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METHODS OF USING VISUALIZED EDUCATIONAL MATERIALS IN TEACHING PROGRAMMING LANGUAGES IN TECHNICAL UNIVERSITIES

Ergashev Nuriddin Gayratovich
Researcher of Karshi engineering-economics institute

Abstract: *This article presents the methods of using visualized teaching materials in the teaching of programming languages in technical universities and its effectiveness on the example of students majoring in engineering.*

Keywords: *Visualization, programming, algorithms, training material, dynamic element, Java, Android studio, animation, Flash, mobile application and more.*

Introduction. The rapid development of computer technology and telecommunications in all spheres of society, the development and implementation of information systems, software, naturally causes problems in the maintenance of computer technology. As a result, society's need for highly qualified professionals in the field of computer technology who are competent and able to adapt quickly to changing information flows is increasing.

Materials and methods. In accordance with the requirements of the state educational standard, bachelor's degree students must be able to use modern programming languages and databases, operating systems, electronic libraries and software packages, network technologies in their professional activities.

However, practice shows that students often demonstrate their knowledge of specific operators, but are unable to apply them in practice when solving specialty problems. The main reason for this is that programming is an integral feature of algorithmic constructions.

The experience of learning programming and teaching programming shows that difficulties arise both in the first stage of solving programming problems and in the algorithmic stage, as well as in the study of the syntax and basic constructions of a programming language. These difficulties are related to the reluctance of students to accept teaching materials with a sufficiently high level of abstraction and logic.

Scientific research and experience in teaching algorithmic languages show that problem solving should be done in several stages. The first is to

have programming concepts and algorithmic skills. In the next stage, the practical parts of the given tables are designed[10] [p. 1,111].

By visualization we mean the quality of human cognitive processes in the process of obtaining and processing information from relevant systems, the formation of visual images and perceptions in the mind[11] [p. 3,100].

Visualization involves the use of lines, diagrams, graphics, animation, and many other tools to depict relationships that are very difficult to describe in simple language. The result of the visualization should be the creation of new images and visual models. Such visual images are easily changed under the influence of dynamic processes and also allow to show the initial, present and future state of the result of any process at the same time. The importance of visualization is that it includes an image that corresponds to the actual process of gathering information into the original image and thinking.

Practical rules should be taken into account in the presentation of educational materials, the visualization tool used performs its function only when it is based on solidly acquired knowledge and figuratively reveals the next presentation. This is because it is ineffective to "explain" incomprehensible learning material using equally vague means. This means that such an order of presentation of teaching material is psychologically unreasonable, as this presentation begins with some generalizing rules, definitions, formulas, and so on. Only then will their general meaning be revealed, the bases, the evidence, the examples given. This disrupts the natural sequence of human cognition and therefore creates additional difficulties in understanding the learning material[12] [p. 6,111].

The use of computers and information technology plays an important role in visualizing abstract mathematical concepts. The computer allows you to convert numbers into images, thereby allowing you to view virtual images.

However, the experience of teaching programming shows that the transition from visualized concepts to the syntactic constructions of programming languages requires an intermediate stage - the description of these constructions in a common language that is understandable to students.

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[10] 1.Kalitina V.V. Information modeling of the process of memorizing educational material // Bulletin of the Krasnoyarsk State Pedagogical University named after V.P. Astafieva. - 2013. - No. 1 (23). - P.111-113.

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[12] 6. Ergashev N.G'., Temirova O.Yu. "Use of visualized electronic textbooks to increase the effectiveness of teaching foreign languages". European Journal of Research and Reflection in Educational Sciences Volume 8 Number 12, 2020 ISSN 2056-5852 Progressive Academic Publishing, UK www.idpublications.org 111-116 p.

At this stage, it is important to create a problem-solving algorithm and provide a variety of ways to write the program: from oral speech to flow charts. The more comprehensible the language of writing the algorithm, the faster it will be possible to understand the syntactic structure of the programming language.

As a next step, we emphasize the use of tools and methods that contribute to longer memorization of algorithmic concepts and structures.

Consciousness, i.e. memory, varies from person to person in duration, speed, accuracy, intensity, and memorization volume. These properties are called quantitative properties of memory. However, there are also differences in quality. They are related to the predominance of certain types of memory - hearing, sight, emotion, etc. - and their performance. Depending on the predominance of the sensory organs, visual, auditory, emotional memory, and their various combinations differ. Everyone should read the study material with their own eyes in order to better memorize and visualize it clearly. In other words, it is better to see once than to hear more than once, because in it acoustic images predominate over the sense of hearing.

Studies in the psychological and physiological literature have shown that the effects of movement have the greatest impact on memory.

When an object moves, the person looks at it and observes the movement. In this case, the muscles repeat the trajectory, direction, and movement dynamics of the object in the field of view. In this regard, we consider it important to use dynamic elements in the learning process and in the teaching materials.

By dynamic element we mean a visually shaped model of an individual object that works in time and space (animation). The best way to create a dynamic element is to use multimedia technologies, especially presentations and Flash animations.

The organization of the programming teaching process for undergraduate students of technical specialties in accordance with the proposed methodology provides an increase in the level of understanding of abstract algorithmic teaching material and a reduction in the time to memorize the syntactic structures of programming languages.

Results and discussion. The fact that a number of effective methods and tools for the use of visualized e-textbooks in the educational process of higher education are covered in many scientific literatures is a clear proof of the above ideas.

Below are examples of a visualized e-textbook created using the Java programming language and the Android Studio environment and its effectiveness.

An example for the dynamic visualization of basic algorithmic constructions is a mobile application created in the Java programming language Android Studio environment and consisting of animated and video menus (Figure 1).

Figure 1. "Mobile application with visualized educational electronic module performing n laboratory tasks in the field of information technology in technical systems".

The above mobile application is a "mobile application with visual modular electronic module for laboratory tasks in the field of information technology in technical systems", which provides theoretical and practical skills in programming languages and programming languages. It is also possible to further consolidate knowledge through the use of animated and video data, the use of ready-made software algorithm codes, as well as self-assessment. This mobile app is also customized to work online, allowing you to access multiple learning resources at the same time.

The last step presents the syntax of programming and algorithmic constructions. Thanks to dynamic images, a step-by-step transition from programming commands to a clear image allows for better understanding and deeper memorization.

Upon completion of the programming course, students are assessed and the extent to which the proposed visualized teaching method influences their performance is determined.

Conclusion and future scope. Visualization of learning materials in the learning process expands students ' imagination and independent thinking

skills in relation to science. As a result, the interdependence and continuity between science topics is further strengthened. The above teaching methods allow the teacher to improve their skills in the learning process, to master the methods and tools of visualizing the teaching material and to successfully apply them in practice.

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