Emergent: Journal of Educational Discoveries and Lifelong Learning (EJEDL) Vol: 6, No 4, 2025, Page: 1-7

Didactic Possibilities of Using The Steam Educational Technology Tool In Teaching Natural Sciences on The Basis of an Integrative Approach

Khamidova Zainura Ramazonovna

Independent researcher of the National University of Uzbekistan, Ministry of Internal Affairs of the Republic of Uzbekistan, Specialized Boarding School, People's Education Organ

DOI:
https://doi.org/10.47134/emergent.v6i4.72
*Correspondence: Khamidova Zainura Ramazonovna
Email: hamidovazaynura@gmail.com

Received: 23-04-2025
Accepted: 23-05-2025
Published: 23-06-2025

Abstract: This article reveals the didactic possibilities of STEAM educational technology based on an integrative approach in teaching natural sciences. The STEAM approach plays an important role in integrating students' interdisciplinary knowledge, acquiring practice-oriented knowledge, and developing critical thinking and problem-solving skills. The article provides scientific analyses of the application of modern pedagogical technologies to natural sciences and their effectiveness. So, provides feedback on the increase in the need for teaching natural sciences today, as well as on the further improvement of the system of teaching natural sciences and improving efficiency.

Keywords: STEAM Education, Integrative Approach, Natural Sciences, Didactic Possibilities, Pedagogical Technologies.

Introduction

In the 21st century, the radical changes in education are calling for a new look at the learning process of students, an approach that focuses them not only on ready-made knowledge, but on independent search, research. In particular, in the teaching of natural sciences, this need became more evident, abandoning traditional methods and introducing modern pedagogical technologies, in particular approaches based on educational technology STEAM (Science, Technology, Engineering, Arts, Mathematics), became an urgent issue.

Through STEAM education, students are formed not just theoretical knowledge, but modern skills such as understanding the connection between them, making the right decisions in problem situations, thinking innovatively, and participating in social projects. Especially when teaching Natural Sciences on the basis of an integrative approach, STEAM technology is distinguished by its didactic efficiency.

The research work concluded that by means of STEAM educational technology, acquaintance with the literature covering the problem of teaching 6th grade natural

sciences, organization on the basis of pedagogical activity, technological approach will give a positive result, and pilot work was organized.

Methodology

Based on the analysis of STEAM educational technology, its orientation to different areas and the specifics of each form, it is possible to determine the stages of development from Uzbek scientists. Tashibekova covered in detail in her dissertation work in 2022. According to him, STEM is an educational technology designed to combine science, technology, engineering and mathematics, which are important for understanding the laws (Tashibekova, 2022).

STEAM, on the other hand, is an educational technology designed to study science, technology, engineering, and art on the basis of combining it with mathematics. STREAM is an educational technology designed to integrate science, technology, engineering, art, and mathematics, which are important for learning the law through reading and writing.

STEM PhBL is an educational technology designed to harmonize science, technology, engineering, art and mathematics, which are vital to understanding the laws of nature based on the study of phenomena.

STEM PBL is an educational technology designed to harmonize science, education, technology, engineering, art, and mathematics, which are vital to understanding the laws of nature based on the study of problems (Bybee, 2013).

Scientist stated that" STEAM –educational technology is a project activity based on collective, group and individual - form experiences aimed at acquiring practical knowledge using contexts, electron tools, distribution and natural tools that enable participants in the educational process to integrate among themselves various modern methods and forms of teaching" (White, 2014) - he gave the author's definition.

Based on the STEAM approach, Natural Science is significant in that it encourages students to think creatively and creatively. In particular, Scientist Z.Sangirova explained- the teaching of Natural Sciences the mutual integration of Sciences in the formation of natural-scientific, technical, environmental and economic literacy in students and the development of critical and creative thinking creates the basis for the realization by the object of nature as a whole, the emergence of a single natural-scientific picture of the world in their thinking (Sangirova, 2022).

Researcher of STEAM education in the teaching of Natural Sciences Sh.Turdiyev said that "these sciences by nature manifest two states: the first is mathematics, design and Natural Sciences if I break theoretical States, the second is akas, where engineering and technology sciences are practically oriented. Thus, the use of integrated education is considered important in explaining the interrelationships of the first and second cases when applying the theoretical acquired knowledge to practice, and STEAM Science Education and integration occurs in the implementation of this education" (Turdiyev, 2022) – gives its definition.

Of course I believe that it makes sense for a scientist to come to such a conclusion on the basis of his studies and theories. STEAM education subjects are separated into two

groups-theoretical knowledge based on mathematics, natural sciences and arts (math, science, art) is acquired and strengthened. It is possible to apply in practice the theoretical knowledge gained through the disciplines of technology and engineering (technology, engineering) (Turdiev, 2022). And through this, it is possible to achieve a harmony of theory and practice.

Cites 5 cases in the integration of STEAM disciplines by Sh.Turdiyev:

1. Science topics can serve to explain one continuous topic next
2. STEAM subjects are taught in parallel at the same time
3. The organization of dual education in showing that subjects are interdependent allows students to understand the objects of science
4. Strengthening the subject of one science in the light of another science
5. Achieving joint teaching of 4 and more subjects. Allows you to understand that one science is no more than the other.

Z. Ashurova said that "STEAM technology is a technology that prepares a researcher"scientist child"for life based on national values, focused on the implementation of practical inventive activities based on the integration of non - standard methods of content of various activities that serve to form competencies related to the field of development and ensuring the acquisition of comprehensive intellectual knowledge of children " (Ashurova, 2023).

The Chinese Ning Fang – "the concept of STEAM is a set of interdisciplinary and thought systems. Students develop thinking logic, spatial imagination and positivity through understanding the connections between different disciplines through their practice" (Fang, 2019).

Of Russia R.Semyonova – "STEAM is considered the most powerful combination of today, science and teaching methods for society, a national strategic priority adopted by such many countries. The term STEAM is a professional employment strategy that includes natural-scientific, computer and mathematical, architectural and engineering types of work" (Семёнова, 2023).

Result and Discussion

An integrative approach is to organize an educational process based on several interdisciplinary connections. Through this approach, students will be able to combine knowledge and skills in several fields of science at the same time and be able to apply them in real-life situations. Through the joint teaching of Natural Sciences — Biology, Physics, Chemistry and geography-students are provided with holistic knowledge.

SCIENCE (Natural Sciences) is also included in the STEAM education system, and the use of pedagogical technologies in the education of students should be the focus of the teachers of each natural science that acts pedagogically in the educational system. In the teaching of Natural Sciences, the individual organization of students ' cognitive activity is mainly used in combination with the lesson in both extracurricular and extracurricular activities. For example, there are opportunities for students to approach them in detail in

their homework. This includes creating crosswords, observing and experimenting on specific topics for students, preparing lectures and abstracts, materials for competitions on various topics. These include the use of all techniques of collaborative teaching technology in the teaching of Natural Sciences, modular programs in which modular educational technology is designed to work in small groups of students (Ramazonovna).

In natural sciences dasrs, the cognitive activity of students has a very high effect when the gross teaching is harmonized with the forms of work in individual and small groups. In the small group teaching method of collaborative teaching, gross teaching is harmonized with small groups, and in the "saw" method, teaching students first individually and then in small groups.

In the teaching of Natural Sciences, it is advisable to improve the traditional lessons that dominate the educational process through the use of modern pedagogical technologies. With this in mind, ways have been developed to use the collaborative teaching method in small groups of collaborative teaching technology in traditional classes. A convenient aspect of this method is the presentation of a new topic by the teacher first using visual materials according to the plan, and then the organization of independent work of students in cooperation in small groups (Ramazonovna, 2024). Problem topics that take place from the natural sciences curriculum are studied in the form of a problematic lesson "mental attack" using problematic educational technologies. It is also advisable that some subjects are studied in the form of a controversial lesson.

In the educational process, 2 types of discussion classes: scientific discussion classes and free thinking classes are used. The implementation of the reversal in the process of successful use of modern pedagogical technology in the lessons of Natural Sciences in an important conditional educational process, that is, the control and assessment of the acquired knowledge of students, identification of typical errors in their answers and ways to eliminate them, making appropriate changes to the course developments in accordance with the results obtained, their improvement Each course is designed to control and evaluate the acquired knowledge of students twice, through the means of test assignments on the past and new topic. This control provides the basis for students ' interests in the academic discipline, regular improvement of their knowledge, conscious assimilation and strengthening of educational material.

STEAM education technology is focused not only on providing theoretical knowledge, but also on testing and experimental learning in practice. This technology has the following advantages:

- Provides interdisciplinary integration
- Shapes students as active, independent-minded individuals
- Develops problem solving, critical and creative thinking skills
- Directs research, experimentation

Forms a culture of the use of modern information technologies. The use of STEAM technology in teaching Natural Sciences creates several didactic possibilities. Including:

- visual teaching: easy meaning of concepts using laboratory experiments, simulations, layouts.
- Project approach: students develop projects on a specific topic and test them in practice.
- Teamwork: STEAM activities are often organized in a group form, which increases socialization, communication skills.
- Solving Real problems: for example, studying environmental problems and developing proposals for their elimination (Mokhinur, 2024).

For example, the topic" increase in the amount of carbon dioxide in the atmosphere" can be studied in connection with the sciences of biology, chemistry, physics and geography. Students identify the sources of carbon dioxide (chemistry), understand its heat capture nature (physics), study the effect on the biosphere (biology) and analyze the geographical distribution of this state (geography).

The application of the STEAM approach in the process of teaching Natural Sciences is considered as one of the important innovations for the current educational system. This approach encourages students not only to limit themselves to theoretical knowledge, but also to actively participate in practical projects aimed at solving life problems. During the discussion, it is analyzed what benefits and problems the STEAM approach brings in teaching Natural Sciences.

First, through the STEAM approach, students further explore various interdisciplinary connections. For example, the application of technology and art-related projects in biology classes not only increases scientific knowledge, but also helps to develop creative thinking and technical skills (Farxodjonova, 2022). This leads the reader to understand the subject more broadly. Research shows that with the STEAM approach, students' problem-solving skills, skills in applying scientific and mathematical concepts are enhanced.

Secondly, the STEAM approach helps students gain interest in the technological and scientific fields. There have been a number of studies in particular that encourage interest in STEM (Science, Technology, Engineering, Mathematics) among female students. Through practical projects and creative solutions, students often create new ideas in areas such as engineering, robotics or biological technology. This makes the educational process interactive and fun. At the same time, in the process of introducing the STEAM approach, there are difficulties associated with teachers and the educational system. Teachers are required to fully master and practice STEAM techniques with specific training. In some cases, educational institutions may not have the material and technical base necessary for such projects. Therefore, to successfully introduce this approach, it is important to provide support and resources in the educational system.

Conclusion

The use of the STEAM educational technology tool in teaching Natural Sciences on the basis of an integrative approach is considered one of the most relevant areas of modern education. This approach will arm students not only with knowledge, but also with deep analysis, understanding of interdisciplinary connections, creative thinking and an innovative approach. Through STEAM technology, it is possible to achieve didactic goals in the educational process, fully demonstrate the intellectual potential of students and form them as a mature person in accordance with the requirements of modern society.

References

Ashurova, Z. (2023). Didactic mechanism for the use of STEAM technology in preschool education . doctor of philosophy in Pedagogical Sciences is written to obtain a PhD degree in diss. autoref. Bukhara 2023. –B.11.

Bati, K. et al. (2018). Teaching the concept of time: A steam-based program on computational thinking in science education //Cogent Education. – 2018. – Т. 5. – №. 1. – С. 1507306.

Bybee, R. W. (2013). The case for STEM education: Challenges and opportunities. – 2013.

Fang, N. (2019). Research on the Application of STEAM Concept to College English Learning in China. International Conference on Economics, Management and Humanities Science (ECOMHS 2019) P-979

Farxodjonova, N. F. (2022). The importance of the spiritual heritage of the jadids in the development of society //Экономика и социум. – 2022. – №. 10-2 (101). – С. 33-35.

Farxodjonova, N. F., Abdurahimov V. A. (2020). Modern technologies of students training in higher education. nauka i tehnika. Mirovye issledovanija. – 2020.

Juanas, S. Ozkaya de (2021). Didactic and outreach possibilities of the Cretaceous palaeontological site of Figueira da Foz (Portugal). *Comunicacoes Geologicas*, *108*, 125-130, ISSN 0873-948X, https://doi.org/10.34637/ksqt-gx19

Mamurova, D. (2024). Didactic possibilities of using computer graphics programs in the educational process. *BIO Web of Conferences*, *84*, ISSN 2273-1709, https://doi.org/10.1051/bioconf/20248402020

Mokhinur, O. (2024). "The Essence of The Concepts Of Politics and The Political Process." *Jurnal ISO: Jurnal Ilmu Sosial, Politik dan Humaniora* 4.1 (2024): 8-8.

Ramazonovna, K. Z. The Use of Steam Educational TECHNOLOGY in the Teaching of Natural Sciences //European Journal of Humanities and Educational Advancements. – Т. 5. – №. 1. – С. 116-118.

Ramazonovna, X. Z. (2023). Steam ta'lim texnologiyalari vositasida 6-sinf tabiiy fanlarni o 'qitish zaruriyati //Zamonaviy ta'limda fan va innovatsion tadqiqotlar. – 2023. – Т. 1. – №. 3. – С. 166-172.

Ramazonovna, X. Z. (2024). Tabiiy fanlarni o'qitishda steam ta'lim texnologiyasidan foydalanishning mazmuni, usullari va vositalari //pedagogik islohotlar va ularning yechimlari. – 2024. – Т. 6. – №. 2. – С. 245-248.

Sangirova, Z. B. (2022). The methodology for organizing educational and project work on the basis of the STEAM approach in secondary schools (on the example of Natural Sciences) is written to obtain the degree of Doctor of philosophy in Pedagogical Sciences diss. Chirchiq - 2022 P.19.

Shatunova, O. et al. (2019). STEAM as an innovative educational technology //Journal of Social Studies Education Research. – 2019. – Т. 10. – №. 2. – С. 131-144.

Soboleva, E.V. (2022). Didactic Possibilities of Mobile Applications to Form Intercultural Competence of Students. *European Journal of Contemporary Education*, *11*(2), 526-541, ISSN 2304-9650, https://doi.org/10.13187/ejced.2022.2.526

Tashibekova, M. X. (2022). ”Methodology for the use of STEAM educational technology in elementary grades " (on the example of Natural Sciences) was written to obtain a PhD in philosophy in Pedagogical Sciences from Diss. Autoreferat. Namangan 2022.

Turdiev, Sh. R. (2022). Theory and methodology of the development of STEAM science education through modeling and digitization. The doctor of Pedagogical Sciences is written to obtain the degree of DSc. Diss. Autoreferat. Against 2022.

Turdiyev, Sh. R. (2022). STEAM Science Education and integration occurrence model. Academic Research in Educational Sciences. Volume 3 | Issue 4 / 2022. B-571-572.

White, D. W. (2014). What is STEM education and why is it important //Florida Association of Teacher Educators Journal. – 2014. – Т. 1. – №. 14. – С. 1-9.

Семёнова, Р. И. (2023). Отраслевая и региональная экономика. Вестн. Моск. Ун-та. Сер. 6. Экономика. 2023. № 3 С-111.