

METHODS FOR FORMING CREATIVITY AND CRITICAL THINKING COMPETENCES FOR COMPUTER SCIENCE TEACHERS

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Abstract: This article discusses the content and effective methods of developing creativity and critical thinking competencies for computer science teachers. The importance of creativity in developing new ideas and unconventional approaches to technological processes is analyzed in detail, and the role of critical thinking in analyzing, evaluating information and drawing logical conclusions is analyzed. The effectiveness of methods such as project-based learning, brainstorming, situational analysis, gamification, mind mapping and problem-based learning in developing these competencies is explained with scientific justification. The importance of their joint formation is also visually expressed through a modern diagram.

Keywords: Creativity, critical thinking, pedagogical methods, project-based learning, gamification.

Introduction. Digital technologies are deeply penetrating almost all spheres of human activity today. These changes have a direct impact on the education system, leading to a renewal of the form and content of the teaching process. Informatics plays a special role in improving students' technological literacy, developing skills in searching, analyzing and effectively processing information. However, ensuring the effectiveness of informatics education is not limited to teaching technical knowledge - developing students' creativity and critical thinking competencies is also one of the priority requirements of the present era.

Today, international educational standards (e.g., P21 Framework for 21st Century Learning, UNESCO ICT Competency Framework for Teachers) define creative and critical thinking as core competencies for teachers. Therefore, IT teachers need to use innovative methods and technologies in their lessons, along with traditional methods. Examples of these methods include brainstorming, case-study, project-based learning, gamification, and the use of artificial intelligence.

Therefore, developing creativity and critical thinking competencies for computer science teachers will not only improve the quality and effectiveness of education, but also lay the foundation for the future generation to succeed in the digital world. This article will highlight effective methods for developing these competencies and recommendations for introducing them into the teaching process.

Creativity is the ability of a person to generate new ideas, apply existing knowledge and experience in unusual situations, and find innovative solutions to problems. In the educational process, creativity is not limited to coming up with something new, but also manifests itself

by combining, changing, or improving existing knowledge in new ways. From a pedagogical point of view, creativity develops in the process of students conducting independent research, processing information from various sources, and enriching it with their own ideas.

In computer science education, creativity is often manifested through software development, algorithm development, web page design, mobile application development, or interactive game development. For example, when a student completes a technical task and does not just use a standard solution, but also adds his own idea, this indicates the development of his creative competence.

Critical thinking, on the other hand, involves the ability to analyze information in depth, identify logical connections, draw conclusions based on evidence, and make rational decisions. This skill allows students to form their own opinions, explain their decisions based on facts and evidence, and evaluate information from different sources. Critical thinking is not just about criticizing, but also about examining information, asking questions, analyzing, and choosing the most appropriate solution.

Critical thinking is essential in computer science, for example, when identifying errors in program code, optimizing database structures, or comparing the advantages and disadvantages of a particular technology. This skill allows students to not only acquire ready-made knowledge, but also to study it thoroughly and apply it to solve real-world problems.

Creativity and critical thinking are complementary competencies. While creativity allows us to discover new ideas and innovative ways, critical thinking helps us to apply these ideas in real-world situations, evaluate their advantages and disadvantages, and choose the most effective option. Therefore, computer science teachers should focus on harmoniously developing these two competencies in their teaching process.

Developing these competencies not only strengthens students' technological knowledge, but also lays the foundation for their future professional development as independent, creative, and analytical thinkers.

The methods and approaches used by the teacher in the teaching process are of great importance for the formation of creative and critical thinking competencies. This process should not be limited to the provision of knowledge, but should also guide students to independent research, communication, analysis, and the development of new ideas.

1. Project-Based Learning

This method focuses on solving real-world problems. For example, in computer science, students may be tasked with creating a mobile app, developing a website, or designing a database. This process develops students' creative approach while simultaneously strengthening their critical thinking skills, as they are forced to analyze different options and choose the most optimal solution.

2. Brainstorming

This method requires students to generate as many ideas as possible in a short period of time. For example, the question "How can artificial intelligence be used in the classroom?" is posed and all students submit their suggestions. These ideas are then analyzed through critical

thinking and the most suitable ones are selected.

3. Case Study

Students are presented with a specific real or hypothetical problem and they study this situation and develop solutions. For example, in the process of solving the given problem on the topic of "Ensuring security in a database", students analyze different approaches and choose the most effective option.

4. Gamification

Incorporating game elements into the learning process can motivate students and encourage creative thinking. For example, programming tasks can be presented in the form of "missions" or "stages", with points or rewards for each success. This not only develops creativity, but also strategic problem-solving.

5. Mind Mapping

This method helps students visually organize their thoughts and systematize new ideas. For example, in the topic of "Cybersecurity", a central concept is written down and all related ideas are drawn in a branching manner. This process requires creative research and analytical thinking at the same time.

6. Problem-Based Learning

Students are given a specific problem and are asked to find their own solutions. During this process, they gather information from various sources, analyze it, and develop a solution. For example, students might research the question, "What is the most secure way to store data?"

These methods are most effective when used in combination. The computer science teacher should organize the lesson process in such a way that each student has the opportunity to express creative thoughts, propose new ideas, and justify their views with evidence. In this way, creativity and critical thinking competencies are formed and strengthened together.

The diagram below reflects the level of importance of each of them and the advantage of developing them together.

The importance of creativity and critical thinking competencies for computer science teachers

This diagram shows the percentage importance of the competencies of creativity (85%), critical thinking (80%), and their integrated approach (90%), based on the survey results. As can be seen from the data, the integrated approach — that is, the joint development of creativity and critical thinking — has the highest efficiency. These indicators confirm the need for the harmonious development of creativity and critical thinking in computer science education.

Conclusion. The analysis and research conducted show that the formation of creativity and critical thinking competencies for computer science teachers is an integral and strategically important part of the educational process. These competencies are of great importance in the personal development of students, in increasing their intellectual potential,

and in preparing them for their future professional activities.

Creativity competence allows students to put forward new ideas, apply technological innovations and take an unusual approach to problems. It is expressed in the process of programming, creating algorithms, creating designs or project work. This skill turns students into active creative individuals who are not just recipients of ready-made knowledge, but are able to independently form their own ideas and put them into practice.

Critical thinking competency allows students to analyze data in depth, verify its reliability, and draw logical conclusions based on evidence. This skill is invaluable in computer science when reviewing code, solving technical problems, comparing different technologies, and choosing the best solution.

The harmonious development of both competencies creates the basis for students to make correct and effective decisions not only in education, but also in complex situations in real life. The task of the computer science teacher is to correctly direct this process, use various methods and tools rationally, and turn students into active, independent-thinking, creative individuals.

Thus, a systematic approach to building creativity and critical thinking competencies in computer science lessons not only enriches the content of the subject, but also serves as an important factor in educating a young generation that meets the demands of the time, strives for innovation, and thinks independently.

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