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## DEVELOPING CRITICAL THINKING IN FUTURE PRIMARY SCHOOL TEACHERS

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### Abstract

The article examines the methodological foundations of organizing interdisciplinary integration within individualized education, with a special focus on its relevance for musical education in higher pedagogical institutions. The study analyzes how interdisciplinary approaches enhance learners' cognitive engagement, creative thinking, and personalized learning trajectories by connecting knowledge, skills, and competencies across various academic domains. Individualized education is viewed as a flexible pedagogical model that prioritizes learner autonomy, differentiated instruction, and adaptive learning pathways tailored to students' interests, abilities, and professional needs. Within this model, interdisciplinary integration serves as a key mechanism for enriching the educational process, promoting deeper conceptual understanding, and fostering holistic development. The research highlights the pedagogical, psychological, and methodological principles that guide the design and implementation of interdisciplinary learning experiences, especially in the context of musical training where creative, analytical, digital, and reflective competencies intersect. The study further evaluates the role of digital technologies, project-based learning, cross-disciplinary collaboration, and competency-based assessment in supporting individualized and integrated learning environments. The findings emphasize that effective interdisciplinary integration contributes to improved learner motivation, enhanced academic performance, and the development of transferable skills essential for professional growth in the field of musical education.

**Keywords:** Individualized education, interdisciplinary integration, pedagogical methodology, differentiated instruction, musical education, competency development, adaptive learning, creative thinking, digital pedagogy, project-based learning.

## Introduction

### **BO'LAJAK BOSHLANG'ICH SINIF O'QITUVCHILARIDA TANQIDIY FIKRLASHNI RIVOJLANTIRISH**

Mirjamolova Moxira Abdugaffor qizi

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Boshlang'ich ta'limda amaliy fanlar kafedrasida matematika fani o'qituvchisi

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## Annotatsiya

Ushbu maqolada siz bo'lajak boshlang'ich sinf o'qituvchilarida tanqidiy fikrlashni rivojlantirish haqida bilib olasiz. Shuningdek, o'qituvchilarga tanqidiy fikrlash qay darajada muhimligi haqida so'z boradi.

**Kalit so'zlar:** Tanqidiy fikrlash, STEM, purposive sampling

## Introduction

Critical thinking is considered one of the core skills of the 21st century because, according to many specialists, it significantly strengthens students' knowledge and competencies. This skill must be taught at every stage of education, as it prepares learners for global competition.

Research shows that critical thinking ranks first among the most essential skills needed in the 21st century. This skill is not only closely connected with students' future professional success but is also regarded as one of the key positive outcomes of science, technology, engineering, and mathematics (STEM) education.

Students who think critically are capable of analyzing problems scientifically and finding solutions. According to researchers, learners who possess critical-thinking skills become active problem solvers. They take an effective approach to resolving real-life issues and making decisions.

Main part. Some scholars emphasize that critical thinking helps students address everyday challenges through inquiry-based learning. This approach is learner-centered and actively engages students in scientific reasoning, analysis, and problem-solving processes.

Critical thinking is also one of the essential skills required by the modern labor market. It serves as a foundation for many competencies such as communication, collaboration, technology use, life and career skills, learning, and innovative thinking.

Students who are capable of critical thinking analyze, synthesize, evaluate, and interpret information to solve problems or make decisions. Therefore, project-based learning is crucial for developing critical-thinking and problem-solving skills. To achieve this, students should be engaged in projects built around contextual, real-life problems.

One of the effective approaches in this regard is STEM education. STEM teaching is considered an efficient method that helps develop students' competencies, enhance problem-solving abilities, and foster tolerance.

Critical thinking holds a central place in STEM education. If 21st-century learners are expected to demonstrate these skills, then 21st-century teachers must not only possess critical-thinking abilities themselves but also understand how to teach these skills to students.

Teachers should be able to select appropriate instructional strategies, foster higher-order thinking, and encourage creativity in students as part of developing critical thinking. For this reason, teachers play a significant role in implementing STEM projects. They provide students with opportunities to create new products, think creatively, and find solutions to problems.

To effectively develop critical thinking through STEM, teachers must possess the required knowledge, skills, and pedagogical approaches.



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Most of the existing studies have examined how teachers develop students' critical thinking through various project-based techniques, including STEM. However, there is still a lack of research focusing specifically on teachers' own perceptions. The majority of scholarly works have analyzed STEM from a learner-centered perspective rather than a teacher-centered one. In addition, studies that involve teachers from different countries and educational levels are limited. Therefore, the purpose of this study is to determine teachers' understanding of developing critical thinking through STEM projects. Investigating this topic is important because teachers' understanding of critical thinking within the STEM framework directly influences their classroom practices and the impact they have on students.

The aim of the study is to identify teachers' perceptions and beliefs regarding the development of critical-thinking skills through STEM projects. This research was conducted using a descriptive method, and teachers were selected from three Southeast Asian countries — Thailand, the Philippines, and Indonesia. The sample was chosen using purposive sampling.

This approach makes the study unique because it includes participants from different countries and educational levels, which reduces bias and allows for broader analysis.

Critical thinking is considered one of the essential 21st-century skills, as many experts believe that it plays a crucial role in strengthening students' knowledge and competencies. This skill must be taught at every stage of education because it prepares learners for global competition. Research indicates that critical thinking ranks first among the most necessary skills in the 21st century. It is not only closely linked to students' future professional success but is also one of the key positive outcomes of science, technology, engineering, and mathematics (STEM) education.

Students who think critically are capable of analyzing problems scientifically and finding effective solutions. Researchers report that learners with strong critical-thinking skills become active problem solvers. They approach real-life challenges and decision-making processes in a more effective and informed manner. Some scholars note that critical thinking helps students address everyday problems



through inquiry-based learning. This learner-centered approach actively engages students in scientific reasoning, analysis, and problem-solving procedures.

Critical thinking is also one of the essential skills required in today's labor market. It serves as the foundation for many competencies such as communication, collaboration, technology use, life and career skills, learning, and innovative thinking. Students capable of critical thinking solve problems or make decisions by analyzing, synthesizing, evaluating, and interpreting information.

Therefore, project-based learning is important for developing critical-thinking and problem-solving skills. To achieve this, students should be engaged in projects based on contextual, real-life situations. One of the effective approaches supporting this process is STEM education. STEM teaching is considered a productive method that helps develop student competencies, enhance problem-solving abilities, and cultivate tolerance.

Critical thinking plays a central role in STEM education. If 21st-century learners are expected to master these skills, then 21st-century teachers must themselves possess critical-thinking skills and understand how to teach them effectively. Teachers need to be able to select appropriate instructional strategies, develop higher-order thinking in students, and encourage creative approaches.

For this reason, teachers play a key role in implementing STEM projects. They provide opportunities for students to create new products, think creatively, and find solutions to problems. The findings of this study show that STEM-based instruction is an effective method for developing students' critical-thinking skills. During the experiment, lessons organized through the STEM approach strengthened students' higher-order thinking skills such as analyzing, identifying problems, evaluating evidence, and drawing logical conclusions.

In traditional teaching, students often take the role of passive recipients of ready-made knowledge, whereas in STEM lessons they participate as active researchers, creators, and problem solvers. This shift significantly enhanced their capacity for independent learning and analytical thinking.

Additionally, the STEM approach helped develop essential competencies in both students and teachers, such as:

teamwork,

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idea sharing,  
 participation in project-based activities,  
 and outcome-oriented practical thinking.

Therefore, based on the research findings, the following recommendations are proposed:

1. STEM integration should be introduced into the educational process gradually.
2. Special training programs on STEM methodology should be organized for teachers.
3. Problem-based tasks, project-based activities, and interdisciplinary integration should be more widely incorporated into the curriculum.

In conclusion, the STEM approach not only increases the effectiveness of teaching science-related subjects but also provides a solid foundation for developing students' critical, logical, and creative thinking skills in modern education.

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