

Chapter 9

Harnessing AI and Digital Tools for Micro-Credentialing in Mathematics Education: Enhancing Learning Outcomes for Students With Learning Difficulties

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ABSTRACT

Understanding decimal place value is a key challenge for students with Learning Difficulties (LD) in mathematics. This study explores the impact of AI-powered ChatGPT, on enhancing learning during the COVID-19 pandemic. Fifty-four sixth-grade students with learning difficulties from six Greek elementary schools engaged with the interactive platforms Khan Academy and DreamBox, with personalized support from ChatGPT. Results revealed significant improvements in decimal place value comprehension post-intervention. Additionally, this research investigated how AI-powered adaptive platforms enhance the effectiveness of micro-credentials in certifying student achievements and upskilling mathematics teachers. The study highlights the potential of micro-credentials to improve pedagogy in technology-driven learning environments. By integrating AI tools and micro-credentials, this study offers insights into how educators can better support students with LD and the importance of micro-credentials in validating learning progress and advancing teachers' skills in the digital age.

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INTRODUCTION

The rapid evolution of technology, particularly artificial intelligence (AI), has significantly transformed educational practices and approaches, particularly in mathematics education. In the wake of the COVID-19 pandemic, the necessity for adaptive and personalized learning experiences has become increasingly apparent, especially for students with learning disabilities. This demographic faces unique challenges that require tailored instructional methods to foster understanding and engagement in mathematical concepts (Dirani et al., 2020; Walpole & Lucas, 2021).

Effective educators enhance student performance, bridge gaps between advantaged and disadvantaged learners, and boost future earnings (Chetty et al., 2014). Consequently, significant investments have been made in professional development (PD) for teachers. Governments have also allocated billions for research to optimize professional development (Edoald & Nevill, 2021). This increased investment has led to more studies evaluating PD's influence on teaching quality and student learning, revealing modest positive effects. Yet, many schools lack access to evaluated PD programs, creating disparities in available resources. Research highlights significant variability in PD effectiveness based on design (Edoald & Nevill, 2021). Attempts to differentiate effective PD have seen limited progress. Despite abundant data on PD program impacts, clarity on effective PD differentiators remains elusive.

Micro-credentials, as a form of certification, have emerged as a promising strategy to recognize and validate the specific skills acquired by these students in AI-supported learning environments.

Micro-credentials offer a flexible and targeted approach to learning assessment, catering to the diverse needs of students (Gauthier, 2020). They serve as formal recognition of the competencies developed through adaptive learning technologies, enhancing the employability and academic progression of students with learning disabilities (Msweli et al., 2022). The integration of micro-credentials in mathematics education not only supports personalized learning pathways but also promotes self-efficacy and motivation among students, vital components for successful learning outcomes.

Micro-credentials are becoming an increasingly important part of education, particularly in the digital and AI-enhanced learning environments designed to support students with learning difficulties. Micro-credentials offer a way to certify the acquisition of specific skills and knowledge, often through smaller, focused learning modules. In the context of students with learning disabilities, particularly during the COVID-19 pandemic, micro-credentials can be used to recognize the achievements of students who engage with AI-powered educational tools and digital platforms. These tools help personalize learning and offer real-time feedback, enhancing student engagement and learning outcomes.

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