

CREATIVE THINKING IN THE AGE OF INNOVATION: STEAM AS A 21ST-CENTURY EDUCATIONAL STRATEGY IN AZERBAIJAN



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ABSTRACT

One of the main priorities of the Ministry of Science and Education is to train well-specialized and competitive professionals who can meet the demands of the modern era. In this regard, it is considered essential to explore and implement new educational models suitable for the age of artificial intelligence and computing. The STEAM education model plays a significant role in this process. It equips students with qualities such as creativity, critical thinking, and enhanced collaboration skills. By applying various programming languages, students improve their ICT competencies, learn to apply technical knowledge in practice, and gain engineering proficiency. It is now widely recognized that the era of purely theoretical education is coming to an end, giving way to practical intelligence. The STEAM project, as discussed in this article, adopts a conceptual and integrative approach to all subjects. By aiming to nurture innovative, creative, and critically thinking students, this model maintains its relevance and importance in contemporary education.

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İNNOVASIYALAR ƏSRİNDƏ YARADICI DÜŞÜNCƏ: STEAM AZƏRBAYCANDA 21-Cİ ƏSRİN TƏHSİL STRATEGİYASI KİMİ



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Açar sözlər:

STEAM,
Yaradıcı təfəkkür,
Yaradıcı tələbə,
İnnovativ tədris,
Praktik zəka

ANNOTASIYA

Elm və Təhsil Nazirliyinin əsas prioritetlərindən biri müasir dövrün tələblərinə cavab verə bilən, yaxşı ixtisaslaşmış və rəqabətqabiliyyətli mütəxəssislərin hazırlanmasıdır. Bu baxımdan, süni intellekt və hesablama əsrinə uyğun yeni təhsil modellərinin tətbiqi və tətbiqi vacib hesab olunur. STEAM təhsil modeli bu prosesdə mühüm rol oynayır. Bu, tələbələrə yaradıcılıq, tənqidi düşünmə və inkişaf etmiş əməkdaşlıq bacarıqları kimi keyfiyyətlərlə təchiz edir. Müxtəlif proqramlaşdırma dillərini tətbiq etməklə tələbələr İKT sərəfələrini təkmilləşdirir, texniki bilikləri praktikada tətbiq etməyi öyrənir və mühəndislik bacarıqları əldə edirlər. İndi hamıya məlumdur ki, sırf nəzəri təhsil dövrünün başa çatması, yerini praktik zəkaya təkan verir. STEAM layihəsi, bu məqalədə müzakirə edildiyi kimi, bütün fənlərə konseptual və integrativ yanaşmanı qəbul edir. Yenilikçi, yaradıcı və tənqidi düşünən tələbələr yetişdirmək məqsədi daşıyan bu model müasir təhsildə öz aktuallığını və əhəmiyyətini qoruyub saxlayır.

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ТВОРЧЕСКОЕ МЫШЛЕНИЕ В ЭПОХУ ИННОВАЦИЙ: STEAM КАК ОБРАЗОВАТЕЛЬНАЯ СТРАТЕГИЯ XXI ВЕКА В АЗЕРБАЙДЖАНЕ



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STEAM,
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Творческий студент,
Инновационное
обучение,
Практический интеллект

АННОТАЦИЯ

Одним из главных приоритетов Министерства науки и образования является подготовка высококвалифицированных и конкурентоспособных специалистов, способных отвечать требованиям современной эпохи. В этой связи считается важным изучение и внедрение новых образовательных моделей, соответствующих эпохе искусственного интеллекта и вычислительной техники. Образовательная модель STEAM играет важную роль в этом процессе. Она развивает у студентов такие качества, как креативность, критическое мышление и развитые навыки совместной работы. Используя различные языки программирования, студенты совершенствуют свои ИКТ-компетенции, учатся применять технические знания на практике и приобретают инженерные навыки. В настоящее время широко признано, что эпоха чисто теоретического образования подходит к концу, уступая место практическому интеллекту. Проект STEAM, рассматриваемый в данной статье, использует концептуальный и комплексный подход ко всем предметам. Стремясь развивать инновационные, креативные и критически мыслящие учащиеся, эта модель сохраняет свою актуальность и важность в современном образовании.

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1.Introduction

As early as the beginning of the 21st century, the question of how to educate individuals in accordance with the demands of the time became a subject of global discussion. In today's world, merely possessing literacy, numeracy, and knowledge in natural sciences is no longer sufficient for achieving success. The rapid advancement of information and communication technologies has led to an overabundance of information, thereby requiring students to develop independent learning skills. In order to thrive in a rapidly changing and evolving world, modern youth must cultivate abilities such as autonomous and fast decision-making, problem-solving, independent learning, collaboration, teamwork, the evaluation of diverse perspectives, and the generation of new ideas. The labor market is also undergoing constant transformation, and there is an increasing demand for products and services based on human creativity. For this reason, there is a growing need in modern classrooms to foster creative thinking, willingness to embrace innovation, and the ability to overcome challenges. One of the core responsibilities of schools today is to educate students in a democratic spirit, preparing them as socially responsible citizens who are equipped to adapt to the realities of the contemporary labor market.

2.Literature review

By prioritizing this approach, the Ministry of Science and Education has emphasized the necessity of exploring and implementing new educational models. Among such initiatives, the STEAM project holds particular significance. The primary goal of the STEAM project is to equip students in general education schools across the Republic with 21st-century skills by fostering creativity, critical thinking, and collaboration, while also demonstrating the practical application of scientific and technical knowledge through hands-on activities [Ministry of Science and Education, 2025]. Additionally, the project aims to develop students' engineering competencies and enhance their ability to utilize modern ICT tools by applying various programming languages. At the core of the STEAM methodology lies project-based learning, which strengthens students' capacity to explore contemporary societal challenges and identify diverse solutions.

In the digital age, there is an increasing demand for professionals equipped with 21st-century competencies. In this context, developed countries are giving priority to innovative directions such as STEAM-based programming, robotics, and related fields within their educational systems. STEAM classes typically involve project-based learning that requires critical thinking and analytical skills. This approach encourages students to think critically, analyze information, and search for effective solutions to complex problems [Akturk et al., p.757].

In the era of the Fourth Industrial Revolution, characterized by the rapid advancement of robotics and artificial intelligence, STEAM has begun to occupy a prominent place in international education. By integrating the arts alongside the natural sciences, STEAM has evolved into a globally recognized educational movement and has found its place in some of the world's leading academic institutions. The implementation of interactive technologies and advanced IT infrastructure in the learning process creates an educational environment designed to stimulate innovation, creativity, and the generation of new ideas-both now and in the future.

According to the results of international studies, many STEAM graduates have moved beyond traditional engineering roles and are now working in innovative, technology-driven companies. However, it is a misconception to equate STEAM solely with robotics and coding. As its acronym suggests, STEAM begins with science and ends with mathematics, encompassing a broad, interdisciplinary learning approach. STEAM is fundamentally about teamwork-seeing, touching, doing, and learning. It offers a conceptual approach to all

subjects and fully integrates them into a cohesive educational framework [Aguilera et al., p.331].

Since technology is a core component of STEAM, students enhance their technological literacy by working with various tools, software, and hardware. Through STEAM lessons, they acquire coding skills and learn to utilize technology for problem-solving and creative expression [Leavy et al., p.1061-1062].

The STEAM Azerbaijan initiative organizes events such as the STEAM Azerbaijan Festival, which includes hackathons and technology competitions that encourage students to engage creatively with robotics and technological innovation. Azerbaijani students have achieved notable success in international STEAM competitions, demonstrating the global competitiveness of the country's young talents [Shamil, 2020]. As Azerbaijan shifts its economic focus toward the non-oil sector, STEAM plays a vital role in preparing qualified professionals to meet this strategic objective. STEAM education supports both the professional development of young people and their preparedness for the global labor market. The successful implementation of STEAM education requires not only strong subject-matter expertise from teachers but also creative thinking, project-based learning capabilities, digital literacy, and collaboration skills.

The Ministry of Science and Education has already initiated the implementation of the STEAM project in general education institutions located in Baku. The schools selected for the project have been equipped by the Ministry with the necessary tools, equipment, and teaching materials. Within the framework of the project, thousands of students across the designated schools have been engaged in STEAM-based education. To support the delivery of STEAM education, professional training sessions are organized for teachers by expert trainers. The primary objective of these trainings is to prepare educators capable of teaching STEAM subjects and to encourage their professional development in this field. In addition, 25 STEAM centers have been established and are currently operational across the country.

Albert Einstein once stated: "Education is not the learning of facts, but the training of the mind to think." In line with this perspective, during instruction, teachers frequently address students with phrases such as "Think logically", "Engage your reasoning", "Approach the problem critically and analyze it", and "Try to find an alternative solution". These expressions are used to activate and develop students' thinking processes through targeted methods and tasks. The ultimate aim of such practices is to cultivate the ability to think effectively. A student who thinks effectively is capable of forming and articulating their thoughts clearly and strives to ensure those ideas are understandable to others. They organize their speech coherently, support their arguments with facts, examples, and justifications, and analyze events in a structured way to draw accurate conclusions. Moreover, such a student is able to determine how and where to obtain information and how to use it purposefully [Mustafayev, 2021].

As previously mentioned, the STEAM approach promotes interdisciplinary integration and supports the development of creative and critical thinking. In this regard, it is possible to examine several projects that enhance both creativity and the interconnectedness of academic subjects. Within the framework of integrating Literature, English, and Art subjects, it is possible to design a STEAM-based project that fosters students' creative thinking, language development, and visual expression.

3.Results

The "Living Literature" project, designed for students in grades 6 to 9, aims to modernize the teaching of literature by making it more interactive and engaging, while also enhancing students' language skills. In this project, students select a fairy tale, short story, or brief literary work from either Azerbaijani or world literature and transform it into a script

in English. After scripting the core scenes, students prepare presentations in the form of models, stage decorations, or videos. Some students design costumes suited to the characters, while others act out or narrate the scenes. This project cultivates a wide range of competencies, including creative writing, foreign language acquisition, teamwork, visual design, and performance skills.

Another STEAM-integrated project that combines English, Art, and Technology is called “*Digital Storybook*”. Also intended for students in grades 6 to 9, this project focuses on enabling students to write original stories in English and present them using digital tools. Initially, students compose short stories in English. Then, they create illustrations-either hand-drawn or using digital platforms-that correspond to the narrative. With the help of tools such as *Book Creator*, *StoryJumper*, or *Canva*, students compile these into interactive e-books. In the final stage, students read each other’s stories and provide constructive peer feedback. This project enhances skills such as written expression, technological literacy, aesthetic sensitivity, listening, and public presentation-all essential components of a 21st-century STEAM-based approach to education.

During my teaching experience, within the “Arts” component of STEAM, I assigned my students an *acrostic poem* activity, where each line begins with a letter from their own name. This task proved to be particularly effective in encouraging students’ individual creativity and in prompting reflection on their surroundings. For example, the following acrostic poem, composed by a 5th-grade student named Nurgul, demonstrates the learner’s creative thinking, emotional expression, metaphorical reasoning, and language development skills:

*Nature is like a home
Until you destroy it
Rain and sun together
Growing plant for it
U must protect the nature
Like you care about yourself*

In this poem, the student metaphorically equates nature with the concept of “home,” emphasizing that nature represents a constant yet delicate environment for human beings. Through poetic expression, the student conveys their emotional relationship with the natural world, highlighting its subtleties and the importance of its preservation. This poem reflects not only a personal emotional stance but also ecological awareness and a sense of social responsibility- articulated through symbolic and poetic language. These elements closely relate to key components of creative thinking such as originality, empathy, divergent thinking, and symbolic expression. STEAM connections:

- Arts- Use of artistic imagery and poetic language;
- Science- Ecological thinking (references to rain, Sun, plants);
- Technology- digital presentation;
- Math- Implicit symmetry and rhythm in poetic structure.

Let us now explore a poem written by Lala, a 5th-grade student:

*Life is very strange
At one level you will scare to move
Last step you will stop and say “I can’t”
At least you will do that*

This poem can be considered a highly valuable example within the STEAM context, particularly in terms of psychological sensitivity, introspective thinking, and aesthetic expression. In this work, the student offers a profound portrayal of life's uncertainty, the inner fears that dwell within a person, and the persistent need to move forward. Through

poetic language, the student expresses personal emotions, doubts, and inner strength, thereby revealing a strong sense of emotional intelligence and self-reflection. The poem cultivates not only creative thinking but also essential skills such as critical reflection, self-expression, and an empathic perspective—all of which contribute to a deeper level of personal development. These are key targets within STEAM education, aimed at nurturing both individual growth and 21st-century competencies. STEAM connections:

- Arts – Philosophical poetics, metaphor, and expression of inner emotions
- 21st-Century Skills – Self-expression, emotional regulation, and reflective thinking
- Technology – digital presentation

Let us now explore a poem written by Melek, a 5th-grade student.

*Magical world in my garden
Especially trees and flowers there
Looking like a heaven
Elegance of my garden
Known everywhere*

This poem, both in terms of theme and poetic language, is a beautifully crafted piece that highlights the aesthetic wonders of nature through vivid and imaginative visual imagery. In the poem, the student's refined perception of nature, their sense of beauty, and poetic imagination are clearly evident. By describing her garden as a “magical and enchanted world,” Melek blends fantasy with reality, offering a unique creative vision. Phrases such as “looking like a heaven” and “elegance of my garden” capture a sense of harmony and beauty through poetic expression.

Such tasks help expand the student's visual imagination, individualize their perception of nature, and stimulate their capacity for artistic expression. STEAM connections:

- Arts – Emphasis on poetic language, metaphor, imagery, and descriptive narrative
- Science – Indirect connection to natural sciences through the inclusion of natural elements such as trees, flowers, and gardens
- Technology – Use of digital tools for illustrating and presenting the poem
- Creativity & 21st-Century Skills – Expression of personal ideas, development of aesthetic thinking, and enhancement of imaginative capacity

Ultimately, these types of tasks contribute not only to students' development in literature and language, but also to the integration of personal experience, emotional intelligence, and technology. Writing an acrostic poem allows students to explore their own creative potential while simultaneously facilitating interdisciplinary integration in line with STEAM principles.

One of the key realizations in today's education landscape is the growing consensus that the era of passive, theory-based learning is over, and a new era of practical intelligence has begun. Merely teaching theoretical concepts and focusing exclusively on them risks turning learners into information-loaded robots. Modern education demands that knowledge be taught through hands-on competencies, not just through abstract academic theory. Listening alone is no longer sufficient for meaningful learning. Today, television, radio, and the internet are all easily accessible sources of information. In our fast-paced digital age, the internet can offer answers to questions that may not even be found in textbooks or explained by teachers. What learners need most is not just access to information, but the ability to internalize and understand what they learn through active engagement and reflection. In this light, STEAM lessons are structured around curricula designed for emerging fields such as:

- 3D Printing
- Micro: bit Programming
- Electrical Engineering

- Biotechnology
- Nanotechnology
- Robotics
- Genetic Engineering
- CNC Laser Cutting
- Unmanned Aerial Vehicles (Educational Drones)

4.Recommendation

These programs aim to cultivate practical skills, interdisciplinary thinking, and future-ready expertise, equipping students for the demands of the digital and innovation-driven world. As Azerbaijan shifts towards a knowledge-based, innovation-driven economy, STEAM education stands out as a key strategy for preparing students to thrive in complex, rapidly evolving global environments. In nurturing both creative expression and analytical reasoning, STEAM education in Azerbaijan strengthens students' capacities to think critically, act responsibly, and contribute meaningfully to their communities and future professions.

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