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TEACHING MATERIALS

MSC 97D40

IMPLEMENTATION OF CREATIVE APPROACH METHODS ON THE LESSONS OF A SPECIALIZED COURSE ON IMAGE THEORY

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The article discusses the questions on implementation of methods of creative approach on the lessons of a specialized course on the theory of images. Development of spatial concepts, systematization of knowledge on the properties of geometric figures and methods of images are under consideration

Key words: combination of spatial figures with bodies of revolution, images of spatial figures, methods of images

Introduction

Mastering the skill of imaging of geometrical figures and their combinations defined by theorem and problem situations in the school course of geometry can be organized not only during training lessons on image methods but also during the lessons of mathematical problem solutions practice (Geometry section), teaching methodology of mathematics. However, in the result of time limitations within the framework of general courses it is impossible to consider different cases of application of image methods in detail. Of special interest is the application of institutional methods for images of spatial body combinations. It is almost impossible to consider all the combinations. However, the most frequent case is when one of the bodies is a ball. Images of such combinations are the most difficult. In that context, we suggest to organize a specialized course for students on the subject "Combinations of a sphere with polyhedrons and bodies of revolution".

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Statement of the problem

Theorems and problems on the combinations of spatial figures (in particular, combinations of a sphere with other bodies) are included into the programs for school and classes of advanced study of mathematics. Such problems are usually offered at the entrance examinations to universities where mathematics is a chief subject. Study of theoretical issues and solution of problems on a defined subject is of great significance for mathematical foundation and brain building of students.

In the result of solution of such problems, students learn to generalize and systematize their knowledge on geometrical figure elements and their dependences. In the process of recognition of different kinds of polyhedrons, bodies of rotation and their combinations and constructions of corresponding images, they develop spatial representations and graphic skills. However, in the current textbooks for secondary schools by L.S. Atanasyan [1] and A.V. Pogorelov [2], the theoretical questions on polyhedron combinations and bodies of revolution are not considered and there are just a few problems on this subject. Only at the end of the textbook "Geometry 9-10"by Z.A. Skopenets, which was published in 1981 for the last time, there is a set of problems on the combinations of a sphere with polyhedrons. Thus, it is necessary to systematize and to generalize the methodology of teaching of this subject and to implement it within the framework of a specialized course.

The suggested specialized course is aimed at development of students' creative thinking, extension of their knowledge by the means of application of image theory to the solution of problems in future professional activity.

This aim unites a number of concrete tasks the most important of which are the following:

- development of spatial representations and graphic culture of students;
- generalization and systematization of knowledge on the properties of geometric figures and methods of images which were studied during the main course of geometry at a school and pedagogical college;
- development of the skill to apply the methods for imaging the figures in the practice of teacher's work;
- development of the skill to write and to solve the problems of geometry school course;
- consideration of methodical problems occurring during the presentation of issues on figure combinations.

We suggest the following structure of content of the specialized course (table);

Number of lesson	Content	Hours
1,2	A sphere circumscribed about a cylinder, cone, blunted cone.	4
3	A sphere circumscribed about a pyramid.	2
4,5	A sphere circumscribed about a prism, blunted cone.	4
6,7	A sphere inscribed in a cylinder, cone, blunted cone.	4
8	A sphere inscribed in a prism.	2
9	A sphere inscribed in pyramid, blunted cone.	2
10	A sphere touching upon a polyhedron edge.	2
11	Solution of advanced problems on different combinations.	4
12	Final test.	2

According to the aims, the content of the specialized course includes the following issues:

- definitions of the combinations under consideration.
- theorems on circumscribed and inscribed spheres (which are not in the school course);
- images of the combinations;
- methodical recommendations for a future teacher on presentation of theoretical questions of a subject, on writing and solution of corresponding problems.

Thus, the specialized course includes the information directly related to the school course of geometry. Proofs of theorems, methods of problem solutions and imaging may be used for extra-curricular activities in mathematics and for advanced study of combinations of polyhedrons and bodies of rotation. The methodical basis of the specialized course is the ETU (Extended Teaching Unit) conception realization of which means extended approach to the content of teaching material. Notably, it is necessary to consider jointly, in relations, the whole groups of interconnected units of this content. Concentration and compaction of teaching material relates separate kinds of knowledge providing their systematization, thus reducing the study load for students and the teaching time [3].

The following technique are applied for the specialized course lessons: simultaneous application of orthogonal projections and Monge method for geometric object images; systematic detection and comparison of affine and metric properties of figures; joint study in the plan of contraposition of planimetric and stereometric notions; application of analogy as a mean for development of knowledge via supposition; application of tasks for writing of mathematical problems; succinct and review presentation of teaching material: matrix recording of information, parallel and joint record of similar or opposite statements: combination of geometric quantities with accurate imaging of figures in computational problems.

In such an organization of teaching material, the students study the relations between units of teaching material which provides better learning and development of the skill to apply their knowledge in different situations. Moreover, a future teacher will be able to use these techniques in the teaching and learning activities at school [4].

Thus, study of theoretical questions and solution of problems with combinations of spatial figures gives opportunities for simultaneous consideration of planimetric and stereometric notions. Analogy helps to find the interrelation of notions, theorems, problems and the possibilities of their joint study within the ETU aims. A teacher organizes the students' activity during a lesson so that to show the techniques of making comparisons between planimetric and stereometric notions while investigating the issues of inscribed and circumscribed spheres which a future teacher will be able to apply in teaching activities.

It is known that only one circle may be circumscribed about any triangle with the center of this circle at the intersection of geometrical locus equidistant from the triangle vertex. Having proved the theorem, the students are offered to write and to consider a similar theorem for space. Comparing a tetrahedron with a triangle, it is natural to suppose that one can circumscribe only one sphere about a tetrahedron. Having studied this supposition, we can say that it is true. The algorithm of solution of this problem for a triangle will be the same as for the generalized case for a tetrahedron.

For successful realization of analogy, the important moment is not the difference of a triangle from a tetrahedron but their similarity that means the possibility of change from one figure to another, from one discussion to a similar one. Such a process of thinking means a method of investigation from one figure to another.

Within the process of solution of the problem for a triangle and a tetrahedron, a pair of ideas (the preceding and the following) forms an extended unit including the notions not only on plane but on space as well.

Conclusions

The necessity of development of a method to study the image theory corresponding to modern conceptions of education and providing students with a complete conception of the subject and general techniques of solution of problems determined the application of creative approach for solution of problems.

Based on this, we developed a method of study of image theory within the main course of geometry in a university and within a specialized course promoting the formation not only of special knowledge at a higher level but general skills to apply the techniques in future professional activity.

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