

# Developing Students 'Space Imagination with Intensive Methods in Teaching the Science of Descriptive Geometry and Engineering Graphics

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**Annotation:** *The article presents the tools and methods of intensive development of students' spatial imagination in the teaching of the subject "Descriptive Geometry and Engineering Graphics" using computer technology and computer graphics.*

**Keywords:** descriptive geometry and engineering graphics, spatial imagination, multimedia electronic textbook, multimedia e-book, intellectual computer games, virtual detail models, video tutorials, set of tasks, level tests, computer graphics.

## I. INTRODUCTION

As part of the reform of the education system in Uzbekistan, the concept of development of higher education until 2030 includes "accelerating the process of studying and implementing best international practices to improve the quality of education and improving teaching methods" [1], training competitive personnel and their worthy contribution to economic development. As a result of reforms in the system, great attention is paid to the inclusion of higher education institutions in the list of the top 1000 higher education institutions in the ranking of internationally recognized organizations. The Action Strategy for the further development of the Republic of Uzbekistan for 2017-2021 identifies the priority "improving the quality and efficiency of higher education institutions on the basis of the introduction of international standards for assessing the quality of education and training." It follows that it is important to use modern methods of teaching based on multimedia computer technologies in research work in the higher education system. Issues of improving the teaching methods of graphic education in the country, the development of spatial imagination of students R.Khorunov, I.Rakhmonov, A.Kholmiraev, Sh.Murodov, D.Kuchkarova, E.Ruziev, A.Khamrakulov, S.Saydaliev, D.Saidahmedova, Ch. Studied by Shokirova, N. Yadgorov and others. Modern issues of teaching the disciplines "Descriptive Geometry and Engineering Graphics", "Drawing", "Engineering Graphics", the formation and development of students' spatial imagination I.P. Istomina, L.V. Zangirov, L.P. Rusinov, A.V. Piliper, Yu.A.Bolkova, A.I.Xubiev, L.N.Anisimov, P.A. Foreign scientists such as Ostrojkov, J.J.Djanabaev, Charles A, Rankovsky, Minaruth Galey, Neda Bokan, Marko Ljucovich, Srdjan Vukmirovich conducted research. As a result of teaching the subject "Descriptive Geometry and Engineering Graphics" in higher education institutions, the basis for the development of students' graphic competencies and the acquisition of graphic knowledge in the field is created. It is no coincidence that drawing is the language of technology. Therefore, the main problem in teaching the subject "Descriptive Geometry and Engineering Graphics" is the development of students' spatial imagination. As a result of educational reforms, young people who graduated from academic lyceums, vocational schools, colleges, technical colleges in the social sphere can be admitted to study in the fields of engineering, technology, construction, manufacturing, as a result of which they have the opportunity to choose the appropriate direction in applying to higher education. On the one hand, this is a practical result of the ongoing reforms to meet the demand for higher education, on the other hand, it requires a high level of graphic competence to study in this area.

## II. METHODS

As a result of research, studies and observations, it was found that the graphic competencies and spatial perceptions of first-year students entering higher education vary (low, medium, high). The main reasons for this are that the subject of drawing is not taught in lyceums, vocational schools and colleges (social sciences, humanities, medicine and economics). It is obvious that the students entering higher education institutions have different potential, understanding, imagination in the field of drawing, that is, their spatial imagination is different.

**Spatial imagination** – to have a complete understanding of the shape, size, appearance, condition, its characteristics of the object, drawing, piece, detail, etc. described. It is understood that a drawing, detail, etc., can be imagined by the human imagination, the imagination, and put it down on paper.

Lack of time (drawing, re-drawing and explaining on the board) is one of the major problems in the teaching of the subject "Descriptive Geometry and Engineering Graphics" in higher education institutions due to insufficient development of spatial imagination in conveying information to students on the topics specified in the model program. Gives a positive result to the educational process through the use of multimedia computer technology in solving the existing problem. In particular, it is necessary to use intensive methods in the development of spatial imagination in students, the formation of creative and independent work skills.

### III. RESULTS

The lack of development of students' spatial imagination in the teaching of "Drawing Geometry and Engineering Graphics" creates various problems in the transfer of knowledge in the subject. Modern multimedia computer technologies and computer graphics should be used effectively to find an optimal solution to the existing problem. The development of spatial imagination in students to understand and consolidate the acquired knowledge of the subject "Drawing Geometry and Engineering Graphics" serves to ensure the quality and effectiveness of education. Based on the above considerations, the issue of intensive development of students' spatial imagination is on the agenda. To do this, students develop science content and comprehension skills through multimedia e-textbooks, computer graphics, visualized virtual visual aids.

Experimental work on the development of students' spatial imagination on the basis of intensive methods in teaching the subject "Descriptive Geometry and Engineering Graphics" was carried out. For this purpose, a multimedia electronic textbook on the subject "Descriptive Geometry and Engineering Graphics" (multimedia e-book, a set of differentiated (level) tasks, intellectual computer games, video lessons, multivariate differentiated (level) test, virtual detail models, glossary) was created.

### IV. DISCUSSION

In teaching the subject "Descriptive Geometry and Engineering Graphics" using multimedia computer technology to develop students' spatial imagination, multimedia e-learning to develop spatial imagination, video lessons for lectures and practical classes, the creation of differentiated multivariate tests to analyze the development of students' spatial imagination. development and creation of differentiated graphic tasks, intellectual computer games, virtual detail models aimed at developing students' spatial imagination using the capabilities of graphics.

In order to determine the accuracy of the scientific hypothesis, experimental work on teaching the subject "Descriptive Geometry and Engineering Graphics" using multimedia computer technology and computer graphics was conducted regularly during the academic semester. Experimental and control groups were selected for the study at the Namangan Institute of Civil Engineering: 1st control group (44-45-TIE-19), 2nd experimental group (30-31-AYA-19) are the spring semester of the 2019-2020 academic year that is, it was done remotely online in a pandemic setting. At the next stage, in the autumn semester of the 2020-2021 academic year, groups 43-44-YM-20, 45-46-47-YM-20 were held both online and in the traditional way. The experiments were performed in weeks. Experimental test work yielded the expected result. Compared to the control group, the mastering rate of the experimental group was 13.5% higher on average.

### V. CONCLUSION

Monitoring students' lessons during the problem-solving phase, checking students' practical assignments and analyzing the results of interviews with teachers, questionnaires proved that the use of multimedia computer technology in teaching is more useful than other modern teaching methods. During the problem-solving phase, the lessons were based on multimedia computer technology. Interviews with students, questionnaires showed that the use of multimedia e-books, intellectual computer games, virtual detail models, a set of level practical assignments, multivariate level tests in the lessons of drawing geometry and engineering graphics increased students' interest in science and developed creative thinking skills.

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