

Interdisciplinary links of mathematical sciences in higher educational institutions

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ABSTRACT: The flow of information sweeps more and more various fields of activities in the modern world. In this connection future teachers' informational culture ought to be formed throughout all the years of study and not within one subject but in a set of majors. It requires a correct organization of inter-subject links of mathematical sciences in higher educational institutions.

Teacher training in higher educational institutions has to be based on the development of a person's creative abilities, the capability to continuous self-improvement and self-development. Now secondary school needs highly qualified university graduates who have got a professional training and therefore are able to switch over from one type of educational activity to another. It is required that the modern teacher should have not only thorough, but, first of all, systematized knowledge and skills.

When studying mathematical disciplines at a higher educational institution the role of information technologies is increased because they act as an effective didactic means that makes it possible to form a student's individual educational trajectory. Such a trajectory results from choosing personally significant content of training, its complexity, type of tasks, their qualitative content, studying speed, etc.

Teaching such subjects as "Elementary mathematics" and "Theory and technique of teaching in mathematics" is of major importance.

Let us consider the subject "Elementary Mathematics". This discipline according to the state educational standard contains secondary school curriculum subjects and therefore needs being taught using methodologically approved means including digital educational resources. In this regard we trace interdisciplinary links of three subjects: "Elementary mathematics", "Theory and methodology of teaching mathematics" and "Computer Science".

A Digital Educational Resource (DER) is a set of digital data applicable for use in educational process as a single unit.

The number of hours allotted by the curriculum is not enough for such a thorough and complicated discipline as "Elementary mathematics" therefore it is necessary to select the themes that will be taught through DER.

It is convenient to use DERs when lecturing, in practical training and in organizing university students' independent activities.

A DER is convenient to use while conducting the following lectures:

1) Elementary algebraic functions (rational and irrational), logarithmic, indicative functions. Graphs of functions and their properties.

2) The solution of the equations and inequalities (irrational, with the module, logarithmic, indicative).

3) Definition of trigonometrical functions, their properties, graphs. Ratios between trigonometrical functions of one argument. Reduction formulas. Addition theorems for trigonometrical functions. Trigonometrical functions of aliquot arguments. Formulas of half arguments. Formulas of transformation of multiplication of trigonometrical functions into the sum. Formulas of transformation of the sum of trigonometrical functions into multiplication.

4) Arch functions; their definitions, property and diagrams. Trigonometrical operations over arch function. Ratios between arch functions. Performance of the return trigonometrical operations over trigonometrical functions.

5) Axioms and theorems of absolute geometry. Axiom of parallelism and its consequence.

6) Circle. Diameters and chords. Angles connected with a circle. Similarity methods. Point degree concerning a circle. Radical axis of two circles.

7) Polygons: convex, non-convex, stellate, correct, inscribed and circumscribed.

8) Remarkable points and lines in a triangle.

9) Menelaus and Ceva's theorems.

10) Geometrical places of points.

11) Constructions on the plane.

12) Areas of flat figures. Isometricity and homogeneity of polygons. Length of a circle and circle area. Method of the areas.

13) Plane transformations: movement, similarity, homothety, inversion.

14) Stereometry axioms. Parallelism and perpendicularity of straight lines and planes in space. Crossing straight lines.

15) Polyhedral angles. Angles between straight lines and planes. Dihedral angles. Trihedral angles. The theorem of cosines for a trihedral angle. The theorem of sine and the dual theorem of cosines for a trihedral angle.

16) Polyhedrons: convex, non-convex, correct, semiregular, stellate. Euler's theorem for convex polyhedrons.

17) Bodies and rotation surfaces.

18) Combinations of polyhedrons and rotation bodies.

19) The image of spatial figures on the plane.

20) Coordinate and vector methods in geometry.

Students can be given different level individual tasks in order that they should be able to provide animated solutions of tasks using computer technologies.

A DER allows to solve more problems at one lesson, consider various ways of solution, consider all stages of solutions in full, and to look at drawings when solving tasks concerning construction as well as various cases of research.

It is necessary to give distinct large scale diagrams and graphs, drawings and illustrations, not including too much information on one slide.

A DER gives the teacher new opportunities to organize educational process, and students to develop their creative abilities. Practical experiment in their application in various subjects showed many advantages as compared to traditional textbooks:

- They provide the student-teacher interaction and feedback for continuous creative improvement of the computerized textbook;

- They considerably reduce the time for studying the subject;

- They create (due to the use of animation illustrations) an illusion of the teacher's constant presence near the trainee and add vitality to the dry pages of the textbook;

- They create a pleasant psychological atmosphere;

- They provide individualization of training due to the fact that every student selects training material and can change the sequence of studying it taking into account his psycho-physiological features, possibility to return to difficult questions several times and the possibility to check himself when choosing and solving problems of various degree of difficulty.

Applying computerized teaching at the lessons, due to its flexibility, is an effective educational technology. New information technologies open access to nonconventional sources of information, give the chance for creativity, and a possibility to secure and form various professional skills.

At present the involvement of information technologies in educational process by teachers is rather scarce in spite of the fact that the use of such programs as Excel Microsoft, PowerPoint Microsoft, and the use of an electronic interactive blackboard allow making materials for study more vivid and easier comprehended. The students get involved in active work. The perception becomes keen. Students' attention is easier focused on the problem, their comprehension and memorizing of the material are improved, which makes the teacher's work more efficient.

There have been developed numerous DERs for the teachers of mathematics. It is rather difficult to pick up something from the accessible DERs for a certain lesson therefore sometimes it is more convenient and less time consuming to make a computer lesson presentation of your own though it is a rather painstaking job. One can create a DER, using the system Matematica, PowerPoint Microsoft, etc.

The use of such programs at the lessons of mathematics means the student's independent discovery of these or those regularities and natural laws, opens opportunities for carrying out experiments, and allows the school student not just to learn the formulation of theorems and definitions, but also to test and check them in practice.

It is advisory to use the system Mathematica in the educational process when it is necessary to construct more exact diagrams of functions or polygons, polyhedrons, surfaces of rotation or make calculations, etc.

In other cases it is sufficient enough to create a DER with PowerPoint with the necessary sequence and material coverage. The advantage of PowerPoint is that it has successfully been used for many years and it doesn't demand thorough knowledge of the basics of programming to create a DER of their own from those who use this system.

The knowledge of educational material, i.e. mathematics, depends on the fundamentals that the student got while at school, as well as the knowledge obtained at the university. Future math teachers should not only have a thorough knowledge of the material to be taught, but also be able to apply their knowledge in practice, that is, when teaching students at school. The knowledge of different forms, methods and means of teaching allows students to select and enhance the learning experience.

When teaching elementary mathematics teachers should pay attention to the students' knowledge and highlight topics of mathematical problems that cause difficulties for students. This approach makes it possible to come back to the gaps in the study of the subject "Theory and methods of teaching mathematics" and select topics for students' self-studying.

The necessity to improve the effectiveness of training teachers of mathematics, which means improving the efficiency of education, requires integration of mathematical disciplines.

The teachers' experience in the integration of mathematical disciplines, as well as the introduction of information technology will enable students to apply their knowledge in their future profession and to be highly qualified in their field.

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