



Exploration of the Pathways for Constructing 3D Textbooks in Interdisciplinary Studies in the Context of Artificial Intelligence

Wenzheng Cai ^{1, 2, a}, Wenyan Zhu ^{3, b*}, Wenhao Zhu ^{4, c}, Ke Zhang ^{4, d}

¹Guangdong University of Science & Technology, Department of Academic Affairs, Dongguan, 523083, China

²Emilio Aguinaldo College, Metro Manila, Philippines 1007

³Guangdong University of Science & Technology, College of Mechanical and Electrical Engineering, Dongguan, 523083, China

⁴Ditong Automation Technology (Guangdong) Co., Ltd, Dongguan, 523012, China

^a393027758@qq.com, ^{b*}1105949043@qq.com

^c13143264319@163.com, ^d1880040@qq.com

Abstract. With the rapid development of artificial intelligence technology, the establishment of interdisciplinary programs has become increasingly common, raising the question of how to cultivate high-quality interdisciplinary students. Among the factors influencing the outcomes of such training, the selection of textbooks plays a significant role, making the construction of interdisciplinary textbooks particularly important. This paper explores how to optimize the development of interdisciplinary textbooks using AI technology. Firstly, it analyzes the current state of interdisciplinary development in China and extracts the characteristics of interdisciplinary textbooks. Secondly, it defines the concept of a multi-dimensional textbook and presents the key stages in the textbook development process. Finally, it proposes methods for integrating AI technology into the textbook construction process. The aim of this paper is to provide a reference for future educational reforms and to facilitate the progress of interdisciplinary textbook development.

Keywords: Artificial Intelligence; Interdisciplinary; Three-dimensional Textbooks

1 Introduction

The rapid advancement of artificial intelligence is transforming education [1], revealing the inadequacy of traditional single-discipline training in meeting society's demand for interdisciplinary talent. To address this gap, the development of three-dimensional interdisciplinary textbooks has emerged as a crucial focus for educational reform. These innovative resources aim to improve teaching effectiveness and cultivate students' problem-solving and innovative thinking skills. This article will explore effective

strategies for constructing such textbooks in the context of AI, ensuring education keeps pace with new industry challenges.

1.1 Current Status of Interdisciplinary Development in China

The development of interdisciplinary fields in China is experiencing rapid growth. In recent years [2], the number of interdisciplinary programs autonomously established by Chinese universities has been continuously increasing, and the status of these programs has been elevated. For example, in December 2021, the Academic Degrees Committee of the State Council issued the “Directory of Disciplines and Majors for the Award of Doctoral and Master’s Degrees (Draft for Comments),” which approved the establishment of six first-level disciplines under the category of “Interdisciplinary Disciplines,” including Integrated Circuit Science and Engineering, National Security Studies, Design, Remote Sensing Science and Technology, Intelligent Science and Technology, and Area Studies. This marks a further consolidation of the status of interdisciplinary fields.

Peking University, as a leading institution of higher education in China, demonstrates its emphasis on interdisciplinary studies through the organization of its colleges. Table 1 provides an overview of the interdisciplinary colleges at Peking University.

Table 1. Overview of Interdisciplinary Colleges at Peking University

NO.	College	Established
1	Yuanpei College	2007
2	Academy for Advanced Interdisciplinary Studies	2006
3	Peking International Center for Mathematical Research	2005
4	Kavli Institute for Astronomy and Astrophysics	2006
5	Institute of Nuclear Science and Technology	1955
6	Yenching Academy	2014
7	School of advanced agricultural sciences	2017
8	Institute for artificial intelligence	2019

Despite the increasing number and recognition of interdisciplinary studies, there are still issues such as insufficient balance among disciplines, limited support from foundational disciplines, and unclear definitions of content [3]. Most interdisciplinary fields are concentrated within specific categories, resulting in relatively narrow interdisciplinary breadth, with better integration among social sciences compared to natural sciences. In the future, support from national policies and proactive exploration by universities are needed to promote the healthy development of interdisciplinary studies [4].

2 Exploring the Pathways for Developing Interdisciplinary Multifaceted Textbooks

2.1 Multifaceted Textbooks

Interdisciplinary textbooks are characterized by their comprehensive, flexible, and forward-looking content. They integrate theories and practices from multiple disciplines, allowing students to tackle complex issues from diverse perspectives [5]. This approach enhances knowledge depth and breadth, making learning systematic rather than isolated. Furthermore, these textbooks adapt to various educational contexts and student needs, enabling personalized teaching plans. By reflecting current research and social trends, they equip students with essential skills and knowledge for navigating today's rapidly changing technological and social landscape [6]. Multifaceted textbooks integrate diverse teaching resources to meet the needs of both teachers and students, enhancing teaching and learning quality. They encompass various materials, including case studies, question banks, and digital tools, available in print and online formats.

The development of multifaceted textbooks involves several steps: demand analysis, defining objectives, integrating media, and designing interactive activities. The figure 1 is a flowchart of the construction process for three-dimensional teaching materials. After organizing and reviewing content for coherence, feedback is gathered to make necessary adjustments. The final product is published and promoted for effective use by teachers and students.

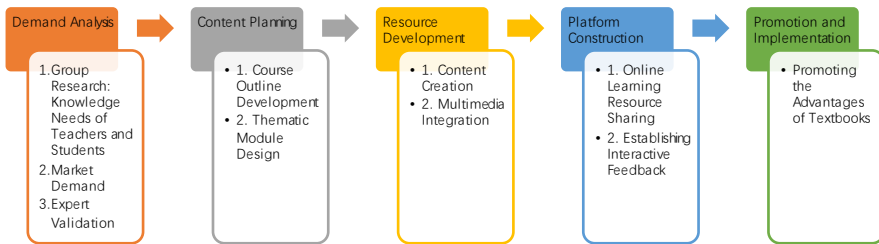


Fig. 1. Flowchart of Three-Dimensional Textbook Construction

2.2 Integration of Artificial Intelligence Technology into Textbook Development

AI technology is transforming textbook development by enabling personalized learning tailored to students' interests and progress. It enhances learning through intelligent recommendation systems and interactive experiences like virtual laboratories and intelligent tutoring. Additionally, AI provides real-time feedback and assessment, allowing students to correct mistakes promptly while offering teachers valuable insights for instructional improvements, ultimately enriching the educational experience.

Integrating AI technology into textbook development profoundly transforms education, significantly enhancing teaching effectiveness and enriching students' learning experiences. One of the key benefits is the personalization of learning content, where AI

analyzes individual students' habits, knowledge mastery, and interests. This allows for tailored educational experiences, enabling students to learn at their own pace and according to their unique needs, thereby fostering greater initiative and effectiveness.

Additionally, AI optimizes textbook content through intelligent recommendation systems that address learning difficulties in real time. By suggesting suitable supplementary materials and exercises, AI not only helps students reinforce their knowledge but also encourages deeper exploration of subjects, sparking their curiosity and engagement. The incorporation of interactive elements, such as virtual experiments and intelligent tutoring, further captivates students and enhances their learning experience.

Real-time feedback is another significant advantage of AI integration, allowing students to receive immediate responses on their work. This mechanism not only boosts learning efficiency but also instills a sense of accomplishment. Teachers benefit as well, utilizing AI analytics to gain insights into student progress and challenges, enabling more effective instructional adjustments.

Moreover, AI supports multimedia integration by combining various formats—text, audio, and video—catering to diverse learning styles and keeping content up-to-date with the latest research and developments. Finally, AI promotes interdisciplinary learning by identifying connections between subjects, fostering a holistic educational approach that equips students with the skills needed for future academic and professional success. In summary, AI's role in textbook development is vital for creating effective, engaging, and personalized learning environments.

3 Conclusion and Outlook

Against the backdrop of rapid development in artificial intelligence, the construction of interdisciplinary and multidimensional textbooks has become an important direction for educational reform. By integrating knowledge from multiple disciplines and advanced technological means, multidimensional textbooks can provide students with richer and more diverse learning experiences. This article analyzes the limitations of single-subject textbooks in the current education system, emphasizes the importance of interdisciplinary knowledge integration, and explores specific pathways for utilizing AI technology to drive textbook innovation.

Looking ahead, with the continuous advancement of educational technology, interdisciplinary multidimensional textbooks will further evolve. We anticipate more research will delve into how to effectively apply AI technology to enhance the interactivity and practicality of textbooks. Meanwhile, establishing a collaborative mechanism among teachers, students, and technology will make textbook development more comprehensive and promote a significant improvement in teaching quality. Ultimately, this will contribute to nurturing students' overall quality and innovative capabilities, adapting to the developmental needs of future society.

Acknowledgment

This article is funded by the China Private Education Association's 2024 annual planning project (School Development category) titled "Research on the Organizational Reconstruction Model of Interdisciplinary Teaching Teams in Higher Education under the Background of Artificial Intelligence" (Project Number: CANFZG241069), and the Guangdong University of Science and Technology's higher education teaching reform project "Exploration and Practice of the 'Golden Textbook' Construction Path at Guangdong University of Science and Technology" (Project Number: (GKNC)LX-KY-C-2023003).

References

1. Ren, Y., & Li, M. (2024). Exploration of Ideas for Interdisciplinary Integration and Cultivation of Interdisciplinary Disciplines in Higher Education—A Case Study of Nanjing University of Aeronautics and Astronautics. *Jiangsu Science and Technology Information*, 41(03), 85-88.
2. Beil, S. B., Bonnet, S., Casadevall, C., Detz, R. J., Eisenreich, F., Glover, S. D., ... & Zeymer, C. (2024). Challenges and Future Perspectives in Photocatalysis: Conclusions from an Interdisciplinary Workshop. *JACS Au*, 4(8), 2746-2766.
3. Schwarz, B., Heyd-Metzuyanim, E., Koichu, B., Tabach, M., & Yarden, A. (2024). Opportunities and hindrances for promoting interdisciplinary learning in schools. *Journal of the Learning Sciences*, 1-42.
4. Wang, Z., Liang, H., Hu, Y., & Fu, Q. (2024). Exploration of the Construction of Three-Dimensional Textbooks for English Courses in Higher Vocational Aircraft Maintenance Based on ETAMP. *Neijiang Science and Technology*, 45(08), 154-156.
5. Huutoniemi, K. (2010). Evaluating interdisciplinary research. *The Oxford handbook of interdisciplinarity*, 10, 309-320.
6. Li, X., Yang, Y., Huang, H., et al. (2021). The Application of Digital Teaching Resources in the Construction of Engineering Training Teaching Materials. *International Journal of Frontiers in Engineering Technology*, 3.0(8.0).

Open Access This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

