Chapter 4
Pedagogical Approaches in STEAM Education:
Fostering Innovation and Creativity in the Classroom

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ABSTRACT

Earlier, science, technology, engineering, and mathematics were considered separate subjects, compartmentalised with their own methods and approaches to teaching. Later, in the 1990s, these interrelated subjects were put together to form STEM education. Researchers have understood the importance of problem-solving and inquiry skills for innovation in the field of STEM, that art is integrated into STEM education. This chapter explores various pedagogical approaches that enhance the integration of STEAM (science, technology, engineering, arts, mathematics) in modern education. By examining innovative teaching methods, this chapter aims to provide educators with practical strategies and insights to foster creativity, critical thinking, and problem-solving skills in students. The chapter will cover project-based learning, problem-based learning, inquiry-based learning, design thinking, collaborative learning, argumentation practice, and multiple intelligences, with a focus on real-world applications and equity in education.

DOI: 10.4018/979-8-3693-7408-5.ch004

INTRODUCTION

The 21st century educational landscape demands innovative pedagogical approaches that foster the 21st century skills (Li & Khlar, 2006) like problem-solving, creativity and critical thinking. Art integrated STEM education emerges as a transformative approach, merging analytical with creative skills to produce wholistic learning experiences. With the alliance of art into STEM education, a new generation of thinkers would emerge who are capable of dealing with the unanticipated challenges of modern life.

This chapter deals with the different pedagogical approaches to STEAM education. STEAM education is an interdisciplinary approach to learning that incorporates the Arts into STEM education. The movement to develop Science, Technology, Engineering and Mathematics (STEM) was initiated in the United States in the 1990's (Perales & Aróstegui, 2021), which expanded globally in a very fast pace. The STEM literacy promoted an interdisciplinary approach to solving everyday problems which would otherwise be difficult with any one of these disciplines (Perales & Aróstegui, 2021). But STEM education remained alienated from the common people, and a lack of touch with the reality is observed in the current STEM students.

Through a comprehensive examination of various teaching strategies, curricular designs and classroom practices, this chapter aims to provide a roadmap to educators who strive to implement STEAM education in their classrooms. The chapter begins with a theoretical foundation discussing the principles and philosophies that guide STEAM education. The crucial role of the teacher as a facilitator in art integrated STEM learning is worth emulating thus realising the importance of professional development and collaborative learning among the teachers.

In today's world that brings unpredictable problems in front of humankind, problem-solving and innovation (Perignat & Katz-Buonincontro, 2019) are necessary skills to be developed by individuals. STEM disciplines have their importance in national wealth creation (Marginson et al., 2013), and this 'utilitarian value of science for economic purposes' ensures that 'science and science related research are connected with national well being' (Tytler & Ferguson, 2023). Science curriculum has two major roles namely, preparing future citizens to engage with science and preparing the next generation of scientists (Tytler, 2014).

There is a huge gender gap in the area of STEM education. The literature shows less participation from women in the area of STEM research and education. The major challenges of STEM education are in the area of curriculum and time planning (Liang & Fung, 2022). The teachers get stressed out due to the discrepancy between integrating STEM curriculum and the present STEM education practices. According to a literature survey conducted by Galiç & Kocadere, (2023) on STEM education research during the years, 2018 to 2022, it has increased yearly, majority of these