

## IMPROVING THE SYSTEM OF USING MODERN GRAPHIC SOFTWARE IN THE CONTEXT OF GEOMETRIC DRAWING FOR STUDENTS

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### ABSTRACT

This article examines the improvement of the use of modern graphic software, particularly AutoCAD, in the teaching of geometric drawing. The study compares traditional and modern instructional approaches and analyzes their impact on students' acquisition of theoretical knowledge, development of practical graphic skills, and enhancement of spatial thinking abilities. The results of the experimental study demonstrated that the use of AutoCAD increases students' learning motivation and engagement while improving their ability to perform geometric constructions and complex graphic tasks accurately and efficiently. Furthermore, the findings revealed that AutoCAD contributes to the development of independent thinking, graphic reasoning, visual analysis, and practical skills. The research confirms the high pedagogical effectiveness of integrating AutoCAD into the teaching process of geometric drawing.

**Keywords:** Geometric drawing, AutoCAD, graphic software, engineering graphics, spatial thinking, graphic skills, pedagogical technologies, educational effectiveness.

### INTRODUCTION

The use of modern graphic software in the field of geometric drawing is important, as it helps students draw complex geometric shapes and constructions accurately and efficiently [3;4]. Through these programs, students not only master traditional drawing, but also get acquainted with modern technologies, while developing their creative and practical skills. Graphic programs, such as AutoCAD, 3D Max, and other modern applications, automate drawing and modeling tasks, simplifying the learning process. With their interactive interface and multifunctional tools, students can expand their capabilities and reinforce important geometric concepts with more practical examples. In addition, drawings created using graphic programs can be edited and modified in real time, bringing innovative approaches to the learning process. These technologies provide students with the opportunity to control and analyze, and help them align their drawing techniques with modern requirements.

Geometric properties and constructions taught using modern graphic programs are mastered more accurately, quickly, and interactively, which serves not only to consolidate theoretical knowledge, but also to deepen practical skills. At the same time, these approaches allow students to develop visual thinking and problem-solving skills, which enhances their overall technical and engineering skills [5;7]. Therefore, improving geometric drawing education based on modern graphic programs creates important conditions for personal and professional development in students.

Geometric drawing, graphic programs, and interactive learning opportunities. Geometric drawing is an important field that combines traditional and modern forms of human thought. This field not only requires the accurate and precise representation of views and lines, but also develops an understanding of processes in engineering, architecture, and design. Modern graphic programs, especially with the development of computer technology, have provided very convenient and fast opportunities for the process of geometric drawing. These programs can not only be used for drawing and modeling, but also for functions such as precision, graphical visualization, and animation [3;4;8;10;14]. Such programs expand interactive learning opportunities, increase students' activity in the learning process, and provide the groundwork for deepening their engineering and art knowledge. Through this, students are able to consolidate not only theoretical knowledge, but also practical skills. At the same time, interactive methods support individual student development and create new opportunities to strengthen collaborative learning. As a result, it is advisable to organize the educational process in a more effective and innovative way by combining geometric drawing and graphic programs [7;8].

Context and subject relevance of the field of study of fine arts and engineering graphics. The current importance of the topic "Improving the system of applying modern graphic programs in the context of geometric drawing of students" depends on the integration of the pedagogical process with modern technologies, the educational work carried out in this direction serves not only to develop student skills, but also to improve the quality of education [1;2;7;8;10].

Technological developments in the external environment and the advancement of science and technology, as well as the adaptation of the field of geometric drawing to modern requirements, further increase the importance of this topic. At the same time, through the interactive capabilities of graphic programs and visual approaches, the processes of information reception and its application by students are becoming more convenient and effective. This, in turn, plays an important role in enriching the educational process with innovative methods and preparing the younger generation to work with advanced technologies [5;8].

Visual arts and engineering graphics are related to educational modifications, the introduction of new pedagogical technologies, aimed at improving their flexibility and creativity in future activities by teaching students to use modern software. Therefore, research and practice in this area are important for ensuring the maximum efficiency of the educational process, serving not only to consolidate theoretical knowledge, but also to develop practical graphic skills. In the current era, the widespread use of modern graphic programs in the education system is becoming increasingly important in the comprehensive development of students and their training as competitive personnel [11;13;15].

"In the methodology section, it is important to integrate modern graphic programs into the educational process based on practical approaches" [1;2]. The training sessions include realistic tasks and exercises for students, which help to strengthen their practical skills. Using interactive methods during training, such as using various visual and animated elements, helps students better understand the process during training. Software integration is carried out using specially designed modules and equipment, along with existing graphic programs. As a result of this integration, the student's opportunities expand, as well as their knowledge, skills, and problem-solving abilities in graphic design [5;6]. Starting from the initial stage, the

practical graphic work is constantly improved through experience, performing graphic work in the AutoCad program in parallel with the traditional method. This approach results in increased learning outcomes and expanded statistical, analytical, and design capabilities for students. In addition, the interactivity of the software opens up new opportunities for students to learn and think independently, which plays an important role in developing their solid and modern graphic drawing skills [12;13;15].

The result, the changes made during the learning process, and the development of students' drawing skills are clearly visible. Lessons conducted interactively using modern graphic programs not only expand understanding, but also allow students to strengthen their practical skills. The lesson process is based on expanding the possibilities of visualization and simulation, unlike traditional methods. This improves students' critical thinking and problem-solving skills.

As a result of integrating the Auto Cad program into geometric drawing lessons, students learn to quickly and accurately implement their drawing designs, as well as analyze their drawings using a computer and identify errors [5;6;11]. During the implementation of these approaches in the educational process, comprehensive knowledge was formed, taking into account not only technical aspects, but also aesthetic and functional aspects.

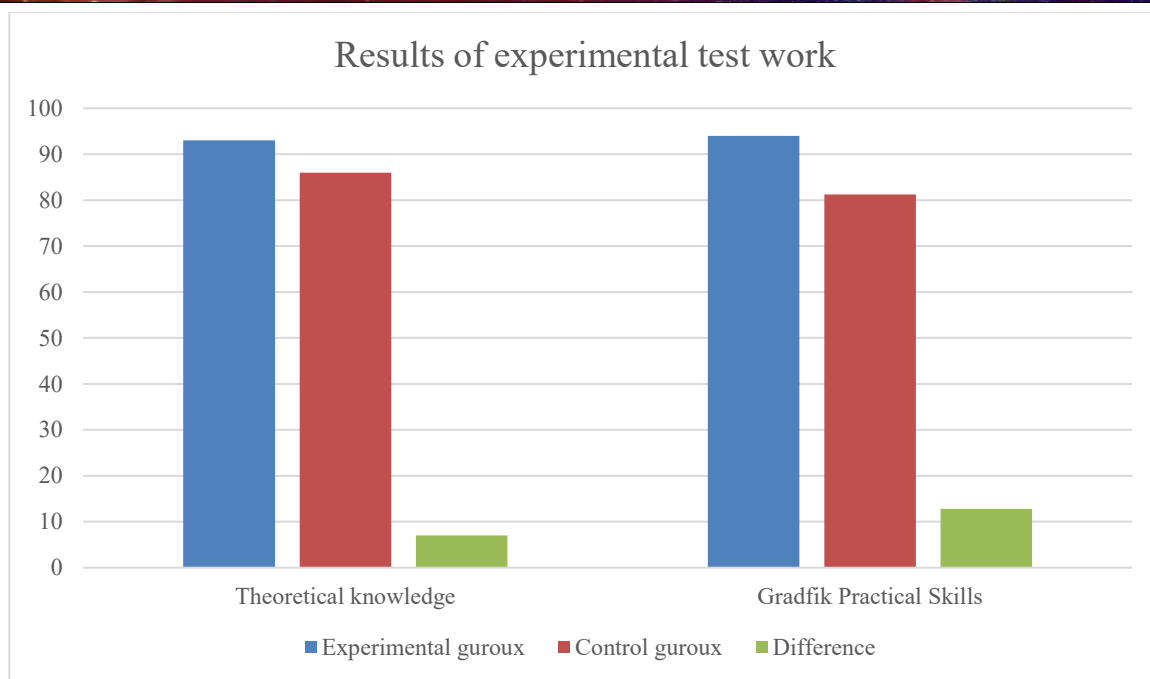
The expected results ensure that students will be successful in developing imagination, creativity, and important technical skills. They not only acquire practical drawing skills, but also learn to independently use modern graphic software. Thus, the student has a greater chance of becoming a highly qualified specialist in the future, based on modern technology. In general, this approach serves not only to deepen students' theoretical knowledge, but also to expand their practical skills, and increases their readiness for the profession. For this purpose, pilot studies were conducted.

Analysis of the results of theoretical knowledge. In order to determine theoretical knowledge, test tasks were developed based on the topics provided for in the curriculum. According to the test results, the experimental group students scored 93%, while the control group scored 86%. The results showed that using AutoCAD helped not only complete practical tasks, but also gain a deeper understanding of geometric concepts and graphical patterns [5;6].

Analysis of the results of graphic practical skills. The graphic practical skills assessment analyzed the geometric constructions, connections, slopes and cones, and graphic constructions performed by students.

According to the results, the level of graphic practical skills in the experimental group was 94%, while in the control group this figure was 81.2%.

The difference in mastering theoretical knowledge is 7%, and in performing graphic work is 12.8%. This is explained by the fact that the AutoCAD program allows you to study geometric constructions and draw them accurately and quickly. With the help of the program, students were able to quickly identify and correct errors.



In the process of analyzing the results, it was found that, through the use of modern graphic programs, there was a significant increase in the qualifications in geometric drawing among students. With this approach, the possibility of accurately drawing complex geometric shapes and constructions in the educational process and understanding them has expanded. In particular, the introduction of new methods and interactive methods in lesson plans has helped to increase student activity, expand the thinking process, and allow them to freely express their opinions, based on preliminary assessments. These situations led to an increase in students' graphic skills and the quality of their sample graphic work [7;8].

At the same time, promising additional opportunities have emerged. By introducing new graphic programs and animation technologies, the possibilities for visualizing complex geometric concepts and providing practical examples are expanding. This not only increases the effectiveness of the learning process, but also increases interest in independent learning. To a certain extent, through technological developments and online platforms, additional resources are provided for both students and teachers, and the groundwork is laid for strengthening coherence in the learning process. As a result, the use of modern graphic software is being shown as a promising direction for improving the quality of education and improving pedagogical approaches in the geometric drawing course.

The experiment was conducted in the following stages as part of the study. Students were divided into two groups to conduct the experiment.

1. The "first group" was trained in traditional methods, including manual drawing and theoretical materials in engineering graphics.
2. The "second group" used AutoCAD-supported digital learning methods to study the same topics.

The experiment lasted 15 weeks, during which each group was taught according to its own program. The students' results were assessed through mid-term tests and a final exam. The final exam included both theoretical and practical tasks.

The following criteria were used to evaluate the results:

1. Mastery of the material – checked using tests and practical tasks;
2. Student motivation – measured through surveys in which students assessed their level of engagement in the learning process;
3. The quality of the drawings was assessed based on the final assignments, in which students created drawings and 3D models.

The experiment showed that the second group of students, who used modern technologies, demonstrated significantly higher results in both theoretical and practical terms [5;6;8]. Their motivation to study was also higher, as confirmed by the results of the survey.

Students of the second group (using modern technologies) showed consistently better results during the reading process. In particular, by Week 15 they had achieved significantly higher results in the final assignments. The satisfaction levels of students in both groups at the end of the semester are shown. The satisfaction rate among students who used modern teaching methods was 92%, while the rate in the group that studied using traditional methods was 80%. The results of the study confirmed that the use of modern technologies such as AutoCAD has a positive effect on the mastery of engineering and graphic disciplines. One of the main findings of the study is that AutoCAD technologies help to better understand spatial concepts and improve practical skills. Students who used these technologies mastered new topics faster and showed greater confidence in completing practical tasks. Visual clarity and the ability to interact with three-dimensional models have proven to be important factors in the learning process. A survey of students showed that interactive teaching methods increase interest in the subject [7;8;9].

**Conclusion.** The results of this study showed that the use of the AutoCAD program in teaching geometric drawing is an effective tool for developing students' theoretical knowledge and practical graphic skills. According to the results of the experimental-test work, the indicator of mastering theoretical knowledge in the experimental group using the AutoCAD program was 93%, and the level of graphic practical skills was 94%, which was significantly higher than the results of the control group. This situation confirms that the graphic tasks have a positive effect on the formation of accuracy, speed, and independent work skills [5;6].

The study found that organizing geometric drawing lessons using traditional methods, as well as the AutoCAD program, helps develop students' spatial imagination, graphic thinking, and problem-solving competencies. The use of software tools has expanded the possibilities for analyzing drawings, quickly identifying and correcting errors, and increased the interactivity of the learning process [12;13;14;15].

Thus, the gradual integration of the AutoCAD program into the teaching of geometric drawing has emerged as an important pedagogical condition for improving the quality of education, strengthening students' professional training, and forming competencies in working with modern graphic technologies. It is advisable to continue research on integrating this approach with other graphic programs and applying it at different educational levels in the future [5;7;8;9].

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