

IMPORTANT FACTORS FOR USING THE GEOGEBRA PROGRAM IN TEACHING ANALYTICAL GEOMETRY

Nurmakhanov Kayrat Erpayizovich

Teacher of the Department of Mathematics Teaching Methodology,

Nukus State Pedagogical Institute named after Ajiniyoz

ABSTRACT

In this article, there is a need to create a set of ready-made models, a system of exercises and tasks for students in accordance with methodological recommendations for studying some topics and sections of the school curriculum in mathematics. It is considered that GeoGebra software can be used as an important tool in forming analytical geometry concepts for students

Keywords: Mathematics, GeoGebra program, analytical geometry, tool, projection geometry.

The use of modern technologies in the teaching of mathematics is mainly directly related to the software used in the educational process. It is usually necessary for educators to have enough knowledge and skills to create a practical mathematical problem in the imagination of students. Mathematical software is often used to research processes based on mathematical models and is aimed at solving complex mathematical problems. At the same time, there are educational software that help enrich the mathematical and analytical geometric imagination of learners.

One of the main features of solving analytical geometry problems is the visualization of the problem. Software does not always allow to completely automate the process of solving a mathematical problem, especially when creating a mathematical model, proving or conducting research, these shortcomings are evident.

However, mathematical software, especially analytical geometry, allows us to simplify the search for solutions by visualizing and drawing models when solving problems. Because by seeing it becomes possible to better understand the problem or clarify the approach to the solution. In this regard, K. F. Gauss expressed his thoughts as follows: "Mathematics is a science for the eyes, not for the ears." In many cases, it is important not to visualize the model, but to observe its behavior in action, at different values of one or more parameters, to identify and take into account situations that lead to different results.

Software products that implement the principles of visualization and dynamics for analytical geometry problems are called dynamic analytical geometry systems. The use of dynamic analytic geometry systems in teaching mathematics provides the following opportunities:

- Providing high visibility in the study of elementary, analytical, differential and projective geometry;
- Quick and easy visualization of analytically given functions, including parametric functions (for example, limiting the search for a solution or determining the appropriate analytical geometry image).

Almost any dynamic analytical geometry systems allow for quick and accurate drawing on the plane and in three-dimensional space, as well as conducting research by manually or automatically moving individual points or changing numerical values of parameters. There are several dozen specialized software packages in the segment of dynamic analytical geometry

systems. However, most of them do not have high functionality. For example, some programs are limited to planimetry, such as GeoNext, KSEG, etc. In addition, C.a.R., Cabri, Cinderella, Dr. Programs such as Geo, FreeGeo Mathematik, GeoProof, Geometria, Geometrix, Geometry Pad, GeomSpace, GEUP, Tabulae, WIRIS only have an English language interface. One of these programs, GeoGebra, stands out from the rest with its multi-functionality.

The main advantages of the GeoGebra package are as follows:

- Free of charge;
- Multilingual interface;
- Simplicity and convenience of the graphic interface;
- Installation on various operating systems (even on tablets and smartphones) and the availability of an online version (the online version does not support input commands that are not provided in the graphical interface when installed on mobile gadgets);
- The availability of a database of open exhibitions and the possibility of introducing didactic materials by users.

The GeoGebra program has an algebraic module, a table processor and a statistical module, and its geometric capabilities are sufficient to solve elementary, analytical, projective and differential geometry problems.

There is no educational literature on the use of GeoGebra software as the main tool in the study of analytical geometry in higher educational institutions. The importance of teaching future mathematics teachers the fundamentals of working in systems of dynamic analytic geometry is very important. Mathematics teachers who have mastered the GeoGebra program during their studies in higher education institutions almost always use it in their further educational activities and become key personnel who recommend the program to their colleagues in secondary schools.

The main mechanisms for using the GeoGebra package for teaching future mathematics teachers are as follows:

- Delivery of handouts prepared in the GeoGebra program;
- Display on the static drawing screen prepared in the GeoGebra program;
- Displaying a dynamic drawing on the screen (with rotation, transition between 2D and 3D, changing the position of individual points, etc.);
- Step-by-step construction of a drawing drawn by the teacher in real time in the GeoGebra program (or create a video of the drawing process for independent study);
- The teacher gives instructions on how to create a file in the GeoGebra program - both for mastering the program's interface and ways of working in it, and for independently performing and making changes to prove theorems or consider problem solving methods;
- Independent drawing and descriptive illustrations by students when solving problems (here several typical scenarios can be distinguished: a) illustrative constructions; b) a graphic experiment to find evidence; c) study the number of different solutions to the problem; g) numerical verification of the results of analytically constructed calculations);
- Carrying out practices on working in the GeoGebra program;
- Implementation of test tasks by the teacher in the form of GeoGebra applets (there are many such tasks in the database of examples on the GeoGebra project website);

- Searching the database of examples of drawings and models suitable for the problem under consideration on the GeoGebra project site, analyzing them and revising them (animation, etc.). Drawing a diagram in GeoGebra is usually not the final solution to a problem, but an important part of it. In some cases, the solution to the problem can be written on the drawing plane using the program interface, but for solving complex tasks with a lot of sequential actions, considerations and constructions, it is desirable to run an additional file.

At the beginning of the teaching of analytical geometry, it is advisable for teachers to familiarize themselves with a separate module dedicated to the GeoGebra interface and to review the processes of visualizing problems using dynamic drawings, repeating the school geometry course.

With GeoGebra, you can do the following:

- Bringing school knowledge of geometry to a new level;
- Supplementing school knowledge of elementary geometry;
- To provide the study of software interface and drawing methods sufficient for quick mastering of fields requiring dynamic drawings (analytical geometry, projective geometry, etc.);
- Is to teach the future teacher to independently create dynamic drawings for use in professional activities.

The use of computer models developed with the help of GeoGebra is one of the important factors that help to further increase the effectiveness of learning analytical and projective geometry, as well as the school mathematics course. Creating and developing web services for sharing computer models is a necessary, timely and important step towards increasing the efficiency and consistency of their use. At the same time, the application of information technologies to the educational process of higher educational institutions and secondary educational institutions requires more study and research in this area. In particular, there is a need to create a set of ready-made models, a system of exercises and tasks for students, in accordance with methodological recommendations, when studying some topics and sections of the school curriculum in mathematics. In conclusion, GeoGebra software can be used as an important tool for students to develop analytical geometry concepts.

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