Chapter 5
Revolutionizing Mathematics Education With AI-Based Learning Tools:
A Synergistic Approach to Pedagogy and Digital Transformation

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ABSTRACT

Mathematics has always played a pivotal role in education, contributing significantly to the intellectual development of learners by fostering analytical reasoning, logical thinking, and problem-solving abilities. Despite its importance, mathematics is often perceived as one of the most challenging subjects by both students and educators. However, mathematics is undergoing a radical transformation. When paired with advancements in Artificial Intelligence (AI), this ancient system of learning can be revitalized into a powerful learning tool. AI has already transformed many aspects of education, including mathematics. This proposed book chapter explores this convergence, offering a holistic, interdisciplinary perspective on integrating AI and Vedic mathematics into contemporary mathematics education, also presents real-world case studies from Indian and global contexts where such innovations have been applied. It examines how intuitive, mental-math techniques, when coupled with data-driven technologies, transforms the teaching and understanding of mathematics across educational levels.

1. INTRODUCTION

Mathematics serves as the foundation for logical reasoning, problem-solving, and analytical thinking. It plays a critical role in shaping students' intellect, to enhance their lifelong learning capabilities. Despite its importance, mathematics is often perceived as abstract, rigid, and intimidating. The overreliance on rote memorization and procedural teaching has led to widespread math anxiety and disengagement among the students (Ashcraft & Krause, 2007). In an era, where technology is rapidly reshaping educational practices, it is imperative to explore innovative pedagogical models that make mathematics more engaging, accessible, and applicable to real-world contexts. (Cobb et al., 1991, 1992) analyse the impact of classroom environment on learning mathematics education. Since we carry with us the culture of learning from generations, there is growing recognition of the value of integrating traditional systems of knowledge into modern education to enrich learners' experiences. One such system; Vedic mathematics, originating from ancient Indian scriptures (Fig.1); offers efficient mental computation techniques that enhance number sense, pattern recognition, and intuitive understanding. These methods simplify complex calculations and promote creativity, aligning well with modern cognitive theories.

Despite its potential, Vedic mathematics remains underutilized in formal education. Through personalized learning, adaptive assessments, and real-time feedback, AI can identify learning gaps, customize instruction, and support educators in making

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