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Using time-lapse technology to implement the eco-steam approach in primary education students Methods of organization

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Abstract

This study highlights the methodology of using the STEAM approach and Time-lapse technology in shaping the environmental competence of future primary education teachers. The possibility of dynamic representation of ecological processes and the development of students' observation and analysis skills is explored using time-lapse technology. The effectiveness of using innovative methods in pedagogical process is also analyzed. The study examines the pedagogical aspects of the integration of Time-lapse technology into the educational process, its role in the formation of environmental consciousness and its importance in improving the professional skills of teachers. With the help of this technology, students will have the opportunity to closely observe the dynamic processes of nature, develop their skills to analyze them and deal with environmental issues. The combination of the STEAM approach and Time-lapse technology makes the educational process more innovative and effective.

Keywords: *STEAM Education, Environmental Competence, Time-lapse Technology, Creative Pedagogy.*

INTRODUCTION

Modern education requires innovative approaches aimed at promoting environmental awareness and the principles of sustainable development. In particular, the formation of environmental competence at the primary education stage plays an important role in the development of a conscious and responsible attitude to the environment of future generations. According to Constitution of the Republic of Uzbekistan. (2023) An important role in this process is played by STEAM approach and modern information technologies. It was adopted by referendum of the Republic of Uzbekistan by popular vote. Decree of the President of the Republic of Uzbekistan dated September 5, 2018, No 3931 "On measures for the introduction of new principles of management in the public education system" (President of the Republic of Uzbekistan. 2018). As outlined in the Decree of the President of the Republic of Uzbekistan "On approval of the Concept of Environmental Protection of the Republic of Uzbekistan for the period up to 2030" (President of the Republic of Uzbekistan, 2019) and the Decree of the President of the Republic of Uzbekistan of 2022 No. UP-134 (President of the Republic of Uzbekistan, 2022), the STEAM approach is based on the integration of science (Science), technology (Technology), engineering (Engineering), art (Arts) and mathematics (Mathematics); serves to develop students' creative thinking, problem-solving skills and research-oriented activities. STEAM is recognized as a popular pedagogical approach aimed at enhancing students' creativity, enhances their ability to solve problems, and fostering their interest in STEM disciplines (Perignat & Katz-Buonincontro, 2019). According to Şahin et al. (2014), STEM education aims to enable individuals to look at problems from a different perspective between fields by gaining skills and knowledge with a totalitarian approach to education. The effective use of this approach, especially in environmental education, expands the possibilities for scientific analysis of real-life processes.

Time-lapse technology is a convenient tool to identify and monitor the dynamics of ecological processes. Time-lapse is a powerful method for visualizing movements and processes that develop at a slow pace (Bennett & McMillan, 2007). With this technology, students will have the opportunity to see, analyze, and raise environmental awareness of environmental changes in an accelerated format. At the same time, the technology of time-lapse helps to develop the skills of observation, experimental analysis and research in the educational process. As stated by Krajcik and Blumenfeld (2006), "The use of technology in education not only enhances engagement but also fosters critical thinking and observational skills." At the same time, the technology of time-lapse helps to develop the skills of observation, experimental analysis, and research in the educational process.

This study aims to develop a methodology for the use of the STEAM approach and Time-lapse technology in the development of environmental competence of future primary education teachers. The research results serve to improve the effectiveness of environmental education in primary education, the introduction of innovative approaches in the process of professional training of teachers. Gunawan (2020) said STEAM learning is an educational concept that focuses on aspects of collaboration, directing children to think critically, and creatively, innovate and find solutions (problem-solving), based on moral values and local culture.

As in other fields, innovative pedagogical approaches are actively used in environmental education, including the STEAM (Science, Technology, Engineering, Arts, and Mathematics) approach. STEAM education also shows its effectiveness in environmental education, as it provides an opportunity for students to develop their creativity and apply integrated approaches to solving environmental problems. In educational settings, integrated STEM is often linked to project-based or problem-based learning (such as inquiry or design challenges), where the results can differ significantly and the required knowledge spans multiple STEM fields (Nadelson & Seifert, 2017). According to Özdemir (2016) STEM education aims to bring these skills to the individual by focusing on literacy skills such as creative thinking, critical thinking, problem-solving, and collaborative work. At the same time, the contribution of time-lapse technology to environmental education is of great importance. Time-lapse is a perfect method for examining this process due to its capability to capture images over a period of time (Wong et al., 2013). The time-lapse technology is used as an effective tool for showing students changes in nature and analyzing them, especially with the help of time-lapse images of accelerated images of ecological processes. This technology gives students the opportunity to connect directly with environmental processes and phenomena, encouraging them to understand and learn more.

There are several studies in the literature on the integration of environmental education and the STEAM approach. Tilavova S.B. in their research used the integration of environmental education with science and technology (Tilavova, 2023). Those who have demonstrated the importance of the STEAM approach in solving environmental problems. Then, Shatunova et al., (2019) demonstrate that STEAM education in "creative spaces" significantly enhances students' project management and creativity skills to address challenges in the Industry 4.0 era. There are also a number of developments on the impact of the application of time-lapse technology on environmental education. Elliott and Pedersen (Yuldashovich, 2022) have explored the role of time-lapse technology in the development of students' environmental consciousness. The integration of this technology into the educational process is an effective tool for the visual observation and analysis of ecological processes and contributes to the formation of students' environmental awareness.

RESEARCH METHODS

Methodologically, the study used an experimental method to study the effectiveness of time-lapse technology in

environmental education based on the STEAM approach. In the research process, special software and digital tools were used to measure the effectiveness of observing, analyzing and visually observing ecological processes. The study also collected readers' feedback through questionnaires and surveys to determine the role of time-lapse technology in the development of environmental competence.

The research methodology aims to measure the effectiveness of the application of time-lapse technology, taking into account the specific features of the STEAM approach in environmental education. This methodology is effective in the development of students' environmental awareness and development of practical skills.

RESULTS AND DISCUSSION

According to the results of the study, it was found that the STEAM approach and the use of Time-lapse technology are effective in the formation of environmental competence of future primary education teachers. Thanks to this approach, students' in-depth understanding of environmental processes, observation and analysis skills have significantly improved.

With the use of time-lapse technology, students were able to visually observe changes in their environment and analyze their cause-and-effect relationships. This served to form scientific thinking and problem-solving competence on environmental problems.

Table 1
(The application of time-lapse technology is reflected in this table. Time-lapse technology)

Key Insights	Description	Qo‘llanilishi	Advantages	Examples
Time-lapse technology	It is still a method of creating a video by shooting pictures at intervals of time and then showing them on them at high speed.	Display events briefly and quickly, which last long.	Creates the possibility of visual demonstration of dynamic processes.	Blooming of the flower, sunrise or setting, construction process.
Shooting intervals	Take pictures at exact and targeted times.	Define a cross-matched interval for each event or process.	Clearly demonstrate continuous processes by reducing time.	Change in the construction process, changes in nature.
Speed Management	Increase the interval between pictures and display them at high speed.	Video speed adjustment and time acceleration.	Display a lot of information in a short time.	Blooming process or production processes of the flower.
Ko'rsatish format	Compression of time by displaying videos at high speed.	Use in describing ecological and scientific experiments.	Faster understanding of comments thanks to time-lapse	Accelerated demonstration of ecological processes.

			videos.	
Pedagogical goals	Environmental education, using STEAM methodology.	Teaching students to observe and analyze ecological processes.	Students will have the opportunity to creatively understand environmental and scientific processes.	Flower opening, sunset, growth processes.

Also, thanks to the STEAM approach, students' interest in research activities has increased, their qualifications to develop environmental projects and offer innovative solutions have developed. The results showed that this methodology contributes to increasing the effectiveness of the pedagogical process, as well as raising the professional level of teachers to a new level.

The formation of environmental competence in the modern education system is one of the important tasks, in which innovative technologies and integrated approaches play great importance. According to Wang (2019) The integration of innovative technologies, such as Time-lapse, within the STEAM framework enhances environmental education by providing students with interactive and engaging learning experiences, ultimately fostering their environmental competence In particular, the development of environmental education through the STEAM approach and its integration with Time-lapse technology serves to increase the effectiveness of the pedagogical process.

The technology of time-lapse allows to reflect in a clear and understandable manner the dynamics of ecological processes and changes over time. With the help of this technology, students will be able to conduct their observations on a scientific basis, conducting a detailed analysis of natural phenomena and environmental changes. For example, by visually observing processes such as the growth of plants, the effects of climate change, or environmental degradation, students can develop a deeper understanding of the environment.

Also, in relation to the STEAM approach, the use of Time-lapse technology activates students' research and creative activities. Through the integration of STEAM, the process of studying environmental problems will not only be integrated within the natural sciences, but also with areas such as engineering, arts and technology. This develops students' ability to conduct comprehensive analysis and complex problem solving. Wijaya, Karmila, and Amalia 2015: 85), consequently, the implementation of this method is very precise for students even though in the beginning, to increase the student’s interest toward STEAM field become wider.

Discussions show that for future teachers of primary education, the value of this methodology is invaluable and serves to increase environmental awareness and responsibility in their pedagogical activities. By engaging with real-world environmental issues through visual and interdisciplinary approaches, teacher candidates develop a deeper understanding of their role in promoting sustainable practices in the classroom. Furthermore, this methodology fosters a sense of agency and ethical responsibility, encouraging future educators to integrate environmental themes across subjects and to inspire young learners to care for the environment.

In the future, further refinement and large-scale implementation of this methodology can strengthen the innovative aspects of the educational process. It holds great potential to transform traditional teaching models by promoting inquiry-based learning, collaboration, and the practical application of knowledge. Continued development and integration of this approach can contribute to the formation of a new generation of teachers who are not only skilled in modern pedagogy but are also

active contributors to ecological preservation and sustainable development.

CONCLUSION

The results of the study showed that the use of the STEAM approach and time-lapse technology is an effective method in developing the environmental competence of future primary education teachers. This approach helps students to understand the dynamics of ecological processes and develop skills in observation and analysis. Time-lapse technology contributes to enhancing students' environmental awareness through the visual representation of environmental phenomena, such as climate change, plant growth, and ecosystem degradation.

At the same time, the STEAM approach integrates elements of science, technology, engineering, the arts, and mathematics, providing a holistic and interdisciplinary model of environmental education. By combining artistic and technical components, it enables future teachers to communicate environmental issues creatively and effectively to young learners. This also encourages critical and innovative thinking in designing project-based learning activities that are oriented toward solving real environmental problems.

According to the research findings, this methodology plays a significant role in intensifying the research activities of primary education teacher candidates, promoting the effective use of innovative pedagogical technologies, and fostering a strong ecological culture within the academic environment. The integration of the STEAM approach and time-lapse technology directly contributes to improving the quality of environmental education and strengthening the professional training of teachers. Therefore, this strategy serves as a crucial step in preparing educators who are not only academically competent but also socially and environmentally responsible.

BIBLIOGRAPHY

Bennett, E. P., & McMillan, L. (2007). Computational time-lapse video. In ACM SIGGRAPH 2007 papers (pp. 102-es).

Constitution of the Republic of Uzbekistan. (2023, April 30). LexUZ. https://lex.uz/docs/6445145

Gunawan, P. &. (2020). Model Pembelajaran Steam (science, Technology, Engineering, Art, Mathematics) dengan Pendekatan Saintifik. Jakarta: Kemendikbud.go,id.

Nadelson, L. S., & Seifert, A. L. (2017). Integrated STEM defined: Contexts, challenges, and the future. The Journal of Educational Research, 110(3), 221-223.

Özdemir, S. (2016). Opinions for STEM education. [Recorded by S. Boz]. Ankara.

Perignat, E., & Katz-Buonincontro, J. (2019). STEAM in practice and research: An integrative literature review. Thinking skills and creativity, 31, 31-43.

President of the Republic of Uzbekistan. (2018, September 5). Resolution No. 3931 on measures for the introduction of new principles of management in the public education system.

President of the Republic of Uzbekistan. (2019, October 30). Decree No. UP-5863 on approval of the Concept of Environmental Protection of the Republic of Uzbekistan for the period up to 2030.

President of the Republic of Uzbekistan. (2022, May 11). Decree No. UP-134.

Şahin, A., Ayar, M. C. & Adıgüzel, T. (2014). STEM related after-school program activities, and associated outcomes on

student learning. Educational Sciences: Theory & Practice, 14(1), 13-26.

Shatunova, O., Anisimova, T., Sabirova, F., & Kalimullina, O. (2019). STEAM as an innovative educational technology. Journal of Social Studies Education Research, 10(2), 131-144.

Tilavova, S. B. (2023). Technologies of improving environmental competence based on STEAM approach. Innovative Education, 1(1), 1–7.

Wijaya, AGUSTA DANANG, NILA Karmila, and MAHMUDAH RIZQI Amalia. 2015a. "Implementasi Pembelajaran Berbasis STEAM (Science, Technology, Engineering, Art, Mathematics) Pada Kurikulum Indonesia." In Proseding Seminar Nasional Fisika Dan Aplikasinya. Tersedia Online: Portal. Phys. Unpad. Ac. Id.

Wong, C., Chen, A. A., Behr, B., & Shen, S. (2013). Time-lapse microscopy and image analysis in basic and clinical embryo development research. Reproductive BioMedicine Online, 26(2), 120-129.

Yuldashovich, K. A. (2022). STEAM integrated educational technology in enhancing eco-learning effectiveness. European International Journal of Multidisciplinary Research and Management Studies, 2(11), 1–5.