DEVELOPING STUDENTS' SPATIAL IMAGINATION IN THE TEACHING THE SUBJECT OF "DESCRIPTIVE GEOMETRY AND ENGINEERING GRAPHICS" WITH THE HELP OF MODERN COMPUTER GRAPHICS

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ANNOTATION

The article presents the tools and methods of developing students' spatial imagination in the teaching of descriptive geometry and engineering graphics with the help of modern 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.

As a result of the work on the systemic reform of higher education in Uzbekistan, the concept of development of the higher education system until 2030 states that ".... based on international experience, the introduction of advanced standards of higher education, including the gradual transition from education aimed at the acquisition of theoretical knowledge in the curriculum to the formation of practical skills; to raise the content of higher education to a qualitatively new level, to establish a system of training highly qualified personnel who will make a worthy contribution to the sustainable development of the social sphere and the economy, who will be able to find their place in the labor market; such tasks have been identified.

Ensuring the quality and effectiveness of education requires, first of all, a great responsibility of teachers and the use of science-based methods. The use of modern pedagogical and multimedia computer technologies to meet the demand for highly qualified competitive personnel is a topical issue.

By teaching the subject "Descriptive Geometry and Engineering Graphics" in higher education, students will be able to develop graphic literacy and acquire technical knowledge. It is no coincidence that drawing is the language of technology. Therefore, the first of the problems in teaching the subject "Descriptive Geometry and Engineering Graphics" is the development of students' spatial imagination. To date, as a result of the expanded opportunities for applying for higher education, there is an opportunity to choose up to 5 specialties. That is, there are no restrictions on the choice of direction in higher education. As a result, young people graduating from academic lyceums and professional colleges in the social sphere can be admitted to study in engineering, technology, construction. 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 that the level of graphic literacy to study in this area be at the required level.

As a result of research and observations, the spatial perception of 1st year students in the field of drawing varies. Because lyceums and colleges (social sciences, humanities, medicine and economics) do not teach drawing. It is obvious that the students entering the university have different potential, understanding, imagination in the field of drawing, that is, their spatial imagination is different.

Imagination is the process of remembering things and events, situations, images of reality, as well as the process of creative imagination. Enriching the imagination with new images plays an important role in

solving thinking tasks. Imagination is important in the acquisition of knowledge, in the acquisition of professional skills.

An important aspect of imagination for a person is that with the help of this imagination a person anticipates the future object, the thing. For example, an engineer imagines the machine he wants to create from his schematic. The architect imagines from the sketch he drew the building which he wanted to build.

Spatial imagination is a complete understanding of the shape, size, appearance, condition of the object, drawing, object, detail, etc., and its characteristics. It is understood that a drawing, detail, etc. can be imagined by the human imagination and can be drawn on paper**.**

Lack of time is one of the major problems (drawing on the board, re-drawing and explaining) due to the insufficient development of students' spatial imagination in the delivery of information on a given topic in the teaching of graphic geometry and engineering graphics in higher technical education. Solving them requires the use of multimedia computer technologies in the educational process. There is a need to use computer technology, computer graphics, especially in the development of spatial imagination, creative and independent work skills of students.

A number of scientific researchess have been conducted on the use of computer technology in the educational process in our country and abroad.

In particular, the content of graphic education in the Republic R.Khorunov, Yu.Kirgizbaev, I.Rakhmanov, R.Ismatillaev, Sh.Murodov, D.Kuchkarova, B.Khaitov and teaching methods A.Umronkhodjaev, B.Khodjaev, E.Ruziev, Sh. Although research on improvement of Abdurahmanov, K.Zoirov, A.Khamrakulov, J.Yodgorov, D.Achilova and others has been carried out, the problems of improving the quality and efficiency through the use of multimedia computer technologies in teaching science have not been sufficiently studied.

From scientists of foreign countries on the use of computer technology in education: Neda Bokan, Marko Ljucovi´c, Srdjan Vukmirovi´c, Charles A. Rankowski, Minaruth Galey, Ramo´n Rubio Garcı´a, Javier Sua´rez Quiro´s, Ramo´n Gallego Santos,Santiago Martı´n Gonza´lez, Samuel Mora´n Fernanz V.V.Dovgan, M.A.Surxaev, I.V.Robert, E.S.Polat, I.G.Ejik, T.N.Suvorova, MI Belyaev, OK Tikhomirov, VV Kondratova and others conducted research.

On the development of spatial imagination: I.P.Istomina, O.V.Razumova, L.V.Zanfirova, L.P.Rusinova, A.V.Piliper, Yu.A.Olkova, E.P.Benenson, N.S. Podkhodova, A.I.Xubiev, L.N.Anisimov, X.A.Arustamov, A.D.Botvinnikov, E.F.Bikov, A.V.Ivanov, I.Ya.Kaplunovich, Yu.F.Katxanov, E.I.Korzinov, I.I.Kotov, M.N.Makarov, A.A.Pavlov, V.S.Stoletnev, V.I.Yakunin, Yu.A.Volkova, P.A.Ostrojkov, I. P. , Although Kaloshin and others conducted research, the problems of developing students' spatial imagination through the use of multimedia computer technology and computer graphics in the teaching of science have not been sufficiently studied..

In the scientific research of LN Anisimov to develop students' independent study through in-depth study of the concepts and images studied in this course in 2 main directions in the teaching of graphic geometry to students of the direction of artistic graphics; 2 emphasized that it is possible to develop creative activity through learning and generalization through creative activities.

According to A. Khamrakulov, "..demonstration of spatial solutions of problems before solving them attracts students to independent thinking and creative approach to the problem, and allows students to show it in a part they do not understand until they understand it again. Also, if there are interactive models of this type of

problem, students will complete their assignments in interactive models. By entering the parameters of the tasks in the interactive model, the solution of the task will appear on the screen".

Today, the lack of development of spatial imagination in the teaching of "Descriptive Geometry and Engineering Graphics" creates problems in imparting knowledge to students in the subject. The existing problem can be solved through the effective use of modern multimedia computer technology and computer graphics in finding the optimal solution. Students need to develop spatial imagination in order to understand and consolidate the acquired knowledge of the subject "Descriptive Geometry and Engineering Graphics". Based on the above considerations, it is possible to improve the quality of teaching and mastery by developing students' spatial imagination in a short period of time through multimedia computer technology and computer graphics.

"Practical work has been done on the development of students' spatial imagination on the basis of multimedia computer technology and computer graphics in the teaching of the subject "Descriptive Geometry and Engineering Graphics". For this purpose, a multimedia electronic textbook on the subject "Drawing 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.

Possibilities of using multimedia computer technologies and computer graphics in the discipline "Descriptive Geometry and Engineering Graphics" (Figure 1).

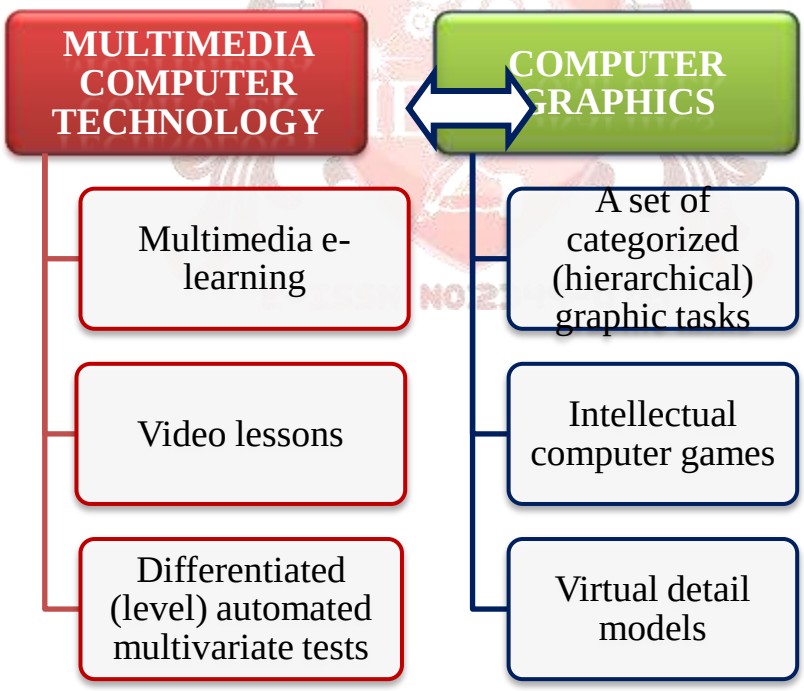

Figure 1. Modern methodological support structure that should be used to develop students' spatial imagination in teaching the subject "Descriptive Geometry and Engineering Graphics".

In teaching the subject "Descriptive Geometry and Engineering Graphics" use 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 stratified 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.

Using computer graphics is an effective way to develop students 'spatial imagination. In the section of engineering graphics, which is the second part of the subject "Descriptive Geometry and Engineering Graphics", various details, objects, assemblies, technical drawings, buildings (plan, facade, shear, perspective), projections marked with numbers (platform, apparel area, slope planes, depth, height, dam, channel, tunnel), etc. is the most convenient tool to use the capabilities of computer graphics in showing and explaining (Figure 2-3).

The use of multimedia computer technology and computer graphics in the classroom is directly related to the type of lesson (Lecture and Practice), the teacher can take advantage of modern pedagogical technologies in combination with traditional methods.

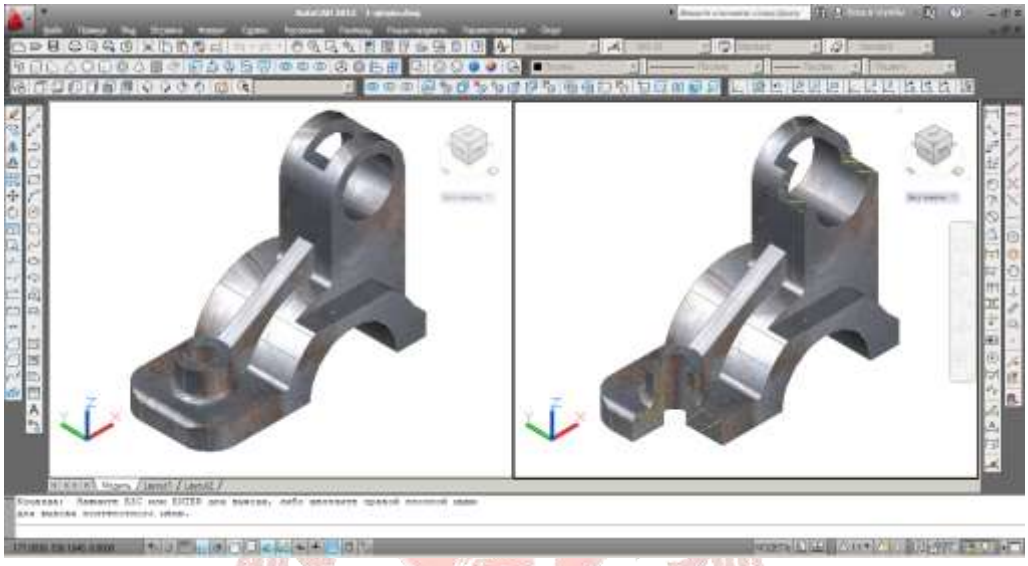

Figure 2. A virtual model of a detail created in an AutoCAD graphics program.

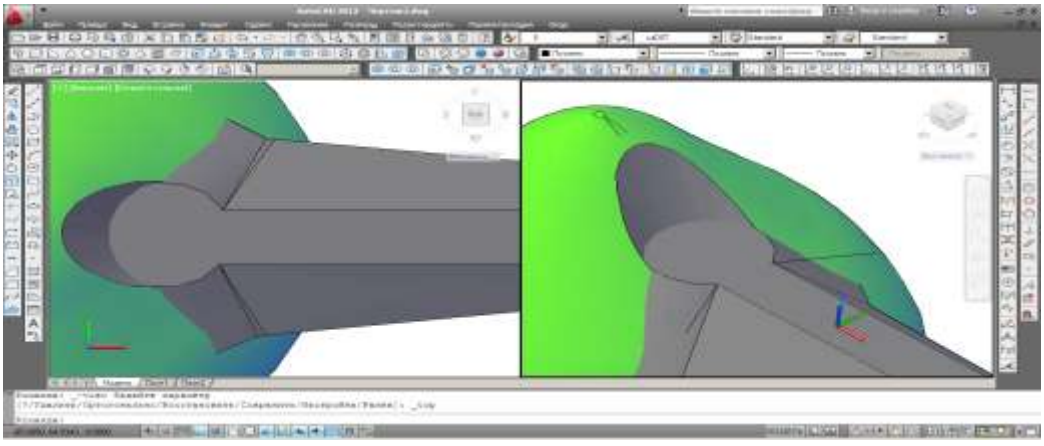

Figure 3. Apparel is a virtual model of the platform created in AutiCAD.

Facilitate the knowledge provided to students by creating interactive details of AutoCAD graphics program and using 2D, 3D modeling capabilities on topics such as surfaces, surface formation, surface plane

and intersection, axonometric projections, views, cuts and sections, assembly drawings, construction drawings, helps them to master easily and effectively.

There are a number of programs available to use computer graphics in the learning process. For example, AutoCAD, ArchiCAD, Compas, 3dMax and others. Among these programs, the use of AutoCAD graphics program in the teaching of "Descriptive Geometry and Engineering Graphics" is effective and convenient for the user, as well as direct application of the laws of science.

It is also possible to shape students' spatial imagination through standard details in AutoCAD. These details can be made in different ways using the necessary dimensions in the creation. This opportunity can be compared to a virtual experience stand. In addition, students will be able to effectively master the knowledge of the subject by performing the necessary editing on its parameters and details.

Depending on the type of lesson, the science teacher determines the time of use of multimedia computer technologies and computer graphics. As a result, it is advisable to use a multimedia electronic textbook or computer graphics for the necessary part of the lesson time to understand the information provided to students on the topic, to be able to spatially imagine the drawing details, assignments. In this case, the information provided through animation, video, video, visual, illustrative, etc., plays an important role in the spatial representation of information acquired by students. The student acquires the knowledge he receives only when he imagines the appearance, condition, condition, shape, size of the drawings.

It is known from the world experience that the creation of opportunities for independent learning, the availability of the necessary information on the subject in a modern way helps students to acquire independent knowledge. The multimedia electronic textbook on the subject "Descriptive Geometry and Engineering Graphics" is designed for learning in all types of education. In addition, there are opportunities for independent and distance learning to receive information on the subject, study and control the acquired knowledge. A multimedia e-textbook can view and learn thematic drawings in animated and video form. It is also possible to automatically and self-control the drawing sequence. Practical assignments can be viewed through the option and a sample of their execution. The student can review the sequence of completion of the task and the part he / she did not understand in order to consolidate and master it. It acts as a tutor to the students.

The multimedia e-textbook provides a full range of science demonstrations. In teaching the subject "Descriptive Geometry and Engineering Graphics" it is necessary to provide visualization to develop students' spatial imagination. That is, students' spatial imagination is developed on the basis of visual materials. It is also the basis for enriching, testing, shaping and developing knowledge based on it.

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 at the Namangan Engineering and Construction Institute were selected for the study: 1st control group (44-45-TIE-19), 2nd experimental group (30-31-AYA-19) these were carried out remotely online in the spring semester of the 2019-2020 academic year i.e. in pandemic conditions. The experiment was conducted 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. In addition, in the 2018-2019 academic year, experimental tests were conducted and the results of the experimental group were 13.2% higher than the control group.

In conclusion, based on today's requirements, the development of students' spatial imagination as a result of teaching the subject "Descriptive Geometry and Engineering Graphics" using multimedia computer

technology and computer graphics has been proven in experiments. Only when the student develops spatial imagination can he master the subject of "Descriptive Geometry and Engineering Graphics". Therefore, the use of modern computer technology and computer graphics as the most advanced tool in the development of students' spatial imagination in the teaching of science is a requirement today.

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