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METHODOLOGY FOR DEVELOPING STUDENTS' TECHNICAL CREATIVITY BASED ON THE STEM APPROACH (USING THE EXAMPLE OF TEACHING PHYSICS)

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Abstract:

Increasing the creative abilities of students is one of the modern demands of the educational system. This article discusses the methodology of increasing creative abilities in physics classes through STEM-educational technology.

Keywords: STEM, technology, physics, teaching, method, result.

Introduction

One of the main problems that an educational institution currently faces is improving the quality of students' knowledge.

The modern education system is aimed at orienting a person towards incentives and assessments received from the outside, from society. The problem of forming a logical culture among students in didactics and educational psychology shows that modern processes of democratization of society and the development of its economic sphere require a qualitatively new level of professional training of specialists, associated to a large extent with their logical and methodological

MATERIALS AND METHODS

Currently, STEM is one of the main trends in global education. Thanks to the rapid development of technology, new professions are emerging, and the demand for STEM specialists is growing everywhere. For example, in EU countries, the share of employed specialists in this field increased from 2000 to 2013. by 12%. Also in European countries, demand for STEM professionals is projected to grow by 8% by 2025, while demand for other professions will only grow by 3%. In 2011, of the 16 OECD countries considered, Finland had the highest number of STEM graduates: 1,109 per 100,000 population aged 20-39. This figure is twice as high as in Canada and Switzerland [1].

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RESULTS AND DISCUSSION

The new generation requires a different approach and other methods, as practice shows - traditional classes do not meet the needs of the modern student.

The study shows that in the context of STEM education, the effect of mastering the topic and the quality of understanding improves. We did a small experiment. We analyzed two completely identical lessons.

Table 1 Types of lessons and tasks for the control and experimental groups

Lesson type	Control group	Experimental group
Physics - the science of nature	Lesson using ACT	Interdisciplinary connections are made with chemistry and biology. The lesson demonstrates a model of "physics as a science of nature."
Laboratory works	Experiments were carried out with special school equipment	An experiment is carried out and at the same time a computer simulation and solution are shown in class
Knowledge assessment	Testing in progress	Writing essays and tests containing open and closed questions
Section "Mechanical Movement"	Demonstrations are shown for each topic	Students come up with their own demonstrations and defend their work.
Practical work	Perform assignments based on handouts	Students complete individual assignments using electronic textbooks, and thus each individual student is assessed immediately after completing the assignment. Each student is given the opportunity to complete creativity tasks.

Let's formulate the advantages of STEM education:

1. Integrated interdisciplinary learning by topic - this means considering one issue from the point of view of completely different disciplines, for example: Dividing bacteria in a glass test tube. The chemist asks: what substances are the causative agents of the beginning of the process of division of the DNA helix, how energy-consuming is this process for bacteria? Therefore, the physicist needs to calculate how much heat is released during this process. Biologist: we can grow a culture of bacteria and, knowing the rate of gene mutation in these bacteria, predict the appearance of a specific gene we need, for example, the herbicide resistance gene. Mathematician: using a first-order differential equation, knowing the rate of reproduction of bacteria in a glass test tube, we can predict their number after the period of time we need.
2. Application of knowledge in real life. A critical approach to the problem. This means that the task will be problem-oriented, let's say that we have a task: to make an airplane for a soldier weighing 500 g. What should the material be like, what does the flight of the airplane depend on? Each time they improve the airplane concept, students will strengthen their confidence that they are successfully approaching their goal, namely, creating a product that meets all the necessary requirements.
3. The advantage of teamwork. Working in a team will teach students to: put forward their ideas freely, not be afraid to make mistakes, be able to listen to other people's ideas, and ask if

something is not clear. Active participation in the learning process leads to a solid understanding of the phenomena and concepts being studied.
4. Awakening interest in engineering specialties.

CONCLUSION

In this way, we contribute to the birth of new talented and creative students who are able to think and create. There is one main thing you need to know about STEM education - it is not just a fashion in education. Now this is the most realistic and effective approach to solving global world problems: in ecology, energy, medicine, engineering, construction, etc.

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