Chapter 2
Personalizing STEAM Learning:
Scope, Challenges, and Opportunities

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ABSTRACT

The chapter discusses personalized learning and STEAM education as approaches to supporting teaching and learning activities, especially in STEAM disciplines. The authors defined each approach and identified the characteristics and challenges involved in its implementation. Also, the authors compared the two approaches and identified and discussed similarities and differences in implementing them in various settings. Further, the chapter provides case studies in K-12 and higher education settings involving students and pre-service teachers. Finally, the authors address opportunities and recommendations that the two approaches contribute to preparing individuals for 21st-century workplaces.

INTRODUCTION

With so much hype about 21st-century pedagogies and emerging technologies, several instructional approaches provide promising impacts on teaching and learning activities at different levels (Leahy et al., 2019; Liang et al., 2024; Moran, 1999). Personalized learning methods enhance educational experiences across disciplines, including those teaching science, technology, engineering, arts, and mathematics, commonly identified as STEAM (Hughes et al., 2020; Li & Wong, 2023). With personalized learning, the authors emphasize the importance of understanding fundamental concepts of using the strategies across STEAM disciplines. However, focusing on STEAM disciplines generates a unique approach labeled STEAM education. Using a STEAM-centered framework could enrich the learner experience by enhancing the acquisition of knowledge and skills that are valuable to the demands of 21st-century schools and workplaces (Boice et al., 2024). In this chapter, the authors describe and discuss the scope

DOI: 10.4018/979-8-3693-7718-5.ch002

of using personalized learning and STEAM education as approaches to teaching and learning content and skills, including opportunities and challenges.

The chapter comprises five sections focusing on 1) Personalized Learning, 2) STEAM Education, 3) the Relationship Between Personalized Learning and STEAM Education, 4) Case Studies, and 5) Conclusion. In the first section, the authors describe and discuss the diverse components of personalized learning emerging and converging into theoretical understanding and practice across periods (e.g., Montessori, special education, individualized learning, student engagement, elective courses, senior projects, among others) (Dumont & Ready, 2023; Mavric, 2020; Shemshack & Spector, 2020). Further, they expand on one's understanding of personalized learning as methods defined in the research literature and practice (Herold, 2017; U. S. Department of Education, 2016).). The discussion enhances the experience of factors contributing to the successful implementation of personal learning methods in various contexts and the challenges encountered by the participants.

The second section defines STEAM education as the teaching, learning, and curriculum development framework. They address how STEAM and related (STEM, STREAM, A-STEM, STEMSS) experiences, as outgrowths of personalization, improve student preparedness in various disciplines (Bevan et al., 2015). Finally, the authors discuss and emphasize the significance of interconnections among specified disciplines within the various STEAM and related (STEM, STREAM, A-STEM, STEMSS) concepts (Dare et al., 2021).

The third section addresses the relationship between personalized learning and STEAM Education as teaching and learning approaches (Childress & Benson, 2014; Dockterman, 2018; Jacobson, 2020). The authors compare similarities and differences between approaches in areas of discipline-related core concepts covered, ways of thinking, and interdisciplinary themes. Also, they review the theory of constructivism and how it relates to personalized learning and STEAM education. Further, the authors demonstrate the alignment of the two approaches using examples from different disciplines. They critique past influences and some common mistakes educators make when attempting to align STEAM-oriented lessons with required standards.

The fourth section introduces case studies about designing and developing teachers and candidates as competent implementers of personalized learning methods in STEAM-related activities. The discussion covers instructional planning strategies that encourage student participation, improve self-confidence, increase interactions with teachers and fellow students, and increase achievement.

The final chapter wraps up with a concluding narrative. The authors outline and discuss how the chapter addresses the scope, opportunities, and challenges for individualizing instruction despite the class size, implementing active strategies, and deeper learning (Herold, 2016).

DEFINING PERSONALIZED LEARNING

Personalized learning is an educational approach tailoring instruction to meet individual student’s unique needs, interests, and abilities (Shemshack & Spector, 2020). It aims to provide a more customized learning experience by adapting content, pace, and methods to each student's strengths and challenges (Gunawardena et al., 2024). Personalized learning is not new but a product evolving from changes in thinking about educational theory and innovative practices across periods of history. The expansion of population, industries, and cities resulted in larger populations. The growth pushes adjustment to ways of instructing larger class sizes, leading to a lecture format and more one-size-fits-all assessments. However,