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Opportunities for teaching the theoretical mechanics section of physics using educational software tools

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Abstract: This paper investigates the pedagogical and psychological opportunities for using educational software tools in the teaching process at higher education institutions, with a focus on the positive outcomes these tools can provide when integrated into the teaching process. The possibilities of using educational software tools in teaching the "Theoretical Mechanics" course in higher education institutions are analyzed, and the conditions for the effective use of these tools are explored.

Keywords: Educational software tools, pedagogical-psychological conditions, theoretical mechanics course, key competences.

Introduction: Today, if we look globally, it is hard to find a sector where information technologies have not yet been introduced. Among these sectors, the field of education is also progressing with the use of modern teaching methods, new pedagogical technologies, and educational software tools to organize the teaching process. Numerous research studies are being conducted to improve the effectiveness of teaching all subjects, and efforts are being made to integrate these technologies into the teaching process. From this perspective, educational software tools, mobile applications, and teaching methods are widely used to enhance the effectiveness of teaching physics in general secondary schools and higher education systems.

Adolescence plays a significant role in improving educational content in non-traditional ways for conveying knowledge in physics. This period forms a unique social group and is described as a crucial condition for life, labor, and experience, as well as the key system of social behavior and psychology. For adolescence, learning, education, and productive labor are the most important types of activities. During this process, adolescents develop a conscious attitude towards labor and learning, and they are able to consciously conclude that they will fully use the knowledge, skills, and competencies acquired in their future professional life.

Their cognitive activities begin to become more active, creative, and independent. During this period, thinking develops based on generalization and abstraction, the ability to conclude about the interconnections of events increases, and the ability to justify and prove situations is formed.

According to V.G. Krisko's theory, the main directions of psychological development during adolescence are:

- free, conscious attitude towards the environment;

- complication of emotional-volitional aspects of the brain's activity;

- abstract-logical understanding of reality;

- sequential intellectualization of personal activity;

- adaptation to social and professional environments.

Psychologists believe that the degree of directionality in an individual's activity plays an important role in their development. This is because an individual's directionality is a psychological characteristic that expresses their needs, motives, worldview, and goals in life and activity. Students' academic period coincides with adolescence. Therefore, the degree to which an individual is directed is determined by students' level of knowledge, professional skills, and competencies. Through the quality organization of the educational process in higher education, increasing the effectiveness of students' mastery of subjects helps

enhance the individual's degree of directionality, which, in turn, assists in solving the issue of providing qualified personnel to the labor market.

In pedagogical theory, intellectual education is considered an important process, and it is within this process that preparing individuals for life and work is a key aspect. Its essence lies in stimulating interest in intellectual activity, equipping with knowledge, acquiring and applying it in practice, and guiding cognitive abilities through the implementation of intellectual labor culture. The competency-based approach formed in the educational process through the practical application of knowledge gained through intellectual education yields effective results.

Intellectual development is defined not only by the volume and quality of knowledge acquired but also by the process of applying the knowledge correctly through thinking, logical reasoning, and intellectual actions.

METHODS

The main processes of intellectual development are explored in the research of L.S. Vygotsky, S.L. Rubinstein, A.N. Leontyev, N.A. Menchinskaya, L.V. Zankov, M.A. Danilov, B.P. Esinov, and M.N. Skatkin. They highlight that intellectual development is an ongoing process that improves through learning, labor, play, and life situations. [1]

According to the great scholar Ibn Sina, intellect is an innate human ability as well as the capacity for thinking that develops through experience and the process of cognition. He defines intellect as the primary natural ability of humans to think healthily, distinguishing between good and bad actions and making decisions based on that understanding. Ibn Sina divides intellectual development into two categories: the development of theoretical intellect and the development of practical intellect. In the development of theoretical intellect, humans comprehend the essence of general things in existence, while the development of practical intellect manifests in the ability to make choices in practical situations.[2]

The main elements of the intellectual development process are shaped during the educational process in higher education. Therefore, organizing the teaching process correctly and effectively in this system has several advantages. From this, it is important to consider what factors are involved in the teaching process in higher pedagogical education.

- Selection of teaching methods: Methods aimed at introducing the basics of knowledge, methods focused on mastering the content of the knowledge, methods related to defining and consolidating the meaning of knowledge, methods for developing knowledge and teaching its practical application, etc.

- Selection of teaching tools: Working with textbooks, choosing visual aids, preparing and selecting materials for using audiovisual aids, setting up teaching equipment, identifying the potential of computer tools, and using them effectively.

- Choosing forms of organization for students' academic work.

- Testing and evaluating the outcomes of students' academic work.

Teaching technology is primarily used for organizing teaching and enhancing its effectiveness. Nowadays, it is referred to as new pedagogical technology, information technology, or interactive teaching methods.

When considering information-technology-based teaching technologies, the development of computer technology in recent years has significantly raised the level of opportunities to apply information technologies in the educational process.

The concept of information technology includes the following elements: information creation, storage, transmission over distance, reception, usage, and access.

Computer technology is the tool used to implement information technology.[3]

Main part.

The effective use of information technology in the teaching process depends on the quality of educational and methodological materials designed according to computer capabilities. These materials are implemented through educational software that combines content, testing methods, textual and other similar tasks, and practical problem-solving approaches. All educational software is created in a logical sequence and tailored to specific requirements, with a plan provided to students via specialized software. The use of educational software in the classroom offers several advantages and contributes to increasing the effectiveness of the teaching process.

Indeed, educational software creates opportunities in the teaching process of any subject, and it must be aligned with the didactic principles for teaching physics. These tools should also integrate physics concepts in a coherent manner. Applying educational software to the teaching process can be viewed as an opportunity to enhance the effectiveness of learning. To better understand what is meant by the teaching process, we need to answer questions such as: What is the goal of teaching? Who do we teach, what do we teach, and how do we teach?

In the continuous education system, the objectives of teaching physics are outlined in the regulatory documents of the curriculum as follows:

- Explaining the role and position of physics in the acceleration of scientific and technological progress, educating students in political and ideological commitment, patriotism, internationalism, and national spirit, as well as discussing the development level of science and technology in the country and contributions by both domestic and foreign scientists.

- Forming knowledge on scientific facts, concepts, laws, theories, research methods in physics, and their practical application.

- Explaining the unity and infinity of the structure of matter, the universality of conservation laws in nature, the dialectical nature of physical phenomena, the continuity and consistency of physical theories, and the importance of practice in learning physics.

- Introducing the key aspects of scientific and technological progress, including automation, electronics, microprocessor technology, robotics, nuclear energy, information technology, and the production of new materials.

- Teaching students how to independently acquire knowledge, develop skills in using textbooks, learning guides, scientific literature, and reference books.

- Developing experimental skills such as working with instruments, measuring, using results, and drawing conclusions from experiments.

- Stimulating interest in physics and technology, developing learning opportunities, fostering an effective approach to learning, linking physics education with real-life applications, and preparing students for career choices.

The questions of "What do we teach and how much do we teach?" are answered by the curriculum and educational programs for each type of education. As for the question of how to organize teaching, there is no single directive answer. This process can be organized through teaching methods, the appropriate use of teaching tools, including educational software.

According to the great thinker Abu Rayhan Biruni, teaching should be consistent, demonstrative, goal-oriented, and conducted in a specific system. Thus, demonstration ensures that teaching becomes clearer, more specific, and more engaging.

In the teaching process, the use of any method or tool must comply with specific requirements. When using educational software in the classroom, the software must adhere to the following criteria:

Alignment with educational goals: The software must be designed in accordance with the teaching goals for the targeted audience.

Clarity and understandability: The educational software should present information in a simple and logically sequenced manner for students to understand.

Activity and interactivity: The software should increase student engagement, allowing them to test their knowledge, express their opinions on problematic questions, and interactively discuss topics.

Interesting and motivational: The software should include engaging content, such as graphics, animations, and game elements, to increase students' interest in the subject.

Step-by-step development: The software should present information in a progressive manner, from simple to complex, while showing the interconnections between related topics.

Individualization: The software should consider each student's level of knowledge, learning pace, and provide various types of exercises, tests, and assignments tailored to their abilities.

Clear visual presentation: The software should be designed with a user-friendly visual interface to enhance the learning experience.

Testing and analysis capabilities: The software should allow students to assess their knowledge, view their mistakes, and make conclusions.

Flexibility and update options: The software should allow for updates to the content, tests, and assignments, ensuring the material remains relevant to the student's level of knowledge.

Educational software is a didactic tool that helps automate the educational process using computer technology. It performs several necessary functions during the teaching process. Each type of educational software is designed for specific types of lessons. For example, tutorial programs are especially suitable for lecture-based classes. The primary goal of physics teachers is to facilitate active learning during new material lessons and ensure students' knowledge engagement. In education, the use of e-learning resources guides the sequence of actions to acquire specific knowledge and forms a logical structure for the creation of knowledge.

RESULTS AND DISCUSSION

When discussing the use of educational software in teaching physics, several factors influence the effectiveness of learning. For instance, when organizing a lesson using educational software, visual information plays a significant role in memory retention. Studies

have shown that the human eye can process millions of bits of information per second, while the ear can only detect tens of thousands of bits. Therefore, visually received information is stored in memory longer and more effectively.

Researchers believe that a well-organized combination of spoken words and visual representations in the learning process improves the quality of education. The integration of digital technologies in education allows for a fuller use of both visual and auditory senses, positively influencing the initial stages of learning, such as perception and cognition. The knowledge received through sensory perception is then processed logically and incorporated into thinking.

The benefits of using information technology in education include: individualization of learning: enabling students to work independently, increasing the volume of tasks completed during lessons, expanding the information flow when using the internet, which boosts engagement and motivation during lessons.

By using information technology, teachers can offload a significant portion of their workload onto the computer, making lessons more engaging, diverse, and content-rich. This also allows teachers to evaluate students' knowledge promptly and adopt innovative teaching methods, thus supporting students' professional development.

Educational software in the teaching and learning process acts as a tool for organizing the educational process. Computers and software, through their processing power, assist in delivering the learning material, while the teacher continues to actively participate in the control and management stages.

The effectiveness of a lesson depends on the model used for organizing the teaching process and adhering to the principles of that model. One popular model in teaching today is the explanatory-demonstrative model. In this model, learning is based on predefined knowledge, and students independently learn from the material provided by the computer, remembering key rules and connections, and drawing necessary conclusions.

In computer-based education, the programmed educational model divides the learning material into distinct elements, presents the information, reinforces the learned material, and assesses students' progress. This process is repeated for each segment of the lesson.

In higher education institutions, the teaching process for subjects like "Theoretical Mechanics" should be organized with interdisciplinary connections, modern technologies, and a clear goal, aimed at developing students' creativity and independent thinking, as well as forming key competencies.

In Uzbekistan, the teaching process for theoretical mechanics in physics should align with international standards, incorporate best practices, and effectively utilize the ideas proposed by specialists, leading to the preparation of competitive, competent professionals.

CONCLUSION

In conclusion, the updated requirements of the State Education Standards and the relevant subject curricula, the development of several measures for reforming the education process, the continuous efforts of pedagogical staff in educating well-rounded individuals, and the emphasis placed on pedagogical-psychological, cultural, and educational aspects in each teaching process are the foundations that can ensure the continuous education system in our country meets global standards in the years of independence. Additionally, efforts to further improve the continuous education system, develop competent and creative personnel, and enhance the material and technical base related to this goal are of crucial importance.

The new stage of scientific progress, the creation of new branches of science, the development of new approaches in education, the encouragement of new projects, and their practical implementation are part of efforts to provide today's youth in our country with equal opportunities with youth around the world. Furthermore, these mechanisms require the teaching staff of higher education institutions to be even more responsible.

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