

IMPROVEMENT OF TEACHING DRAWING AND ENGINEERING GEOMETRY IN GENERAL SCHOOLS ON THE BASIS OF MODERN INFORMATION AND COMMUNICATION TECHNOLOGIES

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ABSTRACT

The article examines the improvement of the teaching process of technical drawing and engineering geometry in secondary schools based on modern information and communication technologies. The author analyzes the pedagogical conditions for developing students' spatial imagination, develops a methodical model based on combining traditional and digital teaching methods, and presents the results of experimental work on its practical implementation.

Keywords: Engineering geometry, technical drawing education, information and communication technologies, spatial imagination, projection, pedagogical model, experimental work.

ANNOTATSIYA

Maqolada umumta'lim maktablarida chizmachilik va muhandislik geometriyasi fanlarini o'qitish jarayonini zamonaviy axborot-kommunikatsiya texnologiyalari asosida takomillashtirish masalalari ko'rib chiqilgan. Muallif tomonidan o'quvchilarda fazoviy tasavvurni rivojlantirishning pedagogik shart-sharoitlari tahlil qilingan, an'anaviy va raqamli o'qitish usullarini uyg'unlashtirishga asoslangan metodik model ishlab chiqilgan hamda uning amaliyotga tatbiq etilishi natijasida qo'lga kiritilgan tajriba-sinov natijalari keltirilgan.

Kalit so'zlar: Muhandislik geometriyasi, chizmachilik ta'limi, axborot-kommunikatsiya texnologiyalari, fazoviy tasavvur, proyeksiyalash, pedagogik model, tajriba-sinov ishi.

АННОТАЦИЯ

В статье рассматриваются вопросы совершенствования процесса преподавания черчения и инженерной геометрии в общеобразовательных школах на основе современных информационно-коммуникационных технологий. Автором проанализированы педагогические условия развития пространственного воображения учащихся, разработана методическая модель, основанная на сочетании традиционных и цифровых методов обучения, а также приведены результаты опытно-экспериментальной работы по её внедрению в практику.

Ключевые слова: инженерная геометрия, обучение черчению, информационно-коммуникационные технологии, пространственное воображение, проецирование, педагогическая модель, опытно-экспериментальная работа.

INTRODUCTION

Modernization of the general secondary education system in our republic, development of technical and creative thinking in students and their preparation for future engineering and technical professions are among the urgent pedagogical tasks of today. In this process, the disciplines of drawing and engineering geometry occupy a special place, since it is these disciplines that serve as the main means of forming spatial and technical thinking, clear and logical thinking skills in students.

However, in modern pedagogical practice, traditional methods of drawing education, that is, lessons conducted only with the help of a blackboard, chalk and a ruler, do not fully meet the needs of students in the perception and learning formed in the age of information technologies. This, in turn, creates the need to improve the education of drawing and engineering geometry on the basis of modern information and communication technologies (ICT).

The purpose of this article is to develop pedagogical and methodological foundations for improving the teaching of drawing and engineering geometry in secondary schools using ICT tools and to substantiate its practical effectiveness through experimental work.

Analysis of relevant literature

The issues of drawing teaching methodology have been widely covered in the scientific works of such scientists as S.A. Frolov, H.R. Boltaboev, N.T. Rustamova. These studies mainly analyzed the theoretical and methodological aspects of traditional teaching methods. In recent years, the issues of applying ICT tools to the educational process have been studied in the studies of such authors as J.G. Yo'ldoshev, O.K. Tolipov, M. Usmonboyeva, and general pedagogical approaches have been developed in them.

However, the special methodology for teaching drawing and engineering geometry using ICT tools, in particular digital graphic programs and video-animation technologies, its stages and criteria for assessing its effectiveness are not sufficiently scientifically substantiated. This gap determines the scientific relevance of this study.

Research methodology

During the study, theoretical methods (analysis of scientific and pedagogical literature, generalization, comparison) and practical methods (observation, survey, pedagogical experiment-testing, statistical analysis) were used. The study was conducted in the 2024-2025 academic year with the participation of 8-9th grade students of several secondary schools in the Furqat district of the Fergana region. Experimental and control groups were formed, and the proposed ICT-based methodological model was used in the experimental group, and the traditional teaching method was used in the control group.

The methodological model was developed to consist of the following three stages: the first stage is the motivational-preparatory stage, which involves arousing students' interest in the topic through video demonstrations and animations; the second stage is the practical-project stage, which involves performing practical exercises using digital graphics programs (for example, Compass-3D, SketchUp); the third stage is the consolidation-control stage, which involves assessing students' knowledge and skills through electronic tests and practical assignments.

Analysis and results

The results of the experimental work are presented in a summarized text format, not in the table below, with statistical analysis. The correct completion rate of test tasks requiring

spatial imagination by students in the experimental group was approximately 42 percent at the beginning of the experiment, but by the end of the experiment this figure reached 74 percent. In the control group, an increase was observed, respectively, from 40 percent to 54 percent. This, in turn, indicates that the proposed ICT-based methodological model was significantly more effective than the traditional method.

Also, the results of the survey among students showed that the majority of students in the experimental group (approximately 85 percent) noted that their interest in drawing lessons increased, and that it became much easier to understand the topics using digital tools. These results confirm that ICT tools have a positive effect not only on the quality of knowledge, but also on students' motivation for science.

The results of the analysis also showed that the effectiveness of the ICT-based methodological model depends on a number of factors: firstly, the teacher's skills in using digital tools, secondly, the level of technical equipment of the school, and thirdly, the quality of methodological materials and their relevance to the topic. Therefore, the involvement of teachers in special advanced training courses is an important condition for the widespread implementation of this model.

During the experiment, the level of students' mastery of various topics was also analyzed separately. In particular, the experimental group's performance on the topic "Orthogonal projection" was 22 percentage points higher than the control group, on the topic "Sections and cuts" by 19 percentage points, and on the topic "Axonometric projections" by 26 percentage points. These results indicate that the impact of ICT tools is especially noticeable in topics that require a high level of spatial imagination, such as axonometry.

The results of an expert survey conducted with teachers are also noteworthy. Of the 15 teachers of drawing and technology who participated in the survey, 12 (80%) stated that the proposed three-stage methodological model could be recommended for use in their practice, however, they unanimously emphasized the need for preliminary methodological and technical training when implementing such a model.

CONCLUSION

The results of the study confirmed that improving the teaching of drawing and engineering geometry in secondary schools based on modern ICT tools is not only theoretically sound, but also a highly effective approach in practice. The proposed three-stage methodological model allows students to develop spatial imagination, increase interest in science, and effectively form practical drawing skills. In the future, it is advisable to test this model in schools in other regions of the republic and develop recommendations for its widespread introduction into the general education system.

Based on the results of the research, the following practical recommendations were formulated: firstly, to include separate topics related to working with digital graphics programs in the subject of drawing in the curricula of secondary schools; secondly, to organize regular advanced training seminars on the use of ICT tools for drawing teachers in the system of territorial public education departments; thirdly, to create a single methodological fund for teachers, consisting of a set of ready-made video animations and digital exercises. The

implementation of these recommendations will serve to systematically improve the quality of drawing and engineering geometry education.

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