Training specialists in material sciences and aerospace engineering using the interactive educational environment

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Abstract. The article considers the actual topic of using a computerized educational environment through an interactive whiteboard in the process of training specialists in the field of materials science and aerospace engineering at a university. The use of technical teaching aids in practical classes is becoming very common in modern educational practice. It allows the educational process to be carried out in new conditions, when the teacher ceases to be the only source of information for students. The article reveals the possibilities of using an interactive whiteboard in practical classes, provides examples of the use of this learning tool when studying certain topics from a physics course.

1. Introduction

Increasing knowledge intensity and automation of the production processes lead to the search and subsequent changes in the training specialists in most industries. If the content of the taught subjects is unchanged, the search for ways of subjects’ cooperation in the learning process and the ways of training management in technical universities is made. This approach is particularly important when training material and aerospace engineers as potential users of knowledge-intensive and automated production facilities.

Traditional training is no longer possible without the use of modern technical training tools. Students are more likely to show more active cognitive activity in the learning process using a computerized educational environment. When training specialists in the field of materials science and aerospace engineering, it is important to create situations of choice for each training task [1, 2]. This approach is feasible through a special technique for computational and graphic tasks using a computerized educational environment that is successfully used in practical classes. This technique is based on the presentation of educational material in a visual form, through the graphic capabilities of special software that is compatible with both a personal computer and programs for interactive whiteboards and tablets. Although the methodology retains a single educational vector, it allows to achieve educational goals for each student along individual educational paths implementing a student-oriented approach to learning.

The student-oriented approach assumes that the future specialists will acquire the necessary competencies in their future activities. The basis of this approach is the emphasis on students’ self-
education and self-development, which is achievable using modern technical training tools and the presented methodology.

2. Computerized educational environment

Special manuals for teaching the course "Physics" to students of engineering specialties of technical universities in the field of materials science and aerospace engineering have been designed. These manuals in conjunction with other pedagogical technologies, for example, with the case method [3,4] allows one to solve a variety of educational tasks.

There are several types of tasks available for classes and independent study.

1. Exercises and tasks with graphs of changes in values. According to the proposed graph, one needs to calculate the presented process characteristic (figure 1). The graph field displays a cursor that can be moved and its coordinates are visible on the screen. The desired values are entered in the opening input window.

![Figure 1. Determining the radius-vector of a material point.](image)

2. The tasks in which the student must independently draw a graph of the magnitude change in the opening main window. Comparison with the correct result is the subject of further discussion (figure 2). These are tasks to study the laws of kinematics and gas processes. The text of the task is offered in the task window, and there is an empty field with graded coordinate axes in the main window. The marker shows the student his/her version of the graph. Then the program displays the correct graph and the result of solving the problem is visible on the screen.

3. Virtual laboratory and simulation (figure 3). In the "External photoelectric effect" program one can not only model all the conditions of this phenomenon, but also check the first law of the photo effect [6, 7].
Figure 2. Solving a thermodynamics problem using an interactive whiteboard.

Figure 3. A fragment of a virtual laboratory for the external photoelectric effect study.
Work with such an educational environment is subject to the following principles:
1. Before completing the tasks, an additional window of complete multi-page theoretical information with all formulas and explanations is displayed.
2. The tasks themselves and the numerical values of the quantities are selected randomly. Repetition of tasks is unlikely.
3. In all cases the student can receive a virtual hint for each task.
4. Entering the wrong answer is always accompanied by explanations and showing the correct answer with the recommendation to check it.

The presented programs are developed in the high-level language Delphi and are multifunctional manuals designed for lectures and practical classroom sessions. The interface also allows students to work independently on the selected topic and hone their knowledge and skills.

3. Conclusion
The active work of future material and aerospace engineers with graphic material allows them to identify new relationships between physical quantities and leads them to a correct understanding of the digital resources’ part in engineering [7,8,9].

It is obvious that such kind of work requires significant efforts, including the synthesis of teachers, programmers and specialists activities in these areas. But it is impossible to train appropriate high-level specialists without such an approach. If it is not done, then young engineers will have to go through the process of learning how to work with the graphical interface in the process of their professional activities [10].

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