, ideas). It is diagnosed by the minimum frequency of this response in a homogeneous group.	<ul style="list-style-type: none"> - the ability to produce (put forward) new ideas and solutions, distant associations; - the ability to put forward unique, exceptional ideas that differ from the obvious answers; - the ability to solve problems in a peculiar, unusual and constructive way.

For the effective implementation of the program of the pedagogical experiment, we adhered to the following principles: to help students solve problems related to practical knowledge during the educational process.

The organization of social and public practice of students of the group of grades 10-11 participating in the pedagogical experiment included such components as the use of situational problems in the study group, teaching creative interaction and stimulating creative skills.

The use of tasks of a creative nature began with the first days of students in the group participating in the study at the intellectual school and took place in the form of Game trainings of a creative direction. This principle is also found in other research literature (Toril et al., 2016; Mangiron, 2021).

Examples of sports classes with students of the 10th grade, which are used in the process of social education in the study group at the main stage of experimental work.

A game training session of a creative orientation for acquaintance. Pedagogical tasks of creative orientation: the development of creative imagination, imagination, the ability to put forward associations; the formation of the ability to create an image; acquaintance of students of the study group with each other.

Exercise creative direction: "I – Association," "I know" "Yes, I am!", "Three cases", "Marriage announcement", "Performance partner, My personal coat of arms".

"Self-Association": students in the research group call their name, choose a community that begins with the capital letter of their name and become a member of it.

"I know": participants in the pedagogical experiment line up in a circle and throw balls into each other's hands, linking the names of celebrities with their names. After all the participants have introduced themselves, the ball is thrown again in the reverse order.

"Yes, I am!": Students participating in a pedagogical experiment need to show their collective image: for example, what profession do I want to associate myself with in the future?

"3 facts": in the pedagogical experiment, each participant of the group of students must clearly describe their name and three facts about themselves. It is necessary to determine whether the participants are real facts of each other, real or fictional, by voting for the truth.

"Personal coat of arms": as an exhibition, presentation of works, on 4 sheets divided into 4 parts, you need to draw a) Your Name, b) your symbol, c) what you like or want; d) describe your self-portrait with colored pencils, paints.

As a form of additional (formal) education in extracurricular time with students, the author's training "Formation of students' creativity" was used, with a volume of 72 hours.

The pedagogical tasks of classes organized in a training nature are as follows:

- development of students' enthusiasm for creativity;
- development of teamwork skills of a creative nature;
- effective implementation of creative opportunities in solving situational problems;
- teach students to use their creative abilities.

Thematic planning of the author's training "Formation of students' creativity"

First theme: «Cohesion. Collective decision-making» (8 hours). Exercises: "Interchange", "Number", "Entanglements", "Ball", "Who? Where to?"

Second theme: «Creative thinking» (6 hours). Exercises: "Associations", "Why?", "Crossence", "Three elephants", "Five seconds to think", "Encryption", "What? Where to? How?"

Third theme: «Barriers of creativity, ways to overcome them» (8 hours). Exercises: "Chairs", "Bridge", "Knees"

Fourth theme: «Nonverbal creativity» (6 hours). Exercises: "Blob", "Magic aquarium", "Supplement the drawing"

Fifth theme: «Verbal creativity» (8 hours). Exercises: "Shifters", "Rhyme", "Add", "Intonation", "Concert", "Joint story", "Conversation"

Sixth theme: «Imagination as a creative process» (4 hours). Exercises: "Guess who I am?", "Clouds", "Freeze frame"

Seventh theme: «Joint creativity» (6 hours). Exercises: "General breathing", "Collage", "Fairy tale", "Count", "Cities", "Row"

Eighth theme: «Individual creativity» (8 hours). Exercises: "Unusual story", "Figures", "Artistry", "Biography of the subject", "This is Me"

Ninth theme: «Creativity in everyday life» (8 hours). Exercises: "Dreams", "Cheat sheet", "Oriental bazaar", "Fashion designer", "Shopping"

Tenth theme: «Creative problem solving» (2 hours). Exercises: "Incredible situation", "Methods of action", "Celebrity", "Flower"

The eleventh theme: «Completion of the training. Summing up the results» (8 hours). Exercises: "Gift", "Crocodile".

Based on the characteristics of the data on clusters and the range of values, the following levels of students' creativity formation in the process of social education in the study group were identified, which are characterized by the corresponding indicators:

Reproductive (R) level. In those characterized by low indicators of the formation of students' creativity, the student is passive in activity, does not show activity when performing tasks of a creative nature. Will be prone to reproductive activity.

Variable (V) level. Due to the fact that it is characterized by average indicators of the formation of creativity, the student shows independent activity, shows the presence of interest in performing tasks of a creative nature. Can offer solutions to practical problems.

Productive (P) level. According to the criteria for the formation of a student's creativity, it is characterized by high and stable performance of all indicators.

Based on the application of the criteria of productivity, flexibility, originality and development used in the study, we measured the levels of creativity formation identified as a result of cluster analysis in the experimental and control groups of subjects.

At the beginning of the pedagogical experiment and at the end of the educational process, the dynamics of assessment by the levels of development of students' creativity and indicators of creativity are clearly shown in [Table 3](#) and [Figure 3](#).

Table 3. Levels of formation of students' creativity in the process of social education in the study group

	Experimental groups				Control group			
	The first section (PS)		Final cross-section (FS)		The first section (PS)		Final cross-section (FS)	
	Human	%	Human	%	Human	%	Human	%
Reproductive	18	30	7	11	18	33	12	22
Variable	82	70	78	64	82	67	82	67
Productive	-	-	15	25	-	-	6	11

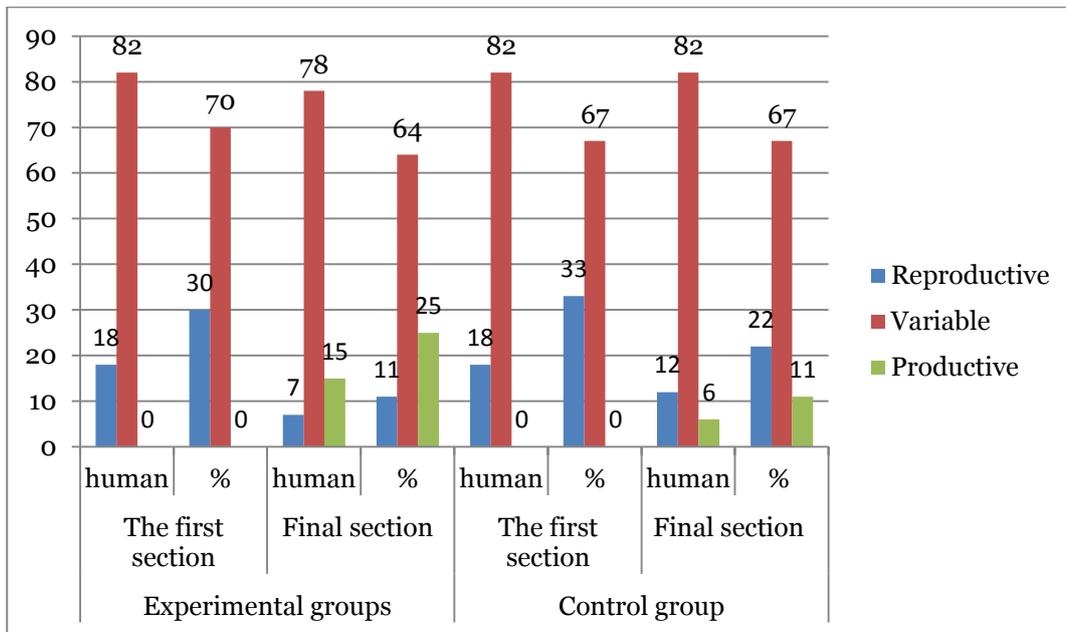


Fig. 3. The dynamics of the formation of students' creativity in the process of teaching in a pedagogical experiment

The presence of subjects with a reproductive level (EG – 31 % and CG – 32 %), a 70 variable level (EG – 46.7 % and CG – 48 %), a variable level (EG – 69 % and CG – 68 %) in a pedagogical experiment, the correlation of the creative potential of students at the beginning of the study of the educational process is characterized.

The tables and charts obtained from the academic exam results show the stability of the creative development level in the control group and the performance increase in the test group. The calculated value $\chi^2 e$ is compared with the critical value $\chi^2 c$, which is determined by the standard table of critical values according to the conditions of a particular experiment. Within the framework of our experiment, for the significance of $p \leq 0.05$ with the number of gradations $g = 3$, the number of degrees of freedom $v=2$, respectively, $\chi^2 c = 5,901$.

If $\chi^2 e < \chi^2 c$ then the null hypothesis is accepted (Ho), otherwise the experimental hypothesis (H1) is accepted.

The hypothesis was formulated as zero (Ho): there are no differences in the distribution of students according to the levels of development of the qualities of creativity in the control and experimental groups. As an experimental hypothesis (H1), the following was adopted: the distribution of students by levels of development of creativity qualities in the experimental group significantly differs from the control group.

At the beginning of the search stage, when comparing the levels of development of the qualities of creativity according to the results of testing in the control and experimental groups, $\chi^2 e = 0.148$ was obtained. Thus $\chi^2 e < \chi^2 c$, it allows us to accept the hypothesis Ho, and

formulate a conclusion about the absence of a sufficient difference in the levels of creativity qualities in the control and experimental groups.

At the end of the search stage, after repeated testing, $\chi^2_{e} = 6,367$, i.e. exceeds the value of χ^2_{c} , thus, the hypothesis H1 is confirmed - the levels of creativity qualities in the control and experimental groups significantly differ.

The statistical analysis of the data obtained during the formative experiment allows us to draw the following conclusions:

- At the beginning of the formative stage, there are no statistically significant differences in the level of development of the qualities of creativity of the control and experimental groups;
- Most students of control and experimental groups at the beginning of the experiment stage have an average and low level of development of creativity;
- The level of development of creativity qualities of students of experimental groups at the end of the experiment stage is statistically significantly higher than the level of development of creativity qualities of students of control groups.

In comparison with the respondents of the CG, the dynamics of the variable level of EG students is 1.5 times higher. It should be noted that at the final stage of the empirical research in the EG, the number of students who have reached the productive level is 26 %, while in the CG, the number of respondents of this level is only 12 %. In general, the number of subjects with a productive level in EG is 2.4 times higher than the corresponding value in CG. The results of comparative analysis showed that there is no high positive dynamics of variable and productive levels in CG.

Therefore, from the table provided, it can be seen that the number of students at the reproductive level in the EG decreased significantly (by 18 %), and in the CG respondents this figure decreased by only 10 %.

It is obvious that the high results obtained in the experimental groups are accompanied by the effect of the complex influence of various factors. These results show the effectiveness of the actions performed in accordance with the model proposed by us for the formation of creativity.

4. Discussion

Researchers distinguish the existence of an actual and potential form of creativity (Kanke et al., 2021). Today, as a realized, expressed creative and potential form, as a potential for creative personal growth and creative self-development, the question of how to change the level of creativity of students has increased.

According to V.N. Druzhinin, the general creative ability corresponds to a certain motivation and a certain type of activity which showed originality. In addition, according to A.G. Maslow, creative activity is interpreted as a motivation for self-actualization.

The opinions of these scientists and the conclusions made as a result of the study allowed us to characterize the indicators that are formed in creative activity as a creative ability. At the same time, this led us to conclude that the effectiveness of creative activity also depends on the level of formation of creativity. This is also found in the works of scientists from other fields of science close to the theory (Oleksyuk, 2021; Berdi et al., 2015).

The identified and justified prerequisites (personal, activity, environmental potentials), the model developed by us clarify the idea of the factors of social education, their consideration contributes to the effective formation of students' creativity in the process of social education in the study group.

The results of our research in the field of creativity give the basis for conclusions about the pedagogical features of the formation of students' creativity in the educational process, and these features will serve as the basis for future research in this area.

5. Conclusion

Searches for the formation of students' creativity in pedagogical education characterize the main development trends in the aspect of the theory of modern knowledge. Creative performance as a skill is reflected not only in the educational activities of students, but also in the organization of life-related activities of the Student Educational team. In the course of our research, we were convinced that the development of a future specialist as an individual, the competitiveness of which depends on the degree of development of his creative abilities. An individual with developed

creative indicators is able to independently solve problems, be flexible in solving problems due to rapidly changing conditions in any area.

Our research work – the result of a preliminary analysis of the literature on the concept of creativity, showed that creativity is the cognitive activity of individuals, generating ideas, methods and new products that have effective integration in different areas to solve a problem.

Consequently, the training of future specialists with a developed creative potential that meets the requirements of the labor market in a dynamically developing society of Science and technology is a vivid reflection of the solution of important problems in the world educational space.

Despite the positive results obtained as a result of a pedagogical experiment, such topical and interesting issues of the study of creativity as the study of the nature of joint creativity in the interaction of interpersonal processes responsible for creativity and innovation, the need and features of the development of creativity in the study of various disciplines remained outside the topic of our research. Based on the results of our research work, it is necessary to further study in all educational institutions as a necessary condition for the social and personal development of students in the study of subjects in the creative sphere.

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