



Research and Practice on the Construction of New Forms of Teaching Materials and Resources in Higher Education Institutions

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Abstract. With the implementation of China's digital strategy, promoting digitalization in education is essential for development, and advancing educational modernization is the direction of reform. The government has issued a series of policies highlighting that the construction of high-quality digital teaching materials is a crucial aspect of advancing the digital education strategy, exploring new fields and tracks, cultivating high-quality talent for the digital age, and building a strong educational nation. This article explores and researches the construction of new forms of teaching materials in higher education institutions, fully leveraging the advantages of these new forms, including the integration of multimedia elements such as video, audio, and animations, precise alignment with teaching syllabi and objectives, expansion of textbook content, broadening of knowledge areas, and close connection to the professional characteristics of disciplines. It also constructs a series of innovative points, including co-construction by teachers and students, analysis of learning conditions, competitive learning, academic competitions, and ideological and political education in courses. By fully utilizing new technological platforms and actively employing modern technological methods, the aim is to enhance the comprehensive understanding of knowledge and improve the ability to master and apply knowledge effectively. This provides valuable references and insights for the innovative construction of integrated teaching materials for new engineering programs in applied universities.

Keywords: New forms, Multimedia, Building, Innovation

1 Introduction

As a key component of the national digital strategy, the digital transformation in the education sector is particularly crucial, with the development of digital textbooks becoming a core trend of this transformation. With the deepening implementation of our country's digital strategy, the digitalization of education has not only become an inevitable requirement for development but also an important direction for educational reform. In the process of educational modernization, the construction and application of digital textbooks have become an indispensable part, marking the active exploration

and practice of the education sector in adapting to the development needs of the new era and responding to the call for reform.

1.1 What are New Form Textbooks

New form textbooks are digital products based on the content of curriculum instruction. They primarily use text as the main medium and are constructed according to the knowledge system of the curriculum. These textbooks adhere to publishing management regulations and undergo strict political and scientific reviews. They integrate various digital media resources, learning interactions, and learning tools, and are packaged according to specific standards. They are disseminated and displayed through the internet for user access. New form textbooks are known for their characteristics of media integration, interactivity, and intelligence^[1].

Specifically, new form textbooks achieve efficient integration by incorporating teaching materials, multimedia educational resources, learning tools, and technology platforms, showcasing four core characteristics. These are described as follows. The key feature of these textbooks is their ability to adapt to the needs of modern education, promoting a deeper understanding of knowledge and the practical application of skills.

1.1.1 Relevance of Knowledge Content.

Compared to traditional paper textbooks, new form textbooks offer more diverse presentation methods. Despite the variety of formats, their essence still focuses on the core position of student learning, aiming to ensure that students can comprehensively and profoundly understand the knowledge system of relevant subjects and build a solid academic foundation on this basis. This student-centered teaching philosophy emphasizes the importance of systematic and deep learning, aiming to help students not only master professional knowledge but also cultivate critical thinking and problem-solving skills, laying a solid foundation for their future academic development and career paths.

1.1.2 Effectiveness of Teaching Applications.

This characteristic can be evaluated from three dimensions. First, in terms of efficiency, new form textbooks should leverage their digital features to enhance interaction and collaboration between teachers and students, thereby improving teaching efficiency. Furthermore, regarding effectiveness, the content construction of digital textbooks must closely align with the unique nature of the subject and the cognitive growth trajectory of learners. Such design aims to ensure that the teaching content is not only explored in depth but also expanded in breadth, encompassing both theoretical depth and practical applicability, enabling knowledge to be transformed into practical outcomes.

Additionally, from an efficiency perspective, digital textbooks should possess intuitive and user-friendly features, as well as the capability to support multiple forms of expression. This design helps enhance the adaptability of textbooks across different devices and various environments, ensuring a smooth and consistent learning experience. This means that regardless of where students are or what devices they use, they

can receive a coherent and consistent learning experience, which is crucial for improving learning efficiency and effectiveness. The flexibility and accessibility of digital textbooks not only meet the needs of diverse learners but also promote equitable distribution of educational resources, allowing more people to benefit from high-quality educational content. In this way, digital textbooks enhance the accessibility of education and strengthen its inclusivity and personalization, providing learners with richer and more diverse learning opportunities.

1.1.3 Scalability of Teaching Content and Learning Processes.

New form textbooks should have the capability to flexibly adjust content and quickly update information, allowing for the timely integration of the latest academic achievements and industry trends across various subjects. Such textbooks can ensure that students are exposed to cutting-edge knowledge, thereby maintaining the timeliness and relevance of educational content.

1.1.4 Convenience of Learning.

New form textbooks are not constrained by time and location, allowing for access anytime and anywhere, which greatly enhances students' learning efficiency and self-directed learning abilities. Students can utilize fragmented time to easily access learning materials through electronic devices, enabling them to arrange their study plans more flexibly.

In summary, new form textbooks are an innovative teaching resource that integrates various media and technologies to provide a completely new way of learning. These textbooks not only enhance teaching efficiency and learning outcomes but also stimulate students' interest in learning and creativity, fostering their critical thinking and problem-solving skills. As technology continues to evolve and educational needs change, new form textbooks will keep evolving to offer learners a richer and more effective learning experience.

1.2 National Policy Support

The report of the 20th National Congress of the Communist Party proposed the major strategic deployment of "promoting the digitalization of education." The government work report for 2024 emphasized the need to "vigorously develop digital education." The digitalization of textbooks and teaching resources is an important form of educational digitalization and a crucial component of textbook development work. Developing first-class digital textbooks is significant for implementing the educational digitalization strategy, exploring new fields and tracks in education, cultivating high-skilled talents suited for the digital age, and building a strong educational nation. This is a key component in the field of education, as it not only promotes the advancement of educational technology but also provides a solid foundation for nurturing future innovators and leaders.

The timeline of national policies is shown in Figure 1.

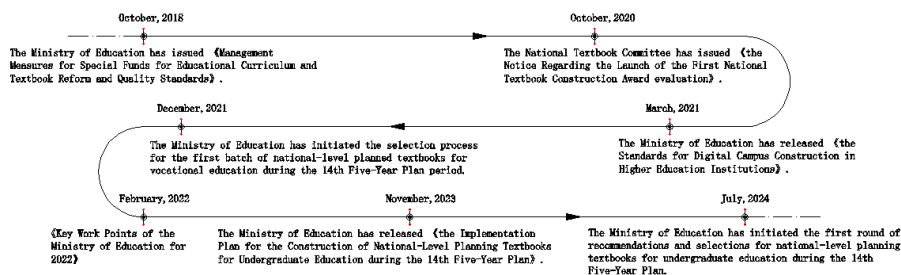


Fig. 1. The timeline of policies.

2 Characteristics of the Textbook

2.1 Basic Attributes

Digital textbooks, as an innovation in the field of modern education, possess unique educational value, technological features, and publishing attributes. The following is an in-depth interpretation of these characteristics of the textbooks:

Firstly, one of the core advantages of digital textbooks is their immediacy. These textbooks can quickly respond to changes in the times and developments in various subjects, allowing for timely content updates and addressing the slow update issue of traditional textbooks. Teachers can efficiently and swiftly revise textbook content using online modification and updating features.

Secondly, compared to the static presentation of traditional printed textbooks, digital textbooks make teaching content more vivid and dynamic through forms such as online videos and animations. This multidimensional approach not only overcomes the limitations and monotony of traditional printed materials but also significantly enhances the efficiency of information exchange^[2]. The multimedia resources included in digital textbooks, such as simulated experiments and discussion forums, provide rich interactive opportunities for both teachers and students.

Thirdly, digital textbooks break through the limitations of content volume found in traditional textbooks and greatly enhance their functionality. For certain skills and professional competencies that are difficult to teach through traditional methods, digital textbooks utilize diverse formats such as micro-lessons and animations to present complex theoretical concepts and workflows in an intuitive and understandable manner. This type of textbook not only makes abstract knowledge more concrete but also improves learning efficiency and comprehension. Furthermore, digital textbooks integrate cutting-edge technologies such as virtual reality (VR) and augmented reality (AR), allowing learners to experience complex structures, high-risk operational skills, and workflows in an immersive way. The application of this technology can even simulate catastrophic accident scenarios, providing learners with a safe and controllable environment to learn and master essential skills, effectively addressing the challenges of simulating high-risk operations and complex scenarios in traditional training. In this way, digital textbooks significantly enrich teaching content, enhance interactivity and

practicality in education, and provide strong support for cultivating high-quality talents with practical operational capabilities.

Fourthly, digital textbooks emphasize a student-centered approach in their philosophy. By constructing teaching designs that include components such as "competency assessment," "critical thinking expansion," and "reflection and summary," we can stimulate students' active thinking, strengthen their deep understanding and absorption of knowledge and skills, and facilitate the effective application of these competencies. This teaching method aims to cultivate students' abilities to analyze and solve problems in a changing work environment, enabling them to flexibly apply the knowledge and skills they have learned to real-world challenges (as shown in Figure 2). Digital textbooks can be customized to meet the personalized needs and characteristics of students, providing diverse learning pathways and methods. This design allows students to choose the most suitable learning resources according to their own learning pace and preferences, making the learning process more aligned with their individual learning styles, thereby enhancing learning efficiency and effectiveness, and further improving students' autonomous learning abilities.

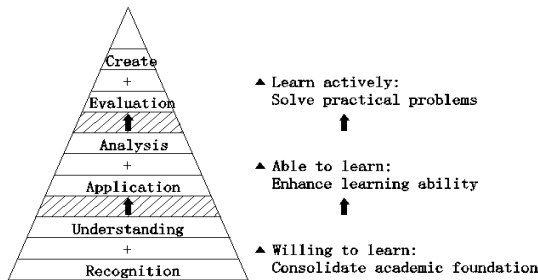


Fig. 2. Learning progression path.

Fifthly, the sustainable development of digital textbooks is of great significance for the holistic development of students and lifelong learning. The construction of high-quality digital textbooks is crucial for the long-term development of students.

Sixthly, the compilation process of digital textbooks integrates three key dimensions: ideological and political education in the curriculum, micro-course videos, and industry case studies. This integration of "three-dimensional" content aims to address the shortcomings of traditional textbooks in terms of content characteristics^[3], by closely combining the educational philosophy of ideological and political education, the intuitive teaching of micro-course videos, and the practical application of enterprise and industry case studies. This achieves the digital integration of textbook content, enhances the application features of the textbooks, and promotes the development of an integrated teaching model.

In summary, digital textbooks, with their unique attributes of educational value, technological innovation, and publishing quality, provide a completely new teaching resource and learning method for modern education. These textbooks not only enhance the efficiency and quality of teaching but also offer students a richer and more interactive learning experience. With continuous technological advancements, digital textbooks will continue to evolve to meet the new demands and challenges of education.

2.2 Should Meet the Requirements

(1) It should meet the requirements of innovative teaching forms, achieving the unification of teaching materials and learning resources, the unification of teaching and learning, the unification of education and training, the unification of practice and evaluation, the unification of formal and informal learning, the unification of dynamic and static, and the unification of theory and practice^[4-5].

(2) It should reflect the needs of technological change and innovation in enterprises. The theoretical knowledge required for technology promotion, technological change, and technological innovation should be integrated into textbook development^[6], incorporating a wealth of industry knowledge and practical examples of technological innovation, and promptly reflecting new trends in industry technology development.

(3) It should reflect the educational objectives of the institution. It should serve the needs of students' career development, the needs for technological innovation in industries and enterprises, the needs for lifelong learning in technical education in society, and the needs for the innovative development of regional technological and cultural systems.

(4) Textbooks should be integrated with the construction of learning resource platforms. They should provide interactive platforms and experiences for independent learning, offering intelligent educational services in various stages such as learning path planning, interactive discussions, learning assistance, learning assessment, and result certification^[7-8], thereby enhancing learners' engagement and experience.

(5) The content of textbooks should be optimized. An integrated design approach should be adopted, combining moral education, humanities education, professional theoretical education, and professional skills training into one. It should have a structure that integrates work and study^[9-10], cultivating students' technical logical thinking and skills needed to quickly adapt to changes in professional positions.

(6) It should meet the five characteristics of learning. The learning process should be recordable, the learning environment should be interactive, the learning content should be rich, the knowledge and skills should be updated in a timely manner^[11], and the content organization should have a vocational context.

3 Textbook Construction and Application Innovation

3.1 Construction Innovation

Digital textbooks have extremely broad applications in the field of education, greatly facilitating teachers' teaching activities and students' learning processes. In teaching practice, various teaching resources such as micro-lessons, ideological and political education resource libraries, digital maps, and red education resources are enriched through interactive teaching methods. This has realized the student-centered teaching philosophy and provided a broader development space for teaching activities. With the rapid development of digital technology, digital textbooks will continue to be updated and iterated, fully meeting the needs of teaching and learning, and laying a solid foundation for the deep integration of information technology and teaching. In the specific

construction process, the following innovations are particularly emphasized and applied:

(1) **Integration of Interactive Teaching Resources:** Digital textbooks enhance the interactivity of teaching by integrating digital resources such as micro-lessons and ideological and political education resource libraries, making the teaching content more vivid and practical. This integration not only increases students' interest in learning but also promotes their active participation in the learning process.

(2) **Personalization of Teaching Content:** Digital textbooks can provide personalized teaching content based on students' learning needs and characteristics, thereby improving their learning efficiency and effectiveness. This personalized teaching approach helps meet the diverse learning needs of students and achieve tailored education.

(3) **Innovation in Teaching Methods:** The use of digital textbooks has driven innovation in teaching methods. For example, through the use of digital maps and red educational resources, teachers can adopt more intuitive and interactive teaching methods, enhancing the appeal and effectiveness of teaching.

(4) **Updating of Teaching Philosophy:** The promotion and application of digital textbooks have better realized the student-centered teaching philosophy. Teachers can pay more attention to individual differences among students, design teaching activities that are more in line with students' actual needs, and promote their comprehensive development.

(5) **Expansion of Teaching Space:** Digital textbooks have broken the temporal and spatial limitations of traditional teaching, allowing instruction to take place at any time and in any location. This flexibility provides teachers and students with more opportunities for teaching and learning, significantly expanding the teaching space.

(6) **Sharing of Teaching Resources:** The development of digital textbooks has facilitated the sharing of teaching resources. Teachers and students can easily access and use a variety of high-quality teaching resources, thereby improving the efficiency of resource utilization.

(7) **Diversification of Teaching Evaluation:** The application of digital textbooks has made teaching evaluation more diversified and scientific. By using data analysis and student feedback, teachers can more accurately grasp students' learning progress and effectiveness, thereby optimizing teaching methods in a timely manner. This approach allows teachers to make necessary adjustments to the teaching plan based on students' specific situations to meet their learning needs.

(8) **Intelligent Teaching Management:** The use of digital textbooks has also promoted the intelligent management of teaching. Through intelligent teaching management systems, teachers can more efficiently carry out the formulation of teaching plans, the organization of teaching activities, and the management of teaching resources.

In summary, the application of digital textbooks has brought revolutionary changes to teaching. This improvement not only enhances the efficiency and quality of teaching but also creates a more colorful and adaptable learning environment for students. Through this approach, students can enjoy a wider range of flexible learning resources, making the learning process more in line with their personal learning habits and needs, thereby improving the overall learning experience. As technology continues to advance,

digital textbooks will continue to develop and make greater contributions to the development of education.

3.2 Application Innovation

3.2.1 Co-creation by Teachers and Students: Bringing Resources to Life.

At the end of each chapter, solicit chapter quiz questions from students, allowing them to create questions in various formats such as multiple-choice, fill-in-the-blank, short answer, calculation, identification of diagrams, and experiments. At least five types of questions should be chosen, with at least one question per type.

3.2.2 Bidirectional Analysis of Learning and Teaching Conditions.

In the first class of the semester, conduct a questionnaire survey to understand students' awareness or perception of the course. Halfway through the semester, in the ninth week, conduct another questionnaire survey to assess students' progressive understanding and mastery of the course and the subject itself. This also serves as a reflection and opportunity for improvement for the teacher. A third questionnaire survey is conducted before the final exam to gauge students' understanding of the course. This approach clearly illustrates the students' progressive understanding and mastery of the course and the subject, and it also promotes and enhances the teacher's instruction.

3.2.3 Competitive Learning: Enhancing the Atmosphere.

Weekly homework leaderboards and overall homework rankings are published to create a positive and uplifting atmosphere, encouraging students to be ambitious and take their studies seriously. There are classroom interactions every week, homework assignments every month, quizzes for each chapter, and reports for experiments, with real-time dynamic evaluations. Assessments are used to promote progress, as shown in Figure 3, Figure 4 and Figure 5.

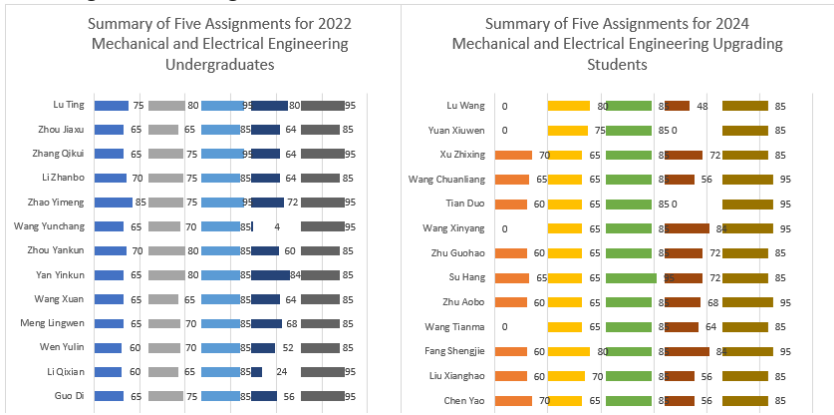


Fig. 3. Homework, Quiz, and Lab Report Grade Summary Table.

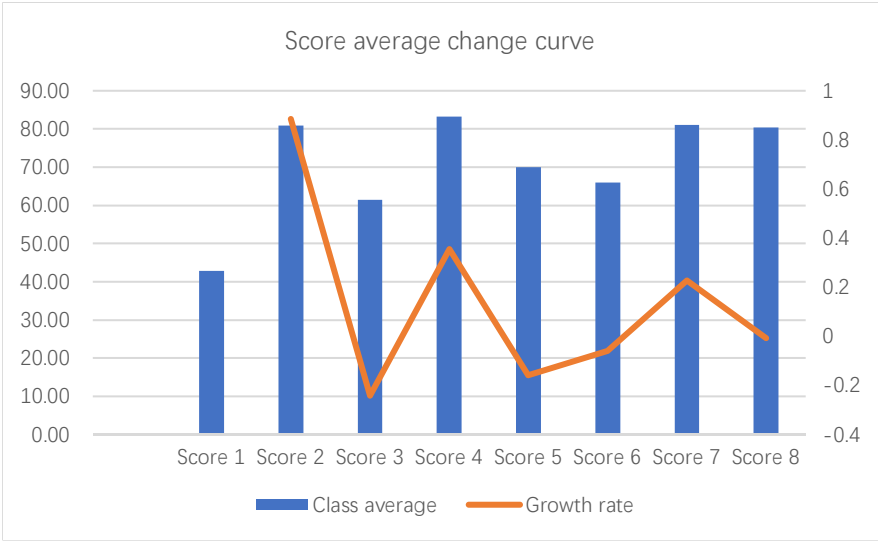


Fig. 4. Score Average Change Curve.

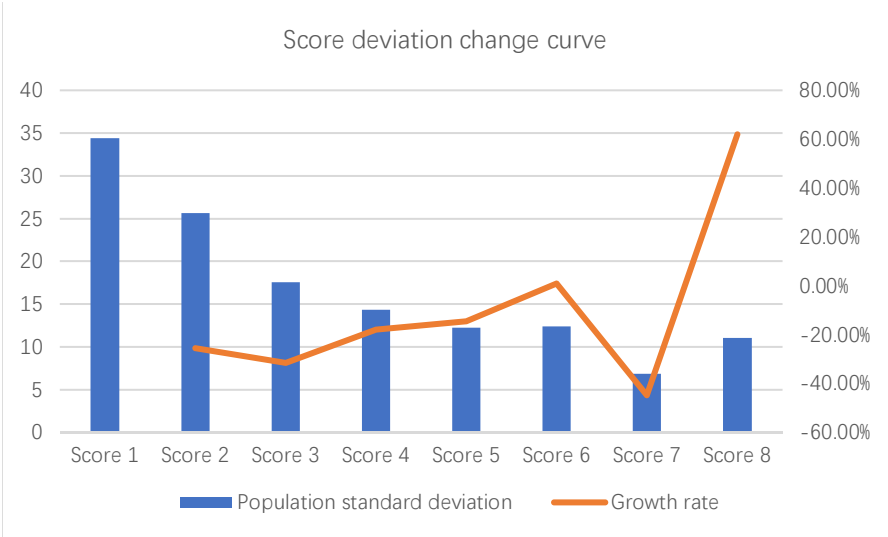


Fig. 5. Score Deviation Change Curve.

3.2.4 Disciplinary Competitions: Unleashing Innovative Potential.

Increase the number of laboratory hours so that students not only engage their minds but also their hands, combining mental and physical efforts, as well as theory and practice. At the same time, actively encourage and organize students to participate in academic competitions such as the Challenge Cup, International College Students' Innovation Competition, Mechanical Innovation Competition, and 3D Digitalization

Innovation Competition. Through learning, doing, and innovating^[12-13], students can engage in deep reflection during internships, practical training, and real-world applications. This leads to an enhancement of their academic qualities, an increase in their innovative abilities, and an elevation of their moral character.

3.2.5 Ideological and Political Education Nurtures Silently, like the gentle Rain that Moistens the soil.

Cultivate students' firm ideals and beliefs, deepen their patriotism, and develop their ability to endure hardships and maintain a broad yet practical mindset. This is not achieved through forceful imposition, but rather through a subtle and natural process, like the gentle rain that moistens the soil. The goal is to nurture well-rounded socialist builders and successors with moral integrity, intellectual acumen, physical fitness, aesthetic appreciation, and a strong work ethic (as shown in Figure 6).

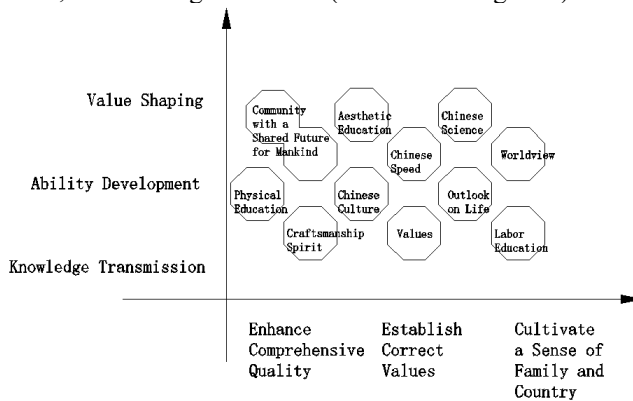


Fig. 6. All-round Development of Morality, Intelligence, Physical Fitness, Aesthetics, and Labor.

The construction of curriculum ideology and politics in engineering education is essentially the deep integration of professional education and values education, aiming to cultivate outstanding engineers with a sense of national identity and innovation capability. Practice has proven that when ideological and political education is incorporated into professional courses in a manner that conforms to the laws of engineering thinking, it does not weaken the effectiveness of professional teaching. On the contrary, it can stimulate students' innovative potential and social responsibility, truly achieving a mutually beneficial relationship between moral education and professional talent cultivation.

4 Existing Issues

1) As the digitization of textbooks continues to advance, copyright issues have gradually become a challenge that cannot be ignored. For professionals involved in textbook writing, how to effectively avoid copyright risks that may arise during the development

of digital textbooks has become an important issue that needs to be addressed urgently. When textbooks include references to copyrighted works without prior authorization from the original authors or copyright holders, it can easily lead to copyright infringement issues. This not only threatens the legality of digital textbooks but may also bring legal risks. Therefore, in the production process of digital textbooks, writers must enhance their understanding of copyright, clarify copyright ownership and usage terms, and ensure that all textbook content is used within the scope allowed by law.

2) How to achieve co-construction and sharing of digital textbooks is also under exploration. How can multiple schools collaborate to form a textbook writing team, jointly argue for talent training programs; jointly build curriculum systems and faculty teams; and cover various regions, enterprises, cities, routes, technologies, and standards in the courses. This aims to optimize courses, majors, and disciplines. Additionally, there is a focus on school-enterprise cooperation, mutual learning, and continuous improvement. This could even lead to the formation of professional regional characteristics, creating a sharing model unique to each city or region.

3) How to achieve collaborative innovation among schools, enterprises, and communities also needs further in-depth research. This includes the deep integration of content, form, and usage^[14], whether the use of platforms is standardized, and whether the operational models are efficient, all of which are worth further exploration.

4) Further research is needed to explore how to use new technological means to deliver learning content to learners accurately and promptly. This can attract or compel learners to utilize fragmented time for learning^[15], achieving ubiquitous learning.

5 Conclusion

This innovative textbook breaks the limitations of traditional printed materials by introducing eye-catching dynamic charts and real-time updated practical cases, enriching the content based on students' personalized development needs. Such a design not only enhances the textbook's expressiveness and appeal but also strengthens its educational function. The new type of textbook not only quickly solves the problem of outdated updates in traditional textbooks but also adapts well to modern teaching modes such as online and blended learning, providing strong support for teaching. We look forward to the further development, expansion, and enhancement of new textbook formats to offer even more powerful functions:

1) For teachers, they need to master a range of key functions, including providing learning support, conducting learning analysis, managing teaching activities, updating teaching resources, and protecting copyright, while also ensuring information security. These functions are crucial for teachers to effectively carry out teaching and management tasks.

2) For students, this resource library is like a portable treasure trove of learning. It can meet their needs for online learning, customized learning, and information searching, ensuring that they can learn anytime, anywhere, easily and conveniently. Such a learning resource library provides students with a flexible learning platform, allowing

them to acquire knowledge at their own pace and in their own way, greatly enhancing the flexibility and efficiency of learning.

3) How can new forms of textbooks integrate learning situation analysis technology to present learning content reasonably, differentiate the difficulty and gradient of content, and help students of different levels learn knowledge within their most suitable range?

4) Teachers can set differentiated course content based on students' comprehension, talent, scientific literacy level, as well as their learning style and tendencies. They can also assess students' learning outcomes through relevant tests to help students engage in personalized learning.

Ultimately, the goal is to achieve "online and offline, anytime and anywhere learning." This makes the textbook capable of diverse interactive functions between teachers and textbooks, students and textbooks, teachers and students, and textbooks with each other. It provides learners with a brand-new learning environment, creates an immersive learning experience, and constructs a complete feedback system, providing important support and strength for promoting the intelligence of education.

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