

BRIDGING DISCIPLINES

INTERDISCIPLINARY APPROACHES
FOR TRANSFORMING EDUCATION

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Tahmeena Khan
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Bridging Disciplines: Interdisciplinary Approaches for Transforming Education

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FOREWORD

I take this opportunity to write a foreword to the book titled “Bridging Disciplines: Interdisciplinary Approaches for Transforming Education”, edited by Dr. Tahmeena Khan, Dr. Manisha Singh, and Dr. Saman Raza, with whom I have been academically associated for the last 15 years. The book is a wonderful amalgamation of research and academics in the field of Science, Technology, Engineering, and Mathematics. This work is a masterpiece in emphasising the relevance of STEM in tackling global challenges across various areas of development and in sustaining human civilisation. It addresses the challenges of various life arenas, including science, Commerce, Technology, and achieving Developmental goals, as well as managing eco-balance and work-life balance, thereby covering the intersection of science and technology with sociology, economics, culture, and politics of a particular nation. The values imparted by research across different aspects of STEM shall provide a holistic learning approach for future generations. This has the potential to bridge the gap between education, rationalism, social norms, economics and foreign relations.

The study of STEM has imbued the application of Artificial Intelligence and its role in teaching and learning. The book contains contributions on diverse topics ranging from interdisciplinary aspects, integration of diverse fields, analytical creativity, environmental, cultural, social, and economic impacts, and an education system imparting knowledge in STEM. This book highlights an interdisciplinary approach to the field of education and emphasises the existence of a multi-faceted education and social system of our nation.

I appreciate the efforts of all the contributing authors, especially young minds who have conceptualised and written the chapters, throwing light on newer aspects of STEM. The growing need for interdisciplinary research has created a requirement for such an education system. The editors should be applauded for bringing out a collection that breaks all the traditional boundaries and sets up a new and deeper meaning towards understanding life. I wish this brainchild of the editors would ignite more minds towards the role of STEM in overall societal development.

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PREFACE

In a world that is ever-changing and increasingly complex, a field such as education, which encompasses various disciplines, must work to prepare students to understand the connections between this complex world and to meet the uncertain demands of the future, as well as the pressing issues of the present. There is no doubt that traditional discipline-specific teaching methods are the foundation of the education system, but they are unable to meet the changing demands of today's education. There is a need for an approach that fosters connections between various disciplines and equips students with adaptable abilities, integrative thinking, and a collaborative mindset, essential for addressing today's world and its complexities. One such approach that may fulfil this need is addressed in this book titled " Bridging Disciplines: Interdisciplinary Approaches for Transforming Education." The book is a compilation of 14 chapters from contributions by different experts in their respective areas and therefore offers a rich account of insights, new frontiers, and interdisciplinarity across disciplines. Each chapter is constructed to be self-contained, allowing readers to dive in and out as their understanding permits.

The book begins with an introduction to interdisciplinarity in education, where the chapter presents various related concepts, including interdisciplinary, multidisciplinary, and bridging disciplines, to enable readers to achieve a clear conceptual understanding upon completing this chapter. The second chapter, Bridging the Barrier Between Science and Arts, aims to reduce the gap between the two major categories of disciplines, *viz.*, science and arts. The third chapter discusses various pedagogical strategies for Interdisciplinary Learning in a general domain. The subsequent chapters cover a broad spectrum of topics, written in a way that each chapter draws upon insights from various fields, including the STEAM paradigm, Commerce, Social Studies, Languages, Biological Science, Chemical Science, Mathematics, Environmental Science, and Architectural Studies. The last two chapters provide insight into creativity and AI tools in interdisciplinary research.

The revolutionary potential of interdisciplinary approaches in education is explored in this book, which advocates for instructional models that break down silos, foster holistic understanding, and stimulate creativity by integrating multiple fields of knowledge. All the chapters are presented herein with the objective of rethinking curriculum, pedagogy, and learning methodologies.

We aim to provide a comprehensive account of insights to the major stakeholders in the field of education, including educators, researchers, policymakers, and students, while promoting interdisciplinarity. Our vision for this book is to empower stakeholders with an education that is both meaningful and skilful, capable of standing up to global competition. This book would be helpful for students, teachers, researchers, and academicians who seek to integrate across different disciplines.

We anticipate that educators, researchers, policymakers, and students will find inspiration and practical guidance within these pages. As we go towards more inclusive, adaptable, and future-oriented educational settings, may this book function as both a resource and a stimulus for continuous experimentation and discourse.

As the editors of this book, we would like to thank the contributing authors for their time and expertise. We also want to thank the readers whose curiosity and commitment to advancing education through technology drive our ongoing investigation of this fascinating intersection.

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CHAPTER 14

The Role of Computational and AI-Assisted Tools in Interdisciplinary Teaching

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Abstract: In response to the growing complexity of global challenges and the evolving demands of the workforce, interdisciplinary education has emerged as a crucial pedagogical approach. This chapter explores the transformative role of computational and AI-assisted tools in facilitating interdisciplinary teaching and learning. It outlines how technologies such as intelligent tutoring systems, AI-powered simulations, natural language processing tools, and data analytics platforms foster integrative learning experiences by bridging disciplinary divides, personalizing instruction, and enhancing learner engagement. By enabling modelling, data visualization, language translation, and collaborative problem-solving, these tools support the development of critical thinking, creativity, and systems-level understanding. Real-world case studies demonstrate the application of AI in collaborative student projects across domains like public health, climate change, and smart city planning. The chapter also critically addresses ethical considerations, including algorithmic bias, data privacy, inclusivity, and digital literacy. It concludes by emphasizing the need for informed and ethical implementation of AI in education, calling for collaborative efforts among educators, institutions, and policymakers to realize the full potential of these technologies in shaping a more connected and adaptive educational paradigm.

Keywords: Artificial intelligence in education, Collaborative learning, Computational tools, Data visualization, Digital literacy, Educational technology, Ethical AI, Intelligent tutoring systems, Interdisciplinary teaching, Personalized learning.

INTRODUCTION

In recent years, education systems worldwide have been compelled to adapt to the rapidly changing demands of society, technology, and the workforce.

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