

TEACHING METHODS AND TECHNIQUES FOR IMPROVING THE QUALITY OF TRAINING OF ENGINEERING STUDENTS

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This article outlines methods of implementation of cognitive-visual approach to the process of teaching Mathematics to engineering students through graphic schemes, information tables, algorithmic prescriptions and algorithmic requirements – methodological tools which we refer to the graphic-sign and sign-and-text groups of visual information representation. The didactic advantages and cognitive possibilities of the outlined teaching tools for the organization and enhancement of students' cognitive analytic-deductive activity are emphasized.

Introduction. There is no doubt that the search for new, more efficient methods which allow in the light of the latest achievements in science and society's abilities to optimize the learning process in higher educational institutions, will always be relevant to the theory and methods of teaching mathematics. However, even the use of modern, efficient means does not always lead to the desired results. Obviously, further research in this area should be aimed not only at the development of new pan-pedagogical technologies and techniques, but also at search for the best possible modes, methods and means of training for certain specialties.

In the present publication a set of various methods and methodological tools, providing favorable conditions for methodically targeted assistance to students in the organization of teaching and learning activities is presented. The outlined tools will improve visibility, accessibility, depth and retention of mastering mathematical information by engineering students in class and extracurricular classes. Organizationally, they contain the potential for the construction and maintenance of continuity, completeness of the didactic cycle of mathematics educative process. Systematic theoretical, practical, and control materials, optimized with respect to the developed scientific and methodological foundations of their creation and to systemic application, gradually provide meaningful productive activity of students.

The overview of publications on the topic. In modern pedagogical science visibility is recognized as a teaching medium with great potential ([1]–[5] and other). Special attention is paid to the implementation of visualization in educational and cognitive process on the basis of the development and use of reserves of students' visual thinking. The approach to training, which takes into account the cognitive role of visualization, is called a cognitive visual one. In our study, a cognitive visual approach is understood as the principle of formation of educational technology on the basis of the interrelation and unity of abstract-logical content of a teaching material and methods with visually intuitive ones. This approach involves the usage of cognitive (cognitive-semantic) features of visual information (for example, when working on illustrations). Cognitive visualization is the key to solving many educational problems. It takes into account the role of color, enhancing the perception, memorization and comprehension of educational information better than the black-and-white presentation of information. This approach encourages the widespread use of colors and shapes, graphs and drawings, of complex cognitive-visual tasks and animation in the educative process [1].

Moreover, this cognitive-visual approach in a methodical system of teaching mathematics to students is expressed in such activities as:

- A shift from the use of an exemplary aspect of visualization to the cognitive process;
- Organization of activity includes systematization of mathematical facts and their analysis and determines the movement to substantial theoretical knowledge;
- Incorporation of elements of problem-based learning in the structure of different types of visualization, i.e. asking questions or revealing contradictions which encourage self-reflection and study of essential internal ties, properties and relations of mathematical objects under consideration;
- Training students in educational activities, the implementation of which leads to the formation of meaningful generalizations which have symbolic mathematical visualization;
- Incorporation in the training of such a visualization structure, which is able to influence the psychological sphere by reinforcing positive motivation, interest in the subject, self-reflection resulting in the enhancement of cognitive activity of students (in particular, compilation of tables, algorithms development or structural logic circuit design) [2, pp. 151–152].

The results and their discussion Here are the examples of the cognitive approach for the design of visual cognitive activity of engineering students when organizing classroom activities:

a) incorporation of elements of PowerPoint presentations explaining theoretical material with a large number of charts and formulas. The presentation takes into account the role of color, enhancing the perception, memorization, comprehension of educational information better than the black-and-white presentation of information (Fig. 1).

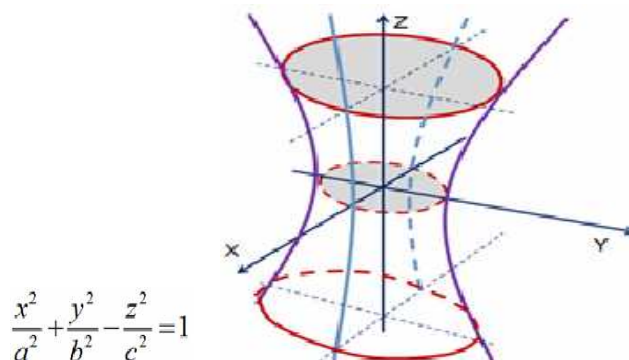


Fig. 1. (hyperboloid of one sheet)

use of computer algebra systems for the construction and analysis of second-degree surfaces (Fig. 2).

b)

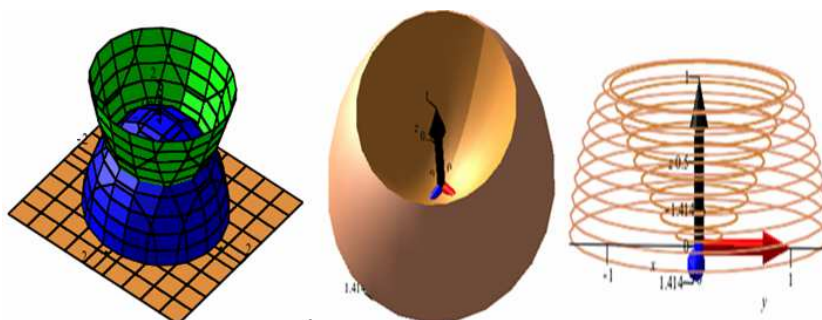


Fig. 2. (surface intersection)

c) experimental studies have shown that sufficiently effective methodical means of implementing cognitive functions of visualization in tutorials are information tables, algorithmic prescriptions or solution algorithms for teaching objectives which we refer to the sign-word group of the presentation of visual information. On the basis of our research we have found out that scientifically sound, circumspect and designed incorporation of outlined methodological tools in the process of teaching new topic, or solution to the problem allows accumulating the advantages of problem and explanatory-illustrative methods of learning mathematics. The use of such tables and algorithms contribute to a better understanding of not only objectives of the task, but also of ways to solve them, and consequently provide students with assistance in systematization, memorizing and application of knowledge [3].

d) incorporation of algorithms or structural logic diagrams in teaching which contribute to the solution of problems ([4, 5]) (Fig. 3).

Conclusion Proposed for discussion methodological tools and techniques, being specific, but convenient and effective means of organization of structuring, specifying, logical organization, systematization and classification of mathematical and other information, form the skills of working with graphic information. Developing visual thinking, they specifically capture attention in learning. Implicitly and indirectly contributing to summarizing mental contents in visual images, allowing the formation of a more complex idea of the image or concept, proposed tools and techniques contribute to the vision of the whole structure of the material being studied, lead to its more lasting and profound assimilation, develop and form the emotional and value-conscious attitude to knowledge in mathematics they obtain.

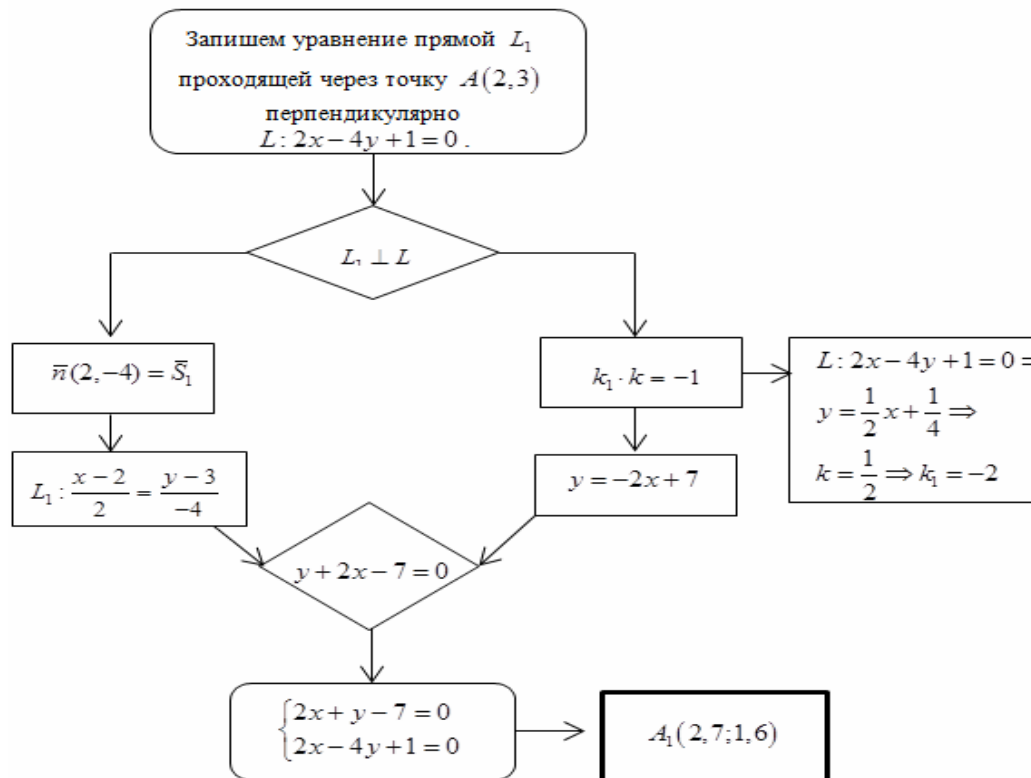


Fig. 3. (solution algorithm)

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