ISRG Journal of Arts, Humanities and Social Sciences (ISRGJAHSS)

ISRG PUBLISHERS
Abbreviated Key Title: ISRG J Arts Humanit Soc Sci
ISSN: 2583-7672 (Online)
Journal homepage: https://isrgpublishers.com/isrgjahss
Volume – III Issue -III (May-June) 2025
Frequency: Bimonthly

ON PRACTICAL EXPERIENCE OF THE FESTIVAL FORMAT: STEAM AND DEVELOPMENT OF SCIENTIFIC LITERACY IN EXTRACURRICULAR ACTIVITIES

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| **Received:** 15.05.2025 | **Accepted:** 20.05.2025 | **Published:** 22.05.2025

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Abstract

One of the ways to develop and enhance students' scientific literacy is by using various educational problems and tasks. These tasks are designed based on real-life situations that simulate specific practice-oriented scenarios. Extracurricular activities, as an integral part of the educational process, provide the opportunity to implement these tasks. This article presents the practical experience of organizing the first STEAM festival in Uzbekistan, analyzing its role in the development of scientific literacy among schoolchildren and students. It demonstrates that organizing such festivals contributes to popularizing science among learners, attracts their attention to the scientific activities of researchers, their studies, and promotes the development of scientific creativity and literacy among schoolchildren and students.

Keywords: *STEAM, scientific literacy, extracurricular activities, creativity, collaboration, communication skills, natural sciences.*

Introduction

In the 21st century, the formation of scientific literacy among youth extends beyond the traditional classroom, becoming one of the key directions for the development of the education system. Scientific literacy is understood not only as the knowledge of facts but also as the ability to apply scientific methods in real life, critically analyze information, build arguments based on evidence, and make well-informed decisions.

STEM education is vital for developing 21st-century skills, leading to increased focus globally and emphasizing interdisciplinary approaches to solve real-world problems (Nala Lidya, 2024). In the statement 'the STEM approach integration could encourage students to make innovation,' most respondents agreed that according to the integrated chemistry learning theory, STEM in chemistry triggers students to innovate and to enhance learning outcomes for students at high school (Fitriyana, N., 2024).

DOI: 10.5281/zenodo.15487003

Recently, along with the development of science and technology, the creative industries have been growing (creative industries). Creative and artistic disciplines, which fall under the concept of Arts, are increasingly being integrated into STEM education. Any innovation implies a creative approach to problem-solving, and the key to creativity is Arts education. This is why there is a global shift from STEM to STEAM education (Sorokina, T.E., 2015). One of the most promising approaches to developing these competencies is the integration of the STEAM (Science, Technology, Engineering, Arts, Mathematics) model into extracurricular activities. STEAM projects allow students to perceive science as a dynamic, practical process where engineering, technology, and art intertwine.

Literature Review

Extracurricular activities in the educational process play an important role, alongside classroom lessons. They are also aimed at achieving the results of mastering the educational program, particularly in chemistry (Alimova, F.A., 2025). Authors Alyana Grace Q. Tapay and Angelo Mark P. Walag highlight the significance of team-based games that contribute to active learning, the development of critical thinking, and encourage cooperation among students (Alyana Grace Q. Tapay, and Angelo Mark P. Walag, 2024).

The tasks of developing scientific literacy within both classroom and extracurricular activities are equally determined by the meaning of scientific literacy, as formulated in the international PISA study: "Scientific literacy is the ability to engage in active citizenship on issues related to the natural sciences and the willingness to engage with scientific ideas" (PISA, 2006).

As noted by authors L.P. Petrishcheva, E.E. Popova, and V.V. Melekhin, the organization of extracurricular activities is driven by the need to shift from knowledge-oriented education to education focused on developing key competencies (Petrishcheva, L. P., 2022). E.Yu. Bukhanova, in her article, examines the formation of scientific literacy in students as the creation of a unified system of understanding about general and specific chemical properties of substances, the regularities of chemical processes, their interrelation, and application not only in human life and the formation of a healthy lifestyle but also in chemical production and the solution of global environmental problems. This is possible only through the systematic inclusion of scientific literacy content in both lesson and extracurricular activities (Bukhanova, E. Yu., 2022).

Research Methodology

The Science and Art Festival, as a form of implementing the STEAM approach, represents an effective educational practice. It combines elements of hands-on learning, interdisciplinary approaches, and creative self-expression, engaging students in deep and motivated cognitive activity. While the main focus of the study is scientific creativity in relation to attitudes and STEM engagement, it emphasizes the need to incorporate these broader skills, including communication, into educational strategies to enhance student learning experiences and promote STEM-related aspirations (Alimova F.A., 2023).

Organisation and implementation of the STEAM Festival

Setting the aim and objectives of the project. The main aim of the festival was to develop scientific literacy among young people through practical participation in interdisciplinary masterclasses, lectures and interactive activities.

The objectives of the festival included:

- Popularisation of science knowledge;
- Demonstrating the practical value of science and technology in everyday life;
- Stimulating interest in research activities;
- Development of creative potential and critical thinking of the participants.

1. Formation of a team of organisers. The festival was initiated by the STEAM student team from different universities of Uzbekistan. The team included students from pedagogical, medical, dental and national universities, which ensured the multidisciplinary nature of the festival preparation. Within the team, functional roles were distributed:

- Responsible for scientific sections;
- Masterclass coordinators;
- Leaders of volunteer groups;
- Responsible for logistics and PR.

2. Preparation of Thematic Sections. The festival covered a wide range of areas:

1. Natural Sciences (zoology, chemistry, physics, genetics, genetics, plant physiology);
2. Engineering and technology (robotics, sewer projection);
3. Art (architecture, painting);
4. Cognitive skills (mnemonics, intellectual quizzes);
5. Health (dentistry).

Each section developed its own educational programme including:

1. Theoretical lectures;
2. Demonstration experiments;
3. Practical tasks for participants;
4. Interactive forms of communication (quizzes, discussions, project works).

Specialists in each field (professors, young scientists, practitioners) were involved as master-class presenters and lecturers.

3. Organization of space and logistics of the event. The venue was the Academic Lyceum at the Tashkent Medical Academy. Separate classrooms with necessary equipment were allocated for each section: laboratory equipment for chemistry and plant physiology, constructors and electronics elements for robotics, art materials for the art section, etc. Registration of participants, section navigation and schedule of events were organized.

4. Developing a motivational system. To maintain high involvement, a system of incentives was introduced. Participants received points for attending sections, being active at masterclasses and taking part in quizzes. The points were exchanged for merchandise (notebooks, caps, T-shirts, pens from Mahorat&Management). Certificates of participation were given to the most active

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participants. This created an atmosphere of game motivation and friendly competition.

5. Methods of data collection to analyse the effectiveness. The following methods were used to further analyse the festival:

1. Observation of youth participation in sections and masterclasses;

2. Questionnaire survey of participants (assessment of satisfaction, interest in science, impressions of the event);

3. Qualitative interviews with volunteers and organizers;

4. Analysis of quantitative indicators of activity (number of participants, attendance at sections, number of points).

Results and Discussion

The festival demonstrated the high effectiveness of the STEAM format in developing scientific literacy among young people:

1. Increased interest in science and technology. According to the results of the questionnaire (via Google form): 82% of participants noted an increased interest in science after participating in the festival; 76% expressed a desire to continue studying one of the presented disciplines. The sections where participants could conduct practical experiments with their own hands (chemistry, genetics, robotics) were especially popular.

2. Development of practical skills of students consisted in the following:

1. Mastered the methods of experiments in chemistry, plant physiology and genetics;

2. Familiarised themselves with the basics of robot design and programming;

3. Learned the basics of dental procedures;

4. Created their own architectural models and artworks.

Thus, the festival became a platform for practising practical and engineering skills.

3. Formation of interdisciplinary thinking. The diversity of topics allowed participants to see connections between different sciences and fields of knowledge, e.g.:

The connection between biology and engineering in the robotics and plant physiology sections;

The combination of art and technology in the architecture section;

The application of cognitive sciences in the study of mnemonics.

4. Development of soft skills. Active work in teams, participation in quizzes, public speaking at masterclasses helped to improve communication skills, develop critical thinking, and increase self-confidence.

5. Social effect. The festival became not only an educational but also a social event. Students from different universities made professional connections. Young people saw examples of successful scientific careers through communication with teachers and researchers. The project aroused interest among a wide audience through active coverage in social networks.

Observations during the program: communication & collaboration - merely creating conditions in which students are forced to work together was not the most effective way to increase their motivation and desire to communicate and collaborate more with each other. Conducting and organizing this kind of extracurricular activities of students helps to attract young people to the sphere of science, to engage in scientific and technical creativity, to get acquainted with the latest scientific and innovative developments, to communicate with world scientists and representatives of scientific schools, which will contribute to improving their scientific literacy.

Fig. 1. Photo gallery of the STEAM festival

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