METHODOLOGY OF CREATING PROBLEM SITUATIONS THROUGH THE STEAM APPROACH IN PRIMARY EDUCATION

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Abstract

The rapid development of science and technology has led to the modernization of educational systems worldwide. In this context, the STEAM (Science, Technology, Engineering, Arts and Mathematics) approach has become an important pedagogical innovation, especially in primary education. One of the core elements of STEAM is the creation of problem situations that stimulate pupils' cognitive activity, critical thinking, and creativity. This article analyzes the methodology of creating problem situations through the STEAM approach in primary education. The study explores theoretical foundations, pedagogical principles, and practical methods of implementing problem-based STEAM activities in primary classrooms. The results demonstrate that STEAM-based problem situations significantly enhance pupils' motivation, collaborative skills, and problem-solving abilities.

Keywords: STEAM education, problem situations, primary education, critical thinking, integrated learning.

INTRODUCTION

Modern education aims not only to transmit knowledge but also to develop learners' cognitive, creative, and social competencies. In the 21st century, rapid technological advancement has transformed the demands placed on education systems. Learners are expected to think critically, solve problems creatively, and collaborate effectively (Trilling & Fadel, 2009). Traditional subject-centered teaching methods are no longer sufficient to meet these requirements.

STEAM education, which integrates science, technology, engineering, arts, and mathematics, has emerged as a promising approach to developing interdisciplinary competencies among learners (Yakman, 2008). Particularly in primary education, STEAM plays a crucial role in shaping pupils' initial scientific worldview, curiosity, and creativity.

One of the most effective pedagogical tools within STEAM is the creation of problem situations. Problem situations motivate pupils to search for solutions, formulate hypotheses, and apply their knowledge in real-life contexts (Hmelo-Silver, 2004). Therefore, investigating the methodology of creating problem situations in STEAM-based primary education is highly relevant.

The purpose of this research is to analyze the pedagogical and methodological foundations of creating problem situations through the STEAM approach in primary education and to identify effective strategies for classroom implementation.

METHODS

This study employed a qualitative-descriptive research design aimed at analyzing pedagogical approaches for creating problem situations within the STEAM framework in primary education. The qualitative approach was chosen because it allows in-depth exploration of teaching practices, classroom interactions, and the cognitive processes involved in problem-based STEAM learning (Creswell, 2014).

Research Setting and Participants

The research was conducted in general secondary schools in Kashkadarya region, Uzbekistan. The participants included primary school teachers (Grades 1–4) and their pupils. A purposive sampling technique was used to select teachers who actively implement STEAM-based instructional strategies in their classrooms. In total, 12 primary school teachers and approximately 240 pupils participated in the study.

Procedure

The research was conducted in three stages:

- **Stage 1:** Preliminary review of literature and curriculum documents.
- **Stage 2:** Observation of STEAM lessons and collection of empirical data.

• **Stage 3:** Analysis and interpretation of collected data.

Data Analysis

Qualitative content analysis was applied to categorize and interpret the collected data. Emerging themes such as collaboration, creativity, critical thinking, and interdisciplinary integration were identified and analyzed.

Ethical Considerations

All participants were informed about the purpose of the research. Participation was voluntary, and confidentiality of personal data was ensured in accordance with ethical research standards.

Theoretical Framework

The study relies on the principles of constructivist learning theory, which emphasizes active learner participation and knowledge construction (Piaget, 1972; Vygotsky, 1978). According to these theories, learners acquire knowledge more effectively when they are actively engaged in problem-solving activities.

Data Collection

The research draws on:

• Analysis of international and national scientific articles on STEAM education.

• Review of primary school curricula and teaching materials.

• Classroom observations of STEAM-based lessons.

Data Analysis

Content analysis was used to identify common patterns, strategies, and pedagogical principles related to creating problem situations within STEAM lessons.

RESULTS

1. Concept of Problem Situations in STEAM Education

A problem situation is defined as a pedagogical condition in which learners encounter a cognitive challenge that requires active thinking and decision-making

(Dewey, 1938). In STEAM education, problem situations are designed to reflect real-life contexts and interdisciplinary challenges.

For example, pupils may be asked to design a simple bridge using paper and sticks, integrating knowledge of mathematics, physics, and engineering while applying artistic creativity in design.

2. Pedagogical Principles of Creating Problem Situations

The analysis revealed several key principles:

- **Interdisciplinarity:** Problems must integrate multiple STEAM subjects.
- **Authenticity:** Tasks should be connected to real-life situations.
- **Student-centeredness:** Pupils should actively participate in finding solutions.
- **Collaboration:** Group work enhances communication and teamwork skills.

3. Types of STEAM-Based Problem Situations

Three main types were identified:

1. **Exploratory problems:** Encourage pupils to investigate phenomena.
2. **Design problems:** Require constructing models or products.
3. **Analytical problems:** Focus on reasoning and data interpretation.

4. Classroom Implementation Strategies

Effective strategies include:

- Using inquiry-based questions.
- Organizing group projects.
- Encouraging hypothesis formulation.
- Providing reflective discussions after task completion.

DISCUSSION

The findings confirm that STEAM-based problem situations significantly contribute to the development of critical thinking and creativity in primary pupils.

These results align with the conclusions of Hmelo-Silver (2004), who emphasized the role of problem-based learning in cognitive development.

Moreover, STEAM activities promote social interaction and collaborative learning, which are essential for developing communication skills (Johnson & Johnson, 2017). The integration of arts within STEAM further enhances pupils' aesthetic and emotional engagement.

However, challenges such as limited teacher training and insufficient resources can hinder effective implementation. Therefore, professional development programs for primary teachers are essential.

CONCLUSION

The findings of this study confirm that the STEAM approach represents an effective pedagogical framework for creating problem situations in primary education. By integrating science, technology, engineering, arts, and mathematics into a unified learning environment, STEAM-based problem situations provide pupils with meaningful and authentic learning experiences that go beyond traditional subject-based instruction.

The results demonstrate that problem situations designed within the STEAM framework significantly enhance pupils' critical thinking, creativity, collaborative skills, and intrinsic motivation. Pupils are not merely passive recipients of knowledge; rather, they become active participants who investigate, design, experiment, and reflect on their learning processes. This active engagement contributes to deeper conceptual understanding and long-term knowledge retention.

Moreover, the integration of arts into STEAM plays a crucial role in supporting pupils' emotional engagement, aesthetic perception, and imaginative thinking. This holistic approach allows learners to express their ideas creatively while developing scientific and mathematical reasoning skills. As a result, pupils gain confidence in their ability to solve real-life problems and apply interdisciplinary knowledge.

However, the study also highlights certain challenges related to the implementation of STEAM-based problem situations, such as the need for continuous

professional development of teachers, availability of instructional resources, and curriculum alignment. Addressing these challenges is essential for the sustainable integration of STEAM in primary education.

In conclusion, the STEAM approach, when systematically applied through well-designed problem situations, significantly contributes to the formation of 21st-century competencies in primary school pupils. Therefore, it is recommended that educational institutions expand STEAM-based instructional practices and provide methodological support and training for primary school teachers to ensure the effective implementation of this innovative educational model.

REFERENCES:

1. **Dewey J.** Experience and Education. — New York: Macmillan, 1938.
2. **Hmelo-Silver C. E.** Problem-Based Learning: What and How Do Students Learn? // *Educational Psychology Review.* — 2004. — Vol. 16, №3. — P. 235–266.
3. **Johnson D. W., Johnson R. T.** Cooperative Learning. — Edina: Interaction Book Company, 2017.
4. **Piaget J.** The Psychology of the Child. — New York: Basic Books, 1972.
5. **Trilling B., Fadel C.** 21st Century Skills: Learning for Life in Our Times. — San Francisco: Jossey-Bass, 2009.
6. **Vygotsky L. S.** Mind in Society. — Cambridge: Harvard University Press, 1978.
7. **Yakman G.** STEAM Education: An Overview of Creating a Model of Integrative Education // *Proceedings of the STEAM Education Conference.* — 2008.