CONTENT OF THE ORGANIZATION OF EXPERIMENTAL WORK ON THE FORMATION AND DEVELOPMENT OF PRACTICAL AND CREATIVE SKILLS THROUGH THE SUBJECT “ENGINEERING AND COMPUTER GRAPHICS”

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ABSTRACT

This article discusses the content of organizing experimental work on the formation and development of practical and creative skills with the help of “Engineering and computer graphics”. The experimental tests carried out are presented. Analysis of the criteria for determining the level of development of students' creative abilities was calculated on the basis of mathematical and statistical analysis, and also determined on the basis of statistical analysis of the effectiveness of experimental tests conducted to determine the effectiveness of students in education and the development of practical creative skills.

Keywords: Assessment, creativity, initial assessment, activity, personal creativity, subject of activity, individual characteristics of a person, potential abilities.

INTRODUCTION

The market economy that is forming in our republic has set the task of training creative specialists who can meet the requirements of world standards, who are capable, agile (active), who can actively accept innovations in the production and social spheres, and who are capable of creating innovations [3]. In addition to mastering the necessary "core" of professional knowledge, such specialists must acquire the skills of creativity, initiative, scientific curiosity, independence, ability to create new things, critical thinking, solving problems in many ways and objectively evaluating them.

The meaning and essence of the term’s "creativity", "creativity", "creative activity", "abilities" and "practical-creative abilities", the review presented in the special literature, the analysis of opinions and comments expressed by foreign and domestic scientists presented to us research work serves as the basis for the realization of the stated goal.

In the literature, however, there are different opinions about the nature of creativity, the structure of the creative process and the formation of human creative abilities, in addition to one or another interpretation of the concept of creativity [9]. Here, when interpreting the concept of” creativity", attention should be paid to its versatility. Because, the concept of creativity is considered as” activity “,” activity “,” process “,” appearance of activity “,” type of activity “,” form of activity". Its other side is reflected in such concepts as” creative potential “,” creative ability “,” creative activity “,” creative attitude “,” creative activity “,” creative work “,” personality creativity".

LITERATURE REVIEW

Let's first dwell on practical creativity. Practical-creativity-the ability to deviate from accepted thinking habits and create and find new original ideas to successfully solve problems in a non-standard way [1]. This is to see the problems from the other side and solve them in a unique way. Creative thinking is revolutionary and creative thinking that is constructive in nature.
"The creativity of students is a mental activity aimed at purposefully changing or designing engineering processes and technical objects, applying the knowledge, skills and qualifications acquired by students and clearly understanding their content, as a result of which the student solves new engineering issues for himself, develops specific solutions that are new, useful" [11].

B.M.Teplov believes that the skill will be present in the process of regular development. It should also be noted that the effectiveness of the performance of each activity is not the same, but depends on the combination of different abilities. The absence of the necessary targets for the development of certain abilities can be replenished due to the fact that their deficiency is highly developed by other abilities.

Rezinkov L.I.ga according to, usually, the creativity of an adult is understood as an activity that leads to the creation of a new, dissimilar product, that is, material and spiritual assets of social and objective importance. In such an approach, first of all, the result is taken into account, and not the process of activity. And in creative activity in the process of training and education of young people, the process of formation of personality creativity begins with the formation of the skills for solving non-standard issues that arise in production and problem situations.

The main rules of the theory of creativity Vigotsky L.S., Bogoyavlenskaya D.B., Semakova V.V., Alekseev P.V. the works of the LAR, and their thoughts on creativity, found their vivid expression in the following definition: "creativity is an activity whose result is considered the creation of new material and spiritual resources. It presupposes that the individual has an ability, motive, knowledge and skill that allows him to create a product that is not his likeness, different in novelty and uniqueness".

We fully agree with this opinion, because in the period of creative activity, students can use previously acquired knowledge, skills and abilities (for different purposes, in different conditions), generalize certain methods of activity, solve problems he must be able to find a new way. So, creative activity is the relationship of the subject's activity to his own work (satisfaction with work, striving for innovation in the process of performing it and creative motivation in solving it) and creative problem solving (using previously acquired knowledge, skills and abilities, as well as new methods of activity independent application in the case, seeing the new function of the concrete object) is a process.

Komsky D.V. Depending on the subject of activity, creativity is classified into the following three types: individual personality creativity; social group (layer) creativity; object creativity.
In our view, in order to overcome this drawback, performance activities should not be viewed as a barrier to intensification of students ' creative activities, but as an independent goal of leadership in their activities [6].

METHODOLOGY

Pedagogical experimental test work on the formation and development of practical and creative skills in the means of Engineering Computer Graphics was carried out in the following higher

educational institutions. Bukhara Institute of engineering and technology, Jizzakh Polytechnic Institute, Tashkent State Technical University named after Islam Karimov and Fergana polytechnic institutes held 6071-2500 years in 2021-2023 in the direction of undergraduate education of vehicle engineering (road transport), a total of 549 students took part in the pilot work. Of these, 277 were students in the pilot group and 272 were students in the control group. Table 1.

Higher educational institutions where experimental tests were conducted on the formation and development of students' practical and creative skills.

No	Name of HEI	Number of respondents			Total number of respondents by HEIs
		2021-2022 academic year	2022-2023 academic year	2023-2024 academic year	
1.	Bukhara Engineering - Technological Institute	47	45	49	141
2.	Jizzakh Polytechnic Institute	44	42	40	126
3.	Tashkent State Technical University named after Islam Karimov	42	40	43	125
4	Fergana Polytechnic Institute	48	53	56	157
Overall:		**181**	**180**	**188**	**549**

The purpose of organizing pedagogical experimental and test work was determined to determine the degree of effective use of the recommended pedagogical conditions, developed model and methodology, which allows students to form and develop practical and creative skills based on the teaching of the subject" Engineering Computer Graphics". The formation and development of practical – creative skills of students are not limited to homework, but also includes classes held in the auditorium with the participation of a professor and under his leadership.

The results of the educational activities of students of higher educational institutions depend on the level of formation and development of practical and creative skills of the student, determined by his own readiness for creative activity, the desire to engage independently and the possibilities of realizing this desire [15].

The dialectic of independent work is based on the interdependence of the content of model training programs for future specialists and the gradual complication of independent methods of work and these methods used by students, which makes it practical to solve the contradictions faced by the future future specialist in the process of cognitive and creative activity.

Formation and development of practical and creative skills in the educational system of higher educational institutions is organized on the basis of certain laws [2]. For example, the psychological and pedagogical validity of this work, the desire to fulfill this task, the moral-voluntary readiness and desire of the student to do it independently without external influence, the formation of the student's worldview, socially active, modern personality qualities, the educational value of independent educational work connection with the process, the unity of knowledge and creative activity, the main means of knowing can be mentioned.

RESULTS

In special literature, one or another interpretation of the concept of creativity is the meaning and essence of the term's "creativity", "skill", "creative activity" and "practical creative skill" in our research work, the review presented in special literature, the opinion expressed by foreign and domestic scientists. and the analysis of judgments serves as a basis for the realization of the goal set before us in the research work. In the special literature, along with one or another interpretation of the concept of creativity, there are different opinions about its nature, the structure of the creative process, and the formation of human practical and creative skills [14]. Here, in the interpretation of the concept of "creativity", it is necessary to pay attention to its versatility. Therefore, the concept of creativity is considered as "activity", "activity", "process", "activity form", "activity type", "activity form". Its other side is reflected in concepts such as "creative potential", "creative ability", "creative activity", "creative attitude", "creative activity", "creative work", "personal creativity" (fig.1).

Based on the above concepts of creativity, it is possible to distinguish several levels of practical - creative skills:

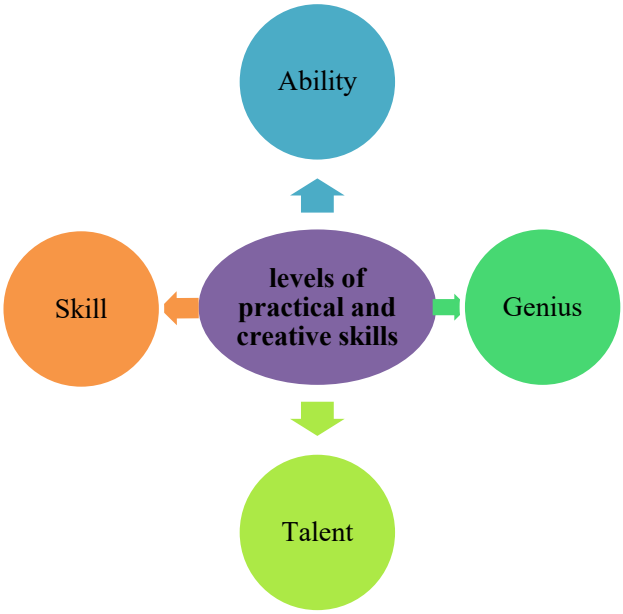

Figure 1. Practical - creative skills based on concepts of creativity. The experiment was conducted in the following steps.

The 1st step (2021-2022) is an emphasis step. In this study, the pedagogical principles of experimental work were determined, its methods were developed, special pedagogical areas were prepared for the experiment, special experimental and control groups were selected for the experiment, and the importance of this activity was explained to them.

The 2nd step (2022-2023) is a formative step. Special developments of the experiment were prepared, relevant methodological tools (questionnaire, interview, survey, discussion, topics of abstracts, test questionnaires, etc.) were prepared. Experimental work was carried out in a continuous manner, continuously, inextricably linked to the educational system, not separated from the educational process, with extensive involvement of partners in the experimental activity. Formation and development of students' practical and creative skills was organized on the basis of the methods recommended by us. In parallel, the obtained data were subjected to the appropriate approval, analysis and analysis process.

The 3rd step (2023-2024) is the final step. In this process, diagnostic systems were developed to evaluate the effectiveness of the proposed methodology and the level of development and development of practical-creative skills of higher educational institutions using the system of tasks created for the formation and development of practical-creative skills of students. The

material and statistical data identified in the practical process were summarized. Based on them, the final mathematical-statistical analysis of the research was re-implemented. According to the results of this mathematical-statistical analysis, the general conclusions of the research were formed.

There are the following criteria for determining the level of development of creativity skills of students:

- determination of motivation for creative activity;
- development of creative thinking skills;
- formation of creative qualities;
- organizing the process of practical creative activity;
- formation of specialized creativity, etc.

Pedagogical experimental work was carried out by the doctoral student in 2021-2023 in 4 higher educational institutions of our Republic, i.e. Fergana Polytechnic Institute, Bukhara Institute of Engineering and Technology, Jizzakh Polytechnic Institute, Tashkent State Technical University named after Islam Karimov "Transportation Engineering (automobile transport)" was conducted in the field of undergraduate education. Respondents-students from experimental areas were attached to the test work.

Table 2.Higher educational institutions where the experiment was conducted

No	Name of HEI	Experimental group	Control group	across higher educational institutions
1	Bukhara Engineering - Technological Institute	71	70	141
2	Jizzakh Polytechnic Institute	64	62	126
3	Tashkent State Technical University named after Islam Karimov	63	62	125
4	Fergana Polytechnic Institute	79	78	157
Overall		**277**	**272**	**549**

In 2021-2022, 2022-2023 and 2023-2024, the pedagogical experimental work was carried out for three years at Bukhara Institute of Engineering and Technology, Jizzakh Polytechnic Institute, Tashkent State Technical University named after Islam Karimov and Fergana Polytechnic Institute. At the end of the experiment, 277 students from the experimental group (EG) and 272 students from the control group (CG) participated (Table 3).

Table 3.The results of pedagogical experiments and tests carried out at Bukhara Institute of Engineering and Technology, Jizzakh Polytechnic Institute, Tashkent State Technical University and Fergana Polytechnic Institute

Level of development of practical – creative skills	Experimental group				Control group			
	277 people at the beginning of the experiment		277 people at the end of the experiment		272 people at the beginning of the experiment		272 people at the end of the experiment	
	the number	%	the number	%	the number	%	the number	%
High	29	10,5	67	24,2	27	9,9	38	14,0
Medium	68	24,5	135	48,7	68	25,0	109	40,1
Low	180	65,0	75	27,1	177	65,1	125	46,0
Overall:	**277**	**100**	**277**	**100**	**272**	**100**	**272**	**100**

Among the students who participated in the experimental group, the level of development of practical and creative skills by means of "Engineering computer graphics" showed a higher level of 10.5% at the beginning of the experiment and 24.2% at the end of the experiment. The medium level increased from 24.5% at the beginning of the experiment to 48.7% at the end of the experiment, and the low level decreased from 65.0% to 27.1%.

In the requirements of the control group, the level of development of practical and creative skills by means of "Engineering computer graphics" showed a higher level of 9.9% at the beginning of the experiment and 14.0% at the end of the experiment. The medium level increased from 25.0% at the beginning of the experiment to 40.1% at the end of the experiment, while the low level decreased from 65.1% to 46.0% (Figure 2).

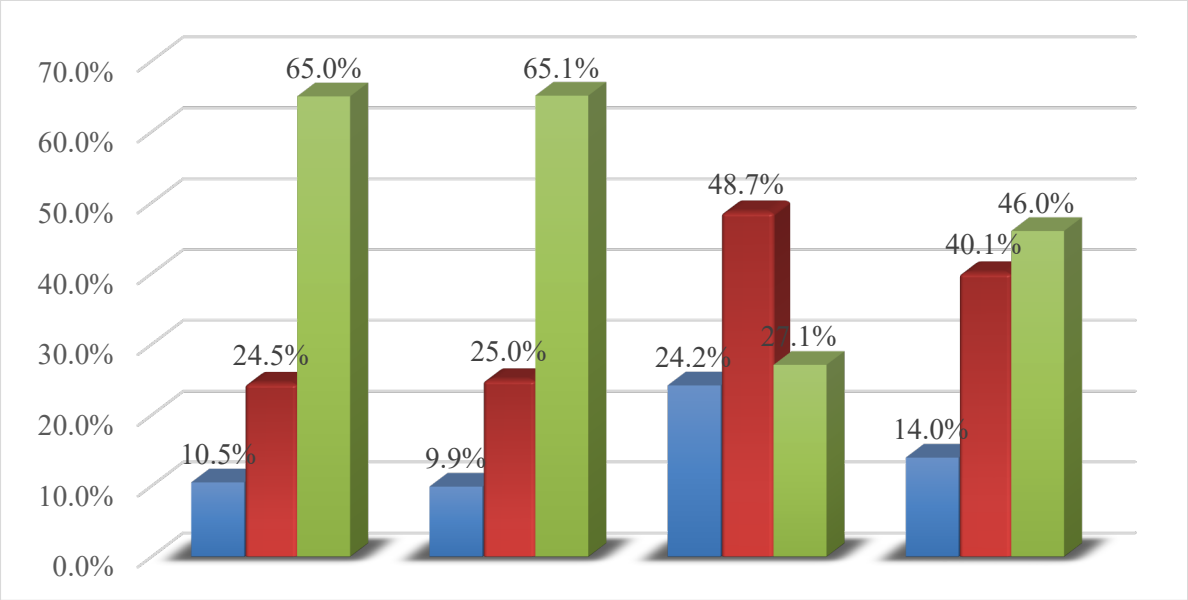

Figure 2. A diagram of the results of pedagogical experiments and tests carried out at Bukhara Institute of Engineering and Technology, Jizzakh Polytechnic Institute, Tashkent State Technical University and Fergana Polytechnic Institute.

In this study, the initial evaluation of the evaluation system was conducted at the beginning of the experiment, and students were evaluated through a test based on the knowledge they acquired in secondary schools and the initial knowledge they received during the semester. At the end of the experiment, students' knowledge was determined through written and oral evaluations on all subjects of science.

From the obtained results, it can be seen that the criterion for evaluating the effectiveness of teaching is greater than one, and the criterion for evaluating the level of knowledge is greater than zero. It is known that the mastery in the experimental group and at the end of the experiment is higher than the mastery in the control group and at the beginning of the experiment.

From this it can be seen that the performance of the experimental group increased by 12% compared to that of the control group. It can be concluded from the conducted statistical analysis that with the help of computer graphics used in the experimental group, the levels of development of students' practical and creative skills are effective, and the conducted experimental-test analyzes can be popularized on the scale of our republic.

So, the effectiveness of the experimental work conducted to determine the effectiveness of students in the formation and development of practical and creative skills was revealed from the statistical analysis.

CONCLUSIONS

According to the results of the experiment, it was proved that the research topic is relevant. Formation and development of students' practical and creative skills by means of the subject "Engineering computer graphics" indicates the development of independent education in students.

In order to improve the quality of the analysis of experimental test results in pedagogical research, an electronic program was developed and introduced into the experimental work. The experimental results were analyzed in MS Excel and Math SAD software. According to the results of the pedagogical experiment, the model and methodology developed by us proved to be effective.

60712500-The EGS (Engineering graphics source) platform was developed and introduced, as well as the textbook "Engineering computer graphics" for the formation and development of practical and creative skills of the students of the vehicle engineering (automotive transport) discipline using the "Engineering computer graphics" subject. "Engineering and computer graphics" training manuals were created and introduced into the educational process. In this, the importance of the system of educational exercises, as well as their functions and peculiarities, is increased. The principles of creating a system of tasks were distinguished: constantly increasing the complexity of tasks; that they are aimed at mastering all the highlighted bases of the methodology of their creative activity in educational subjects; it was determined that the tasks were oriented to modern problems in the field of education.
Based on the results of the research, the results were determined and analyzed by mathematical-statistical processing, and it was confirmed that the efficiency and mastery levels of the experimental groups significantly increased compared to the control groups. According to the results of the study, the experimental group was 12% higher than the control group. This proves that the model and methodology developed by us is effective.

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