

BRIDGING DISCIPLINES

INTERDISCIPLINARY APPROACHES
FOR TRANSFORMING EDUCATION

Editors:
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 2**Bridging the Barrier between Science and the Arts:
A Novel Approach****Shweta Pandey¹, Venika Dhoonter¹, Shahla Tanveer² and Mohammad Imran Ahmad^{2,*}**¹ Chandigarh College of Pharmacy, Mohali, Punjab 140307, India² Department of Chemistry, Integral University, Lucknow, Uttar Pradesh 226026, India

Abstract: Recent years have witnessed a significant surge in exploring the connections between the arts and the sciences. This chapter addresses the significant rise in exploring the connections between the arts and the sciences. It analyzes the evolving dynamics of this connection and underscores the idea that a holistic approach to learning in both fields requires mutual recognition and integration. It explores the potential for the arts to enrich science teaching and learning at multiple levels: through the structural organization of subjects, the contextualization of science within STS frameworks, and the adoption of arts-inspired pedagogical practices. The rise of STEAM further underscores the evolving nature of twenty-first-century science, necessitating innovative pedagogies from the arts to bridge the widening gap between contemporary science and school science. Furthermore, this chapter conceptualizes the collaborative potential of art, science, and technology (AST) through a social-ecological lens. This framework characterizes AST collaborations through antecedent conditions (knowledge, aesthetics, interdependence, and experimentalism), process elements, and potential outcomes, offering a valuable tool for evaluation and reflection for practitioners, researchers, educators, and policymakers seeking to foster meaningful interdisciplinary engagement.

Keywords: Art and Science Integration, Interdisciplinary education, Scientific visualization, STEAM education, Synergistic interaction, Technological advancement.

INTRODUCTION

The conventional view positions science and art as contrasting forces: one objective and structured, the other subjective and intuitive. Yet, at their core, both disciplines strive to understand, interpret, and shape the world we inhabit. This artificial separation has impeded progress in both fields. This chapter presents

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“**Bridging the Barrier between Science and Arts**, a novel approach designed to integrate science and art.

As Albert Einstein wisely noted, “*The most beautiful thing we can experience is the mysterious. It is the source of all true art and science.*”

THE INTERSECTION OF ART AND SCIENCE

The intersection of art and science represents more than just a point of contact; it is a fertile ground for synergistic interaction, powerfully stimulating imagination and fostering innovation. Leonard Shlain’s seminal work, *Art & Physics: Parallel Visions in Space, Time, and Light* (1991), provides a compelling illustration of this, arguing that scientific discoveries often originate in the realm of imagination, with artistic visualization preceding their scientific articulation (Shlain, 1991). This chapter reinforces this perspective, drawing on the work of Barrett (2012) and Kelley and Chang (2018), who emphasize the potential of multidisciplinary approaches, particularly digital art, to unlock novel ideas and address intricate problems (Barrett, 2012). We argue that dismantling the traditional separation between art and science is crucial for the advancement of both fields, as it nurtures the complementary skills of imaginative creation and rigorous analysis, both indispensable for revolutionary breakthroughs (Kelley & Chang, 2018).

Historical Divide between Art and Science

The historical development of academic disciplines has largely maintained a separation between art and science. This division was often justified by contrasting art's inherent subjectivity and engagement with emotion against science's commitment to objective analysis and empirical evidence. The intellectual climate of the Scientific Revolution further reinforced this compartmentalization. Nevertheless, contemporary interdisciplinary initiatives are increasingly demonstrating the powerful synergies and deeper levels of understanding that result from intentionally bridging these historically divided domains (Danto 1981). The historical journey of art and science reveals a fascinating trajectory, commencing with intertwined beginnings, as art increasingly focused on aesthetic expression and subjective interpretation, while early science started to prioritize systematic observation and categorization (Fig. 1).

The Growing Interdisciplinary Approach in Modern Science

Modern science increasingly embraces interdisciplinary approaches, recognizing the powerful intersection of scientific inquiry and artistic creativity. This integration unlocks new avenues for innovation, enhances problem-solving