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CREATIVE THINKING DEVELOPMENT OF FUTURE DESIGNERS WHEN MASTERING TECHNICAL ART DRAWING

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Abstract

The paper discusses the experience of developing creative thinking of students studying in the design field. The team of teachers implemented the art drawing into existing model of professional training of designers. For this reason, the graphics problems were developed that form the willingness to act in non-standard situations by using the creative potential of each student. The experimental work was carried out in three stages. At the first stage, a system of graphics problems was developed that makes it possible to include the subject Technical Art Drawing into the Module aimed at designer professional competencies development. In the traditional course, tasks were introduced to transform the form of the subject, as well as a group of creative tasks, among which there are tasks with design elements turned out to be especially significant. The experiment has been conducted over 10 years. At the beginning of each academic year, a test aimed at checking up the students' creative thinking was carried out. At the second stage during the year, the theoretical and practical foundations of drawing were mastered. At the same time, students' abilities for abstract thinking, mastery of logical operations of analysis and synthesis developed, as well as the ability to think variably, systemically, rationally, and in an original way was developed. The work carried out has shown that the technical art drawing can successfully shape students' creative thinking abilities. This increases students' readiness for self-development and self-implementation in professional design activities.

Keywords: Creative thinking, designer training, technical art drawing.

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1. Introduction

The high quality of professional education of the young generation is a guarantee of achieving social and economic goals of our state. From the position of a new educational paradigm, any student is considered as an active subject, capable of influencing the social and cultural development of society. He or she will create a new life space, the spiritual world of science and art, moral standards, and universal values.

Regardless of the field of training, all graduates should have creative thinking, including future designers. The State Educational Standards in the field of Design (54.04.01) include the list of proposed competencies (LC) with a direct indication of the need to develop creative thinking of graduates. The competence of LC-2 states that future designers should be able to justify their proposals when developing a project idea based on a conceptual and creative approach to solve a design problem.

Many publications have been devoted to the development of creative thinking (Akhmetov, 2016; Shentsova et al., 2016; Valliulina & Yakovets, 2015). Both scientists and teachers have long identified the features of creative thinking, i.e. stable activity, intellectual initiative, flexibility, originality, the desire for completeness of form, and the implementation of ideas. The process of its formation consists in the gradual complication of the tasks presented (Shtifanova, 2017). The improvement of these features helps to transform creative thinking into a stable personality trait.

Continuous interest in the problem of development of creative thinking contributes to an increase in the number of studies by domestic and international scientists. The studies concerning design students are especially important for this study (Nikashin, 2015; Shokorova & Mamyrina 2015; Zhdanova Ekaterinushkina, Grigoriev, Ilyasheva, & Pischugina, 2019).

In the scientific and methodological literature, the designer thinking is considered as a special kind that can be developed to a high level of producing ideas, images, technologies that are distinguished by fundamental novelty and social significance. Creative thinking develops based on an organic combination of knowledge, skills, emotions, imagination, and intuition. All this is enriched by life experience and the development of various thinking strategies.

The analysis of professional activities of designers allowed us to determine the main features of design thinking. They can be represented as follows:

- Systemic knowledge of logical operations;
- Presence of variability, flexibility, constructiveness;
- Understanding of expediency and rationality;
- Awareness about the ways to create a new, aesthetically organized object and harmonious environment.

The article does not allow a detailed discussion of the development paths of all the features; only the results of the development of systemic ownership of logical operations, variability, and knowledge of how to create a new object will be described here. Variability is also an indicator of creative thinking, because it shows its productivity. The presence of several solutions increases the likelihood of an optimal solution to a design problem, and makes it possible for both the designer and his customer to choose. That is why variability in training is given special attention.

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The effectiveness of the development of creative thinking of students is much greater if carried out within the framework of several academic disciplines, which are integrated into a single unit. There have been written a lot about the integrative approach in training (Kryucheva & Gavrilyuk, 2016; Wachter, 2012). Fewer publications deal with design training. "If to implement an integrative approach to all parts of the educational process, the total effect would be much higher than from the individual actions of these components," the authors of the article say (Zhdanova, Gavritskov, Ekaterinushkina, Mishukovskaya, & Antonenko, 2018). This paper proposes an integrative model for training designers. It combines different units of competencies and can be supplemented by some other types of activities, in particular, the course Technical Art Drawing.

Design thinking is implemented in a peculiar way in each academic discipline. The implementation of technical drawings has always contributed to the development of logical operations, which make up a large part of creative thinking. Graphics problems specially developed and introduced into the training course allow developing variability of thinking, which contributes to the emergence of new and original solutions.

2. Problem Statement

In the process of future designer training, it was necessary to answer the following question: Is it possible to expand the integrative model of professional training with new disciplines, including the course Technical Art Drawing so that students develop creative thinking that allows them to solve non-standard tasks in new conditions. There was an assumption that if to introduce into the training course Technical Art Drawing specially designed graphic tasks of different complexity this will contribute to the development of creative thinking. Integration facilitation would enhance training of future designer.

3. Research Questions

Identification of common ground between Design and Technical Art Drawing, which will help integrate the latter into the model of professional training of designers. Development of graphic tasks that contribute to the development of creative thinking of future designers. Testing the system of graphic tasks and checking their influence on the development of creative thinking.

4. Purpose of the Study

Check the effectiveness of the impact of the system of graphic tasks on the development of creative thinking of students, i.e. future designers.

5. Research Methods

The analysis of design activities showed that integration can be successful if elements of creative activity appear in the course Technical Art Drawing. For this purpose, a system of graphic tasks was developed, which makes it possible teaching the implementation of technical drawings and contributing

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to the development of creative thinking of students. The system included gradually complicated tasks. This intensified the mental activity of students.

The experimental work was carried out in three stages At the first stage, at the beginning of the school year, a test (checkup of components of creative thinking) was carried out when solving the simplest type of tasks. To evaluate the results obtained, the criteria were developed attributed to the component growth of creative thinking.

The second stage is the training of students in technical art drawing through the introduction of a system of graphics problems that are gradually becoming more complex and require application of acquired knowledge in new conditions or the production of new solutions. The third stage was carried out at the end of the school year, when students worked on complex graphics problem.

An assessment of the decisions of students of the first and the third stages was carried out according to a unified method: the total amount of solutions was calculated, after which the correct and the original ones were identified. Points were given for all decisions that were evaluated. The methods of mathematical statistics were used to determine the initial and final level of the growth of the selected components of creative thinking.

6. Findings

Designers embody their creative thoughts through graphic project images and no matter if they are executed by hand or using computer programs. Mandatory images include technical drawings. To master the methods of their implementation, well-developed spatial representations, graphic knowledge and skills are required. However, in secondary schools, when the drawing has to be canceled most students - future designers – experience certain difficulties in performing technical drawings.

The course Technical Art Drawing is intended to partially compensate for the lack of knowledge and skills in the implementation of drawings for various purposes. Students are required to operate with logical and spatial operations simultaneously. This causes certain difficulties, since they are carried out by different hemispheres of the brain. Logical operations include analysis, synthesis, comparison, induction and deduction, classification, generalization, abstraction, and some others. The same operations and in almost the same context are used by students in the implementation of educational projects.

The teachers carried out a focused effort to establish an integrative relationship between technical art drawing and design. It turned out that the fundamental difference in thinking is the lack of a creative component in students' activities when performing technical drawings. Most assignments in the framework of this discipline have one suitable solution. Students get used to it very quickly. However, designers must have flexible, mobile and multivariate type of thinking. The traditional content and methodology of technical art drawing came into conflict with the requirements for professional qualities of future specialist in the field of design.

A small team of teachers developed a system of graphics tasks for the development of creative thinking and has been testing it for more than 10 years (Mishukovskaya & Zhdanova, 2008). In this difficult work, teachers relied on the experience gained in the 1980s of the twentieth century in the bowels of the All-Union Scientific Research Institute for the Content and Methods of Education of the Academy of Sciences of the USSR in the laboratory of teaching methods of drawing. The graphics

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problems were developed for students of secondary schools and successfully implemented in the educational process. High educational effectiveness prompted researchers and methodologists to test the influence of these problems on the intellectual activity of adults. Unfortunately, this stage coincided with the beginning of the 1990s, because most studies were not completed. However, even those that had been implemented were enough to see their positive effect.

The developed system of graphic tasks included four groups, depending on the nature of mental activity:

1. Comparison of images.
2. Image conversion.
3. Reconstruction of images.
4. Creative tasks.

At the beginning of the educational process, the comparison tasks are actively used, as they require the simplest mental operations. The course ended with creative tasks, which sometimes requires more than just logical and spatial thinking, but heuristic guesses. These tasks are described in more detailed way by Mishukovskaya and Zhdanova (2008).

Each type of task to one degree or another influenced the development of spatial representations. The tasks for comparison actively form images of memory, tasks for reconstruction – static representations that allow you to hold for a very long time an established image based on a recreating imagination. The tasks of transforming images contribute to more rapid development of dynamic spatial representations among students, because they require mental transformation of the shape or position of the part or item itself.

Among creative graphic tasks, tasks with design elements that in the course of technical graphics do not require special technological knowledge and calculations were highlighted. The value of this type of problem lies in the fact that, along with the general skills for solving any graphic problem, they provide heuristic methods for solving and make spatial representations active.

To state the changes in the creative thinking of students at the beginning of the school year, a diagnostic test was proposed that made it possible to establish the level of creative thinking through some of its features. This became a task with design elements, but of the simplest type. Condition: draw two types. Introduce additional protrusions and holes in the side view in accordance with the main view, without violating the symmetry about the vertical axis. If it is necessary, make new drawing (Figure 01).

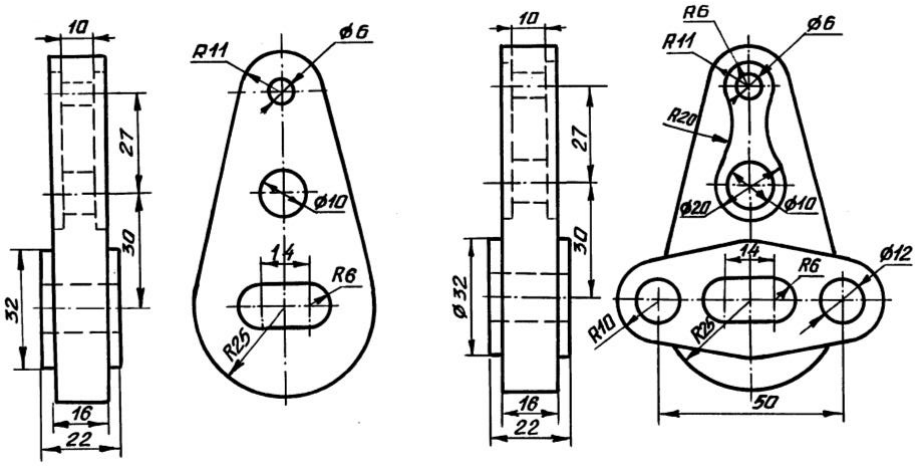

Figure 01. Graphics condition and one solution to the diagnostic task

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When solving this task, it was necessary to divide all the mistakes into two groups, i.e. the design and the graphics ones. Both the correct design decisions and mistakes showed the development of creative thinking, because only they would be considered in this paper. Figure 01 shows one correct solution. All technical drawings were given two grades: for creative solution and graphic literacy. The criteria for evaluating creative thinking were the following:

- Number of decisions: showed the degree of development of variability;
- Correct decisions: reflected the systemic ownership of logical operations;
- Originality of decisions: creation of a new object. For evaluation, a 100-point system was chosen. Only few students managed to achieve the highest point. Immediately, the tables were created where the names of students and their results according to the selected criteria were recorded (Table 1).

Table 01. The results of the initial diagnostic test

	Name	Number of solutions and number of units	Number of correct solutions	Number of not typical solutions	Total number
1.	Ivanov A.A.	6/30	4/20	1/10	60
2.	Petrov I.I.	4/20	3/15	3/30	70
3.	Sidorov Yu.A.	7/35	5/25	1/10	70
4.	…….				

The first criterion reflected the number of solutions. 5 points were given for each of them. The student A.A. Ivanov proposed six solutions, so he got 30 points. The second column shows the number of correct solutions. 5 points were granted for this task as well. So, Ivanov A.A. gained twenty more points. For not typical solution, points were awarded twice as much, i.e. 10 points for each of them. As a result, the first student scored 60 points. The student I.I. Petrov gave out only four possible options' however, three of them were correct and original, and therefore he scored 70 points. The student Sidorov Yu.A. received the same amount due to quantitative indicators.

The results obtained provided rich material for analyzing the level of students' readiness for technical art drawing and further design. The teacher already knew what to look for. Different student groups showed different levels of knowledge of drawing and creative thinking.

The group of creative tasks included tasks with design elements. They became the fulcrum for integration. These tasks had several correct solutions out of which it was necessary to choose the most suitable one. During the year, students solved the following types of graphic tasks with design elements:

1. Tasks for introducing new elements into an object;
2. Tasks for changing the number of parts or elements;
3. Tasks for changing the part shape;
4. Tasks for changing the combination of parts;
5. Tasks for changing the overall dimensions of a part and its elements;
6. Tasks for changing the shape of elements and overall dimensions (combination of 3 and 5 features).

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The proposed graphics problems with design elements were associated with the geometric and projection drawing. One of them related to Division of a Circle into Equal Parts; two of them related to Axonometric Projections; all the rest related to Projection Drawing. This corresponds to the sequence of the course Technical Art Drawing set out in the curriculum for students, i.e. future designers.

At the end of the year, students were asked to complete final diagnostic test, which belonged to the first group of tasks. The complex nature of this task was increased due to the initial form of the part (it included more elements). For each student, the same Table was compiled as for the first diagnostic task. The criteria and the scores were awarded in the same order. At the end, the results of the beginning and the end were compared as shown in Table 2.

Table 02. Comparison of performance indicators diagnostic test at the initial and final stage of the study

	Name	**Number of points in the beginning of the year**	**Number of points at the end of the year**
1	Ivanov A.A.	60	85
2	Petrov I.I.	65	70
3	Sidorov Yu.A.	60	80

Almost all students had an increase. They successfully coped with the tasks that are more difficult. Of course, there were errors, both graphic and constructive, but the variety of the proposed solutions and the desire to cope with the difficulties was satisfactory.

Due to the information collected, it was possible to track personal growth of each student. Sidorov Yu.A. did not become a leader, but took the longes way of self-development, which is also very important.

During the training, the students developed the following skills:

- To analyze the condition of the problem;
- To select the correct direction of the search;
- To predict the consequences of the actions;
- To critically interpret the hypothesis;
- To select the best solution;
- To substantiate the choice;
- To draw the right conclusions;
- To formulate final solution graphically.

All these skills meet the requirements set for professional activity of the designer and help ensure high quality of the work performed.

7. Conclusion

The need to increase the professional competencies of future designers contributed to the beginning of the search for new ways of learning. The teachers' appeal to the possibilities of an

integrative approach made it possible to see and understand the important contact points between design and technical art drawing. Introduction to technical art design of creative tasks that can have several correct solutions makes it possible to use intellectual potential partially formed in the design process, and the knowledge and graphic skills acquired during technical art drawing training will allow students to express their design intent.

The integrative approach transfers the emphasis from the process of accumulating certain knowledge and skills into the plane of the formation of ability to practically act and creatively apply the knowledge gained in various situations.

Thus, the professional training of designers based on an integrative approach provides for updating the content, forms and teaching methods, as well as those personality characteristics that determine a good professional. Comprehensive integration of different activities contributes to the development of creative thinking.

The discipline Technical Art Drawing was integrated into the educational process and showed high efficiency. Throughout the entire period of study, students developed design thinking, which is distinguished by systematic, variability, rationality, expediency and novelty of solutions.

Developed creative thinking increases competitiveness of a specialist in the modern labor market and guarantees his or her adjustment to modern production conditions.

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