

BRIDGING DISCIPLINES

INTERDISCIPLINARY APPROACHES
FOR TRANSFORMING EDUCATION

Editors:

Tahmeena Khan
Manisha Singh
Saman Raza

Bentham Books

Bridging Disciplines: Interdisciplinary Approaches for Transforming Education

Edited by

Tahmeena Khan

*Department of Chemistry, Integral University
Lucknow, Uttar Pradesh 226026, India*

Manisha Singh

*Department of Education, Integral University
Lucknow, Uttar Pradesh 226026, India*

&

Saman Raza

*Department of Chemistry, Isabella Thoburn College,
Lucknow, Uttar Pradesh 226007, India*

Bridging Disciplines: Interdisciplinary Approaches for Transforming Education

Editors: Tahmeena Khan, Manisha Singh & Saman Raza

ISBN (Online): 979-8-89881-648-3

ISBN (Print): 979-8-89881-649-0

ISBN (Paperback): 979-8-89881-650-6

© 2026, Bentham Books imprint.

Published by Bentham Science Publishers Pte. Ltd. Singapore, in collaboration with Eureka Conferences, USA. All Rights Reserved.

First published in 2026.

BENTHAM SCIENCE PUBLISHERS LTD.

End User License Agreement (for non-institutional, personal use)

This is an agreement between you and Bentham Science Publishers Ltd. Please read this License Agreement carefully before using the ebook/echapter/ejournal (“**Work**”). Your use of the Work constitutes your agreement to the terms and conditions set forth in this License Agreement. If you do not agree to these terms and conditions then you should not use the Work.

Bentham Science Publishers agrees to grant you a non-exclusive, non-transferable limited license to use the Work subject to and in accordance with the following terms and conditions. This License Agreement is for non-library, personal use only. For a library / institutional / multi user license in respect of the Work, please contact: permission@benthamscience.org.

Usage Rules:

1. All rights reserved: The Work is the subject of copyright and Bentham Science Publishers either owns the Work (and the copyright in it) or is licensed to distribute the Work. You shall not copy, reproduce, modify, remove, delete, augment, add to, publish, transmit, sell, resell, create derivative works from, or in any way exploit the Work or make the Work available for others to do any of the same, in any form or by any means, in whole or in part, in each case without the prior written permission of Bentham Science Publishers, unless stated otherwise in this License Agreement.
2. You may download a copy of the Work on one occasion to one personal computer (including tablet, laptop, desktop, or other such devices). You may make one back-up copy of the Work to avoid losing it.
3. The unauthorised use or distribution of copyrighted or other proprietary content is illegal and could subject you to liability for substantial money damages. You will be liable for any damage resulting from your misuse of the Work or any violation of this License Agreement, including any infringement by you of copyrights or proprietary rights.

Disclaimer:

Bentham Science Publishers does not guarantee that the information in the Work is error-free, or warrant that it will meet your requirements or that access to the Work will be uninterrupted or error-free. The Work is provided "as is" without warranty of any kind, either express or implied or statutory, including, without limitation, implied warranties of merchantability and fitness for a particular purpose. The entire risk as to the results and performance of the Work is assumed by you. No responsibility is assumed by Bentham Science Publishers, its staff, editors and/or authors for any injury and/or damage to persons or property as a matter of products liability, negligence or otherwise, or from any use or operation of any methods, products instruction, advertisements or ideas contained in the Work.

Limitation of Liability:

In no event will Bentham Science Publishers, its staff, editors and/or authors, be liable for any damages, including, without limitation, special, incidental and/or consequential damages and/or damages for lost data and/or profits arising out of (whether directly or indirectly) the use or inability to use the Work. The entire liability of Bentham Science Publishers shall be limited to the amount actually paid by you for the Work.

General:

1. Any dispute or claim arising out of or in connection with this License Agreement or the Work (including non-contractual disputes or claims) will be governed by and construed in accordance with the laws of Singapore. Each party agrees that the courts of the state of Singapore shall have exclusive jurisdiction to settle any dispute or claim arising out of or in connection with this License Agreement or the Work (including non-contractual disputes or claims).
2. Your rights under this License Agreement will automatically terminate without notice and without the

need for a court order if at any point you breach any terms of this License Agreement. In no event will any delay or failure by Bentham Science Publishers in enforcing your compliance with this License Agreement constitute a waiver of any of its rights.

3. You acknowledge that you have read this License Agreement, and agree to be bound by its terms and conditions. To the extent that any other terms and conditions presented on any website of Bentham Science Publishers conflict with, or are inconsistent with, the terms and conditions set out in this License Agreement, you acknowledge that the terms and conditions set out in this License Agreement shall prevail.

Bentham Science Publishers Pte. Ltd.

No. 9 Raffles Place

Office No. 26-01

Singapore 048619

Singapore

Email: subscriptions@benthamscience.net



CONTENTS

FOREWORD	i
PREFACE	ii
LIST OF CONTRIBUTORS	iv
CHAPTER 1 INTERDISCIPLINARITY IN EDUCATION: BEYOND TRADITIONAL BOUNDARIES	1
<i>Manisha Singh, Waseem Zahra, Arbind K Jha, Tahmeena Khan and Saman Raza</i>	
INTRODUCTION	1
LEVELS OF INTEGRATION AND COLLABORATION	4
Multidisciplinary Approach	4
Interdisciplinary	4
Features of Interdisciplinary Approach	5
Interdisciplinarity in School Education	8
Interdisciplinarity in Higher Education	9
<i>What is Interdisciplinary Thinking?</i>	10
<i>Benefits for Students</i>	11
<i>Benefits for Teachers</i>	12
<i>Strategies Towards Inter-Disciplinary Teaching</i>	13
CONCLUDING REMARKS	14
REFERENCES	15
CHAPTER 2 BRIDGING THE BARRIER BETWEEN SCIENCE AND THE ARTS: A NOVEL APPROACH	19
<i>Shweta Pandey, Venika Dhoonter, Shahla Tanveer and Mohammad Imran Ahmad</i>	
INTRODUCTION	19
THE INTERSECTION OF ART AND SCIENCE	20
Historical Divide between Art and Science	20
The Growing Interdisciplinary Approach in Modern Science	20
Purpose and Significance of Bridging the Gap	21
THEORETICAL FOUNDATIONS	22
Philosophical Perspective on Art and Science	22
<i>Key thinkers who advocated for integration (e.g., Leonardo da Vinci, C.P. Snow's "Two Cultures")</i>	22
THE ROLE OF CREATIVITY AND INNOVATION IN BOTH FIELDS	22
CONTEMPORARY APPROACHES TO INTEGRATION	23
STEAM education (Science, Technology, Engineering, Arts, and Mathematics)	23
Cross-disciplinary collaborations in academic and research	24
ROLE OF DIGITAL AND MULTIMEDIA ART IN SCIENTIFIC VISUALIZATION	25
APPLICATIONS IN VARIOUS FIELDS	25
Medicine & Biomedical Imaging – Artistic visualization of complex biological processes	25
The use of art in UX/UI design and human-centred AI	26
Environmental Science – Art as a medium to communicate climate change and sustainability	27
Space Exploration – Scientific illustrations and immersive experiences in astrophysics	27
CHALLENGES AND BARRIERS	27
Deep institutional and cultural resistance	28
Integration of art and science into academic and professional circles	28
Barriers to Interdisciplinary Communication	28
CASE STUDIES AND SUCCESS STORIES	29

Some examples of artists and scientists working together (MIT Media Lab, NASA collaborations, BioArt)	29
The role of museums and exhibitions showing science through art	30
FUTURE DIRECTIONS AND INNOVATIONS:	30
Emerging technologies (VR, AR, AI-generated art):	30
The role of communicators in education as a part of focused science communication	31
Potential for further integration in research and industry	31
CONCLUDING REMARKS	31
REFERENCES	33
CHAPTER 3 PEDAGOGICAL STRATEGIES FOR INTERDISCIPLINARY LEARNING	35
<i>Waseem Zahra and Manisha Singh</i>	
INTRODUCTION	35
Overview of Past Research	37
Identification and Analysis of Effective Pedagogical Strategies that Support Interdisciplinary Learning in Educational Institutions	38
<i>Project-Based Learning (PBL)</i>	38
<i>Team Teaching</i>	39
<i>Problem-Based Learning (PBL)</i>	40
<i>Inquiry-based learning</i>	41
<i>STEAM Approach (Science, Technology, Engineering, Arts, Mathematics)</i>	41
<i>Application of Case Studies</i>	42
<i>Flipped classroom</i>	43
<i>Role-Playing and Simulations</i>	44
Integration of Technology	45
<i>Final Thoughts</i>	45
Evaluation of the Role of Technology and Experiential Learning in Enhancing Interdisciplinary Education Outcomes	48
The Role of Technology in Interdisciplinary Education	48
<i>Virtual Reality (VR) for Medical and Engineering Integration</i>	48
<i>AI and Big Data for Environmental Science & Economics</i>	49
<i>Coding and Robotics in STEM and Humanities</i>	49
<i>Examples of Experiential Learning in Interdisciplinary Education</i>	50
Exploration of the Challenges Faced by Educators in Implementing Interdisciplinary Teaching Methods and Proposed Solutions	52
<i>Curriculum Constraints and Rigid Subject Boundaries</i>	52
<i>Lack of Training and Expertise in Multiple Disciplines</i>	53
<i>Time Constraints and Increased Workload</i>	53
<i>Challenges in Evaluating Student Performance</i>	54
<i>Resistance to Conventional Teaching Methods</i>	54
<i>Absence of Administrative and Institutional Support</i>	54
<i>Challenges in Engaging Students with Varied Learning Backgrounds</i>	55
CONCLUDING REMARKS	55
ACKNOWLEDGEMENT	56
REFERENCES	56
CHAPTER 4 THE STEAM PARADIGM: INTEGRATING DISCIPLINES FOR A HOLISTIC LEARNING EXPERIENCE	59
<i>Priya Mishra, Satya, Kulsum Hashmi, Sakshi Gupta and Seema Joshi</i>	
INTRODUCTION	59
STEM AND A SHIFT TOWARDS STEAM	61
KEY ELEMENTS OF THE STEAM MODEL	63

Interdisciplinary Learning	63
Critical and Creative Thinking	64
Practical and Problem-Solving Approaches	64
Personalized and Inclusive Approach	66
Collaborative and Project-Based Learning	67
Flexibility for Real-World Challenges	68
Implementation and Impact	69
TRAINING OF TEACHERS TO ADOPT THE STEAM MODEL: KNOW-HOW	73
CHALLENGES AND PROSPECTS	74
CONCLUDING REMARKS	77
ACKNOWLEDGEMENT	77
REFERENCES	78
CHAPTER 5 INTERRELATIONSHIP OF COMMERCE, MANAGEMENT, AND ICT	84
<i>Martha Sharma and Ekta Pal</i>	
INTRODUCTION	84
INTERCONNECTED ASPECTS OF MODERN BUSINESS AND SOCIETY	85
Commerce	85
Management	86
ICT (Information and Communications Technology)	86
ICT in E-Commerce	87
ICT: The Technological Backbone of Modern Business	87
<i>ICT in Commerce and Management Education</i>	87
<i>Understanding Commerce Management</i>	88
The Role of Commerce and Management in the Global Economy	89
<i>Effective management</i>	89
Commerce Management: A Framework for Prosperity	89
KEY FUNCTIONS OF ICT IN BUSINESS	91
Automation	91
Communication	91
Data Management	92
E-commerce Enablement	92
Decision Support	92
Remote Work Capabilities	92
SOME REAL-WORLD EXAMPLES:	93
COMMERCE AS A CATALYST FOR ECONOMIC ACTIVITY	93
Management: The Strategic Engine behind Commerce	94
The Synergy between Commerce and Management	94
Impact on National and Global Prosperity through Commerce, Management, and	
Information and Communication Technology (ICT)	95
Core Functions of Management in Modern Commerce	97
Key functions of commerce management include:	97
Inventory Control	98
<i>Key Benefits:</i>	98
Marketing and Sales Management	98
<i>Key Benefits:</i>	99
Financial Planning and Analysis	99
<i>Key Benefits:</i>	99
Customer Relationship Management (CRM)	99
<i>Key Benefits:</i>	99
Supply Chain and Logistics Management	99

<i>Key Benefits:</i>	100
IMPACT OF ICT IN BUSINESS	100
Digital Tool of ICT	101
The Symbiotic Relationship: ICT, Commerce, and Management	101
The Digital Transformation of Commerce	102
THE FUTURE LANDSCAPE	103
Points of Integration between Commerce Management and ICT	104
<i>Decision-Making Support</i>	104
<i>Automation and Efficiency</i>	104
<i>E-Commerce and Online Transactions</i>	104
<i>Customer Relationship Management</i>	104
<i>Supply Chain Optimization</i>	104
THE FUTURE OF ICT IN COMMERCE	104
CONCLUDING REMARKS	105
ACKNOWLEDGEMENT	106
REFERENCES	106
CHAPTER 6 FROM THEORY TO PRACTICE: INTEGRATING SOCIOLOGY, ECONOMICS, AND POLITICAL SCIENCE IN SOCIAL RESEARCH	109
<i>Tahir Hussain Ansari, Aleena Alam Khan and Bushra Saiyeda</i>	
INTRODUCTION	109
DISCIPLINARY CONTRIBUTIONS TO SOCIAL RESEARCH	112
Sociology: Society, Relationships, and Social Structures	112
Economics: Resources, Incentives, and Outcomes	112
Political Science: Power, Governance, and Policy	113
Bringing the Disciplines Together	113
<i>The Case for Integration</i>	114
<i>Why Integration Matters</i>	114
<i>What Integration Offers?</i>	115
<i>Common Challenges to Integration</i>	115
<i>Overcoming the Barriers</i>	116
METHODOLOGICAL APPROACH	116
Institutional and Pedagogical Challenges	117
Relevance and the Road Ahead	119
CONCLUDING REMARKS	121
REFERENCES	123
CHAPTER 7 REVISITING THE POWER OF LANGUAGE: AN INTERDISCIPLINARY INQUIRY INTO FOREIGN LANGUAGE ANXIETY, CULTURAL SENSITIVITY, AND IDENTITY IN ENGLISH STUDIES	125
<i>Prashant Kumar Astalin, Leena Rajak and Sangeeta Chauhan</i>	
INTRODUCTION	126
Language as Transformative Power	126
The Rationale for an Interdisciplinary Framework	127
Linguistics and Beyond: Language as a Multidimensional Construct	128
<i>The Role of Psychology and Educational Theory</i>	128
<i>Education and the Ethics of Teaching Language</i>	129
<i>Literature and Identity: English Studies in a Globalized World</i>	129
The Need for Integration	129
<i>Theoretical Foundations</i>	130
<i>Linguistic Turn in English Studies</i>	130
<i>Educational Psychology and Language Learning</i>	131

<i>Intercultural Communication and Identity Construction</i>	131
The Problem of Foreign Language Anxiety (FLA)	132
<i>Defining and Diagnosing FLA</i>	132
<i>The Role of FLA in English-Dominant Contexts</i>	132
<i>Intersections with Cultural Sensitivity</i>	133
<i>Identity, Language, and Learning in Global English Contexts</i>	133
English as a Global Language: Opportunity or Oppression?	133
<i>Identity Construction in the Language Classroom</i>	134
<i>Toward Interdisciplinary Interventions</i>	134
Addressing FLA through Instructional Design	134
<i>Implications and Future Directions</i>	136
Rethinking English Studies	136
Policy and Curriculum Recommendations	137
Suggestions for Future Research	137
CONCLUDING REMARKS	138
REFERENCES	139
CHAPTER 8 BIOLOGY AS AN INTERDISCIPLINARY SUBJECT: BRIDGING	
DISCIPLINES FOR A DEEPER UNDERSTANDING OF LIFE	141
<i>Shifa Suhail, Kashifa Khatoon, Arpita Tripathi, Pallavi Awasthi, Reena Vishvakarma and Swati Sharma</i>	
INTRODUCTION	141
Biology in STEM	143
Chemistry and Biology	143
Chemical Biology	145
Biochemistry	145
Molecular biology	145
Biology and Physics	146
Biology and Mathematics	146
Biology and Environmental Science	146
Biology and Engineering: Biotechnology and Biomedical Engineering	146
Fermentation technology	147
Synthetic Biology	148
Agricultural Biotechnology	148
Biomedical Engineering	148
Molecular medicine	149
BIOLOGY AND COMPUTER SCIENCE: COMPUTATIONAL BIOLOGY	149
Interdisciplinary Research for Life Science	150
Computer-aided drug designing and Health informatics	150
Biology and Social Sciences: The Human Connection	151
Bridging Biology and the Human Experience	152
<i>The Arts and Literature</i>	152
CONTEMPORARY ETHICAL CHALLENGES IN BIOLOGY	153
CONCLUDING REMARKS	154
REFERENCES	155
CHAPTER 9 BRIDGING DISCIPLINES WITH A PARTICULAR EMPHASIS ON	
CHEMISTRY	157
<i>Kulsum Hashmi, Tahmeena Khan, Manisha Singh, Saman Raza, Seema Joshi and Abdul Rahman Khan</i>	
INTRODUCTION: POTENTIAL OF BRIDGING DISCIPLINES	158
Teaching Science as an Interdisciplinary Discipline: Aids and Methodologies	160

<i>Analysis of Interdisciplinary Teaching Aid Design</i>	161
Methods for Interdisciplinary Education	162
<i>Project-Based Learning</i>	162
<i>Other methods of Interdisciplinarity</i>	163
CHEMISTRY FOR SUSTAINABLE DEVELOPMENT	164
Chemistry as an Interdisciplinary Subject	167
<i>Chemistry, Geography, and Ecology</i>	169
<i>Chemistry and Biology</i>	169
Informatics and its Association with Chemistry and Biology	173
<i>Cheminformatics</i>	174
Amalgamation of Cheminformatics and Bioinformatics Integration with Artificial Intelligence (AI)	177
CONCLUDING REMARKS	178
REFERENCES	178
CHAPTER 10 MATHEMATICS MEETS ART: UNLOCKING THE POWER OF ANALYTICAL CREATIVITY	185
<i>Sangeeta Chauhan, Michael Tarance Suraj and Sonu Bara</i>	
INTRODUCTION	185
THEORETICAL FRAMEWORK: HISTORICAL CONNECTIONS BETWEEN MATH AND ART	188
Dimensions of Integration	190
Math-Art in Emerging Fields	191
PEDAGOGICAL IMPLICATIONS:	192
Enhancing Learning Through Interdisciplinary Math and Art Integration	192
Project-Based Learning: Combining Math with Visual Art or Music	194
Challenges and Considerations: Integrating Math and Art in Education	195
Future Directions	196
CONCLUDING REMARKS	197
REFERENCES	200
CHAPTER 11 ENVIRONMENTAL STUDIES: AN INTERDISCIPLINARY APPROACH	204
<i>Saman Raza, Tahmeena Khan and Manisha Singh</i>	
INTRODUCTION	204
The Concept of Interdisciplinary Studies	206
KEY DISCIPLINES INTEGRATED INTO ENVIRONMENTAL STUDIES	207
Natural and Physical Sciences	207
<i>Biology:</i>	207
<i>Chemistry:</i>	208
<i>Physics:</i>	208
<i>Geology:</i>	209
<i>Meteorology</i>	209
<i>Ecology</i>	210
<i>Oceanography</i>	210
Social Sciences	210
<i>Sociology</i>	210
<i>Economics</i>	211
<i>Political Science</i>	211
<i>Geography:</i>	211
<i>Management</i>	211
Humanities	212
Law and Public Policy	212

Health Sciences and Epidemiology	212
BENEFITS OF INTERDISCIPLINARY ENVIRONMENTAL STUDIES	213
Educational Implications of Environmental Studies and Its Education	214
Integrating Environmental Studies into the Curriculum	215
Challenges and Solutions for Environmental Education Implementation	216
Potential Solutions:	217
CONCLUDING REMARKS	218
REFERENCES	219
CHAPTER 12 SPACES OF INTERACTION: ARCHITECTURE AS A CONDUIT FOR CROSS-DISCIPLINARY COLLABORATION IN EDUCATION	224
<i>Zeba Nisar and Khurram Ashraf</i>	
INTRODUCTION	224
The Shift Toward Interactive and Interdisciplinary Learning Environments	225
THEORETICAL FRAMEWORK	226
The Concept of Space as a Facilitator of Interaction	227
Architectural Design Principles Supporting Interdisciplinary Engagement	227
<i>Openness and Transparency</i>	228
<i>Spatial Flexibility and Modularity</i>	228
<i>Common Spaces and Interaction Hubs</i>	229
<i>Technology Integration</i>	229
Evolution of Educational Spaces and Their Influence on Collaboration	229
<i>The Industrial-Age Classroom (19th–Early 20th Century)</i>	230
<i>The Progressive Education Movement (Mid-20th Century)</i>	230
<i>The Open-Plan Learning Movement (Late 20th Century–Early 21st Century)</i>	230
<i>The Digital and Post-Pandemic Era (21st Century–Present)</i>	230
ARCHITECTURE AS A MEDIUM FOR LEARNING AND COLLABORATION	231
Open-Plan Learning Spaces	231
<i>Flexible and Adaptable Spaces</i>	231
<i>Makerspaces and Innovation Labs</i>	231
<i>Hybrid Learning Environments</i>	232
Case Studies of Educational Institutions Fostering Cross-Disciplinary Collaboration	232
<i>Case Study 1: Stanford School (Hasso Plattner Institute of Design, USA)</i>	232
<i>Open and Reconfigurable Spaces</i>	232
<i>Transparency and Connectivity</i>	232
<i>Maker Spaces and Prototyping Labs</i>	233
<i>Technology-Integrated Learning Hubs</i>	233
<i>Impact on Learning and Collaboration</i>	233
<i>Case Study 2: MIT Media Lab, USA</i>	233
<i>Open Laboratory Spaces:</i>	234
<i>Glass Walls and Visual Connectivity</i>	234
<i>Flexible and Multi-Use Areas</i>	234
<i>Collaborative Prototyping Studios</i>	234
Impact on Learning and Collaboration	234
<i>Case Study 3: The Learning Hub, University of Melbourne, Australia</i>	235
<i>Multi-Layered Spatial Design</i>	235
<i>Flexible and Adaptive Learning Environments</i>	235
<i>Technology-Rich Learning Spaces</i>	235
<i>Social and Collaborative Nodes</i>	236
<i>Impact on Learning and Collaboration</i>	236
Key Design Strategies for Enhancing Interdisciplinary Interaction	236

<i>Spatial Planning and Zoning for Diverse Learning Needs</i>	236
<i>Open and Flexible Layouts</i>	236
<i>Blended Formal and Informal Learning Spaces</i>	236
<i>Distributed vs. Centralized Collaboration Zones</i>	236
The Significance of Common Spaces, Hubs, and Informal Learning Areas	237
<i>Learning Commons and Innovation Hubs</i>	237
<i>Collaborative Workspaces and Maker Spaces</i>	237
<i>Courtyards, Atriums, and Outdoor Learning Spaces</i>	237
Integration of Technology in Architectural Design to Enhance Interaction	238
<i>Smart Classrooms and Interactive Technologies</i>	238
<i>Virtual Learning Environments and Hybrid Spaces</i>	238
<i>Adaptive Lighting, Acoustics, and Ergonomic Design</i>	238
Sustainable and Inclusive Design Approaches in Educational Environments	238
<i>Sustainable Design for Cross-Disciplinary Learning</i>	238
<i>Universal Design for Inclusive Learning</i>	238
<i>Adaptive Reuse of Buildings for Learning Environments</i>	239
CHALLENGES AND LIMITATIONS	239
Institutional and Financial Constraints	239
<i>Potential Solutions</i>	240
Balancing Flexibility with Functional Needs	240
<i>Potential Solutions</i>	240
Cultural and Pedagogical Barriers to Spatial Transformation	240
<i>Potential Solutions</i>	241
Accessibility and Inclusivity Concerns	241
<i>Potential Solutions</i>	241
Sustainability Challenges in Educational Spaces	242
<i>Potential Solutions</i>	242
CONCLUDING REMARKS	242
REFERENCES	243

CHAPTER 13 CREATIVE TEACHING TOOLS FOR ENHANCED LEARNING: PROMOTING STUDENT ENGAGEMENT THROUGH BLENDED LEARNING IN HIGHER EDUCATION	246
<i>Shahla Tanveer and Mohammad Imran Ahmad</i>	
INTRODUCTION	246
TEACHING METHODOLOGIES FOR ACTIVE LEARNING	247
Reverse Teaching/ Flipped Classroom	248
Gamification:	249
<i>Game-Based Learning (GBL):</i>	249
<i>Gamified Elements:</i>	250
Project-Based Learning (PBL):	251
Role-Playing Games:	252
Simulation-Based Learning:	253
Artificial Intelligence Tools in Education	254
Educational Platform:	255
Chatbots:	255
AI-Powered Virtual Reality:	256
FURTHER APPLICATIONS OF AI IN EDUCATION:	257
CONCLUDING REMARKS	261
REFERENCES	261

CHAPTER 14 THE ROLE OF COMPUTATIONAL AND AI-ASSISTED TOOLS IN INTERDISCIPLINARY TEACHING	265
<i>Anushka Pandey, Anukriti Pandey and Tahmeena Khan</i>	
INTRODUCTION	265
The Evolving Landscape of Education	266
The Need for Interdisciplinary Approaches	267
Emergence of Computational and AI Tools in Education	267
CONCEPTUAL FOUNDATIONS	267
Defining Interdisciplinary Teaching	267
Overview of Computational and AI Tools	268
The Synergy between Technology and Pedagogy	268
FACILITATING INTEGRATION ACROSS DISCIPLINES	268
Modelling and Simulation in Multi-Disciplinary Contexts	269
Data Science and Cross-Disciplinary Analysis	269
Bridging the Gap: Tools that Translate Concepts across Fields	269
PERSONALIZED LEARNING AND ENHANCED ENGAGEMENT THROUGH AI	270
AI-Based Learning Analytics	270
Intelligent Tutoring Systems	270
Tailoring Content for Diverse Disciplinary Backgrounds	270
AI-Powered Problem-Solving Environments	271
Scenario-Based and Inquiry-Driven Learning	271
Gamification and Simulation Tools	272
SUPPORTING COLLABORATIVE AND PROJECT-BASED LEARNING	272
Empowering Real-Time Interdisciplinary Collaboration through Virtual Labs and Shared Workspaces	272
Structuring Effective Interdisciplinary Teams and Project Management Using AI Tools	273
Real-World Case Studies Demonstrating AI-Supported Interdisciplinary Student Projects	274
VISUALIZATION AND INTERPRETATION ACROSS DOMAINS	276
Role of Computational Tools in Visual Thinking	276
Interpreting Complex, Multimodal Data	277
Visual Narratives in Education	277
ETHICAL, SOCIAL, AND PRACTICAL CONSIDERATIONS	278
Addressing Algorithmic Bias in Education	279
Data Privacy and Digital Literacy	279
Accessibility and Inclusivity in Interdisciplinary Learning	280
CONCLUDING REMARKS	281
REFERENCES	282
SUBJECT INDEX	290

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.

Dr. Nidhi Mishra
Department of Applied Sciences
Indian Institute of Information Technology, Allahabad
Uttar Pradesh, India

CHAPTER 3**Pedagogical Strategies for Interdisciplinary Learning****Waseem Zahra^{1,*} and Manisha Singh²**¹ *Department of B.Ed., Mahila Vidyalaya Degree College, Lucknow, Uttar Pradesh 226018, India*² *Department of Education, Integral University, Lucknow, Uttar Pradesh 226026, India*

Abstract: In modern education, interdisciplinary learning (IDL) has gained popularity as a method to develop students' creativity, critical thinking, and problem-solving abilities. By combining perspectives, knowledge, and skills from various subjects, interdisciplinary learning enables students to comprehend complex topics more effectively. Unlike traditional learning, which is subject-centred and isolates disciplines, IDL develops analytical thinking and problem-solving by connecting various study areas and providing a holistic picture. One of the biggest advantages of this approach is its ability to address real-world challenges, such as those related to artificial intelligence, healthcare, or climate change. This chapter explores the teaching of interdisciplinary strategies that can enhance learning by fostering significant connections between subjects, promoting collaborative inquiry, and integrating real-world applications into the curriculum. Furthermore, it examines the role of technology in interdisciplinary learning, providing access to diverse resources and enabling interactive, multimedia-based teaching. The chapter also highlights the challenges teachers face when implementing multidisciplinary teaching methods and offers practical solutions to address these challenges.

Keywords: Challenges, Collaborative learning, Experiential learning, Interdisciplinary Learning (IDL), Pedagogical strategies, Problem-based learning, Project-based learning, Solutions, Team-teaching, Technologies.

INTRODUCTION

Interdisciplinary learning combines insights from various fields, providing students with a comprehensive and interrelated understanding of complex issues. Unlike traditional education, which limits knowledge to separate academic disciplines, this approach encourages students to explore the connections between subjects, developing critical thinking, creativity, and problem-solving skills. This method is particularly effective in addressing real-life challenges that cannot be

* **Corresponding Author Waseem Zahra:** Department of B.Ed., Mahila Vidyalaya Degree College, Lucknow, Uttar Pradesh 226018, India; E-mail: waseemzahra85@gmail.com