

Virtual Electronic Practical Work on Elements of Mathematical Logic

Izhutkin Viktor, National Research University(MPEI), Moscow, Russia

Pickl Stefan , Universität der Bundeswehr München, Germany

Use of new information technologies is one of ways to increase the efficiency when studying mathematical disciplines [1,2], in particular, elements of mathematical logic.

The work offers the program-methodical complex of mathematical applets (so called mathlets) - the dynamic software allows for making studies of the material more active, gives opportunities for development and in order to extend mathematical knowledge and skills of students. The following topics of studies are included: “Basic Concepts”, “Predicate Languages”, “Terms and formulas”, “Truth Table”, “Axioms of Logic”.

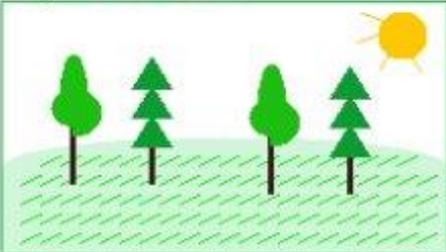
The offered complex is developed for students of following specialities: mathematicians, physicists, lawyers and biologists. Studying passes by a principle when knowledge are given to students not in a ready version, and they must obtain them during the problem decision, becoming the participant of the scientific search. Sizes of the learning courses, and also given examples and exercises are composed according to a learner professional speciality which are resolved with the help of logic laws. For example, for the students - lawyers we give the examples and exercises with using the formal-logic aspects in structures and features of legal concepts and statements, showing application of logic procedures in judicial activity, in the legal theory. When designing the pedagogical scenarios in the beginning we create the student motivation, further - consecutive performance with an increasing difficult levels of examples and exercises according stage-by-stage formation of intellectual actions. During the material learning reminders before the studied elements are done if it is necessary, according to the associative-reflex theory of learning.

First the students gets acquainted with illustrative introduction example from his learning field, which are resolved with the help of logic. Using the principles above, introduction examples for biologists and mathematicians can be produce like this:

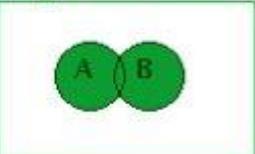


Introduction example

Graphic illustration:



Diagramms:



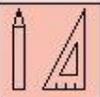
The statement:

A + B - In a wood can grow deciduous or coniferous trees

Formulas:

A + B

Preview

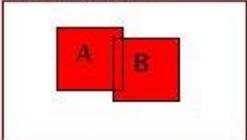


Introduction example

Graphic illustration:

-12 -11 -10 -9 -8 -7 -6
-5 -4 -3 -2 -1
0
1 2 3 4 5
6 7 8 9 10 11 12

Diagramms:



The statement:

A+B - The numbers can be negative or positive

Formulas:

A + B

Viewing

For students - mathematicians we give the fuller educational course, and also a lot of examples and exercises for formation mathematical-logic thinking.

There is an opportunity of step-by-step viewing of solution with "forward" and "back". Thus there is a connection of the text elements not only with a graphical illustration, but with data of the truth table and

used formulas. In some problems the student can set own data or change some parameters.

Following problems are considered:

- to receive the analytical formula, having the graphical illustration;
- to build diagrams, knowing the data of truth table;
- to compose formulas, having the statement, etc.

After that the student carries out the individual task with interactive support of his solution. During this process the help and the control over each step of performance is offered based on the current information on the successes and mistakes of the student.

Exercise for physicists can be produce like this:

The screenshot shows an interactive interface for a physics exercise. At the top left is a small circuit diagram icon. The title is "Exercise for physics" with three stars. Below the title, there is a "Graphic illustration:" section showing two overlapping rectangles, A (red) and B (blue), with the label "A\B" above them. To the right is a "Choice of variant:" dropdown menu set to "Variant 1". Below the graphic illustration is a text box containing the instruction "Make the statement and formula appropriate to graphic performance" and the statement "Some substances are not explorers". Underneath is "The statement:" section with five dropdown menus: "Some", "substances", "are not", "explorers", and a greyed-out menu. A "Check" button is to the right. Below that is "The formula:" section with three dropdown menus: "A", "\", and "B", followed by a "Check" button and the word "Correct".

All educational elements be developed in view of psychological laws of mastering knowledge, allows to raise efficiency of training process:

- to program scripts of each example and exercise according to universal behavior theory of training according to which the material is broken into fine parts and moves stage by stage.

- to develop examples and exercises in view of the person focused attributes, motivations, a professional orientation, a level of complexity, depth of studying, etc. for formation logic thinking.

- to use means of illustrative schedules at construction of course material which gives such graphic opportunities owing to which students can dynamically operate while analyzing of images, to rule their maintenance, the form, the sizes and color, achieving the greatest presentation.

- to apply cognitive schedules in constructions of material, development of examples and exercises which help students to extract new components of knowledge by means of researches on mathematical models.

Application of various ways and methods of learning, planning individual pedagogical scenarios increases speed of the information transfer for students and raises a knowledge level.

References

1. Izhutkin V., Toktarova V. Principles of construction and realisation of educational systems on numerical methods // /Educational Technology & Society 9(1) 2006. - ISSN 1436-4522. P. 397 – 410; <http://ifets.ieee.org/russian/periodical/journal.html>
2. Izhutkin V. Virtual Electronic Practical Work on Matrix Games // Abstracts of the Symposium on Operations Research (OR2009), Augsburg, 2009, P.189.