Article

Research on the Construction of Digital Textbooks for New Business Disciplines

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Abstract: The rise of the digital era has made traditional teaching materials and instructional methods increasingly inadequate for the fast-paced information flow in modern education. This inadequacy points to a clear need for digital transformation—a need that becomes even more pressing when we consider the distinctive nature of new business disciplines. These fields are marked by deep integration across subjects, strong links with industry, and close ties to educational practice, all of which call for a fundamentally new approach to digital textbook development. When designing digital textbooks, we should ground our work in college students' Technology-Enhanced Learning (TEL) and actively harness innovative technologies. The goal is to keep content both scientifically sound and up-to-date, while also making it dynamic, diverse, interactive, and practically useful. But effective development goes beyond content alone; it also requires thoughtful attention to interactive features. Intelligent tools—such as virtual assistants, adaptive learning platforms, and scenario-based simulations—can be woven into the design to boost student engagement, encourage collaboration, and support self-directed learning. On the teaching management side, several actions are critical: establishing strong communication channels between teachers and students, offering targeted training for faculty, and building experience-sharing networks. These steps help shift educators from being mere knowledge transmitters to becoming facilitators and co-learners. At the same time, we need comprehensive evaluation and feedback systems, including online assessments, peer and self-evaluations, learning analytics, and post-course surveys. Such mechanisms allow teachers to track learning outcomes, spot behavioral trends, and fine-tune their instructional strategies accordingly. Ultimately, by combining content innovation, technological integration, pedagogical support, and systematic evaluation, digital textbooks in new business disciplines can maximize learning effectiveness, foster students' initiative and independence, and ensure that educational resources are used efficiently in line with current societal and industrial demands.

Keywords: Digital Textbooks; New Business Disciplines; Technology-Enhanced Learning; Digital Empowerment

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1. Introduction

The fast-moving development of modern information technologies—especially big data and AI—has made the digital transformation of textbooks not just a strategic necessity but also an unmistakable contemporary trend [1]. At the 2024 World Digital Education Conference, China's Minister of Education, Jinpeng Huai, stressed the need to promote equitable, high-quality basic education by diversifying the forms of educational resources, and specifically called for vigorous efforts to develop digital textbooks in line with the overall shift toward digital education.

Digitalization, as a more advanced stage of information technology, gives digital textbooks a dual role: they serve both as centralized resource repositories and as versatile learning platforms. In this way, they are gradually bridging the gap between traditional print materials and purely digital courseware. When digital technology is thoroughly embedded across all aspects of education, these textbooks take on several critical features—dynamic content adjustability, precise localization, multimodal presentation, and highly efficient interactivity. For these reasons, digital textbooks are now widely seen as a key lever for driving comprehensive classroom reform and broader educational transformation, and they have become a vital strategic tool in advancing the digitalization of education [2].

Higher education institutions, in particular, are being urged to adopt technology-enhanced learning as a crucial step in this transformation. While digital technologies offer clear promise for improving teaching and learning, they also push education systems to rethink and adjust their pedagogical approaches. What is urgently needed, therefore, is a new generation of textbooks that deeply integrate modern information technology into actual teaching practice, make full use of multiple media formats, and offer rich, expressive content delivery.

Digital technology is now so widespread that it provides the technical groundwork for a fresh wave of socioeconomic transformation and deep-rooted change. Business professionals today are facing ever more complex socioeconomic challenges [4]. At the same time, the rise of new business disciplines and rules calls urgently for talent equipped with entirely new skill sets. If we are to use technological innovation to drive high-quality teaching development, we should place greater emphasis on building and reshaping digital textbooks—so that they can bring innovative energy into talent cultivation.

Meanwhile, college students' learning habits have changed considerably. They are increasingly drawn to technology-enhanced learning, making use of fragmented time, and preferring interactive experiences. Unlike low-tech, overly uniform tasks, personalized digital textbooks for new business fields can help students develop distinctive, innovative thinking and practical know-how. This approach moves beyond the old model of homogeneous talent development and actively promotes a more diversified growth of students' technical abilities. Digital textbook development can also support personalized learning that fits students' individual needs, which in turn stimulates their interest and motivation [5]. That is why strengthening research into student-centered, new business-oriented digital textbook development is now a critical priority in the current push for textbook advancement.

2. The Significant Role of New Business Disciplines in Digital Textbook Development

New business disciplines are a strategic change in traditional business education, and this change is driven by the digital economy and industry restructuring; these cross-disciplinary fields combine core digital technologies with different types of knowledge, and they focus heavily on digital capabilities and social duties; their aim is to develop all-round professionals who can deal with complex, data-rich settings and who can weigh commercial value against social needs in new areas like FinTech and green supply chains.

The educational philosophy behind these disciplines gives digital textbooks innovative content and formats that meet the practical demands of applying knowledge in digital teaching settings. This shift has a deep impact on teaching and learning, and we can identify three core roles, which are elaborated below.

2.1. Driving Digital Innovation in Textbook Development

Digital textbooks are not just digital versions of paper-based materials, like e-textbooks or online newspapers; instead, they are a new type of teaching resource that comes from the close combination of textbook content and digital technology. They go beyond the old single-format model and create different ways to innovate in textbook design; they include animation, sound, video, and virtual simulation, and these match well with today's teaching requirements and also meet students' wish for more interactive classes.

In terms of their basic features, digital textbooks are not the same as simple digital copies of print materials, such as PDFs; their special point is that they can build a dynamic and smart learning environment that keeps changing, while fixed forms like books or PDFs cannot do that. Their main features include media mixing, strong interactivity, organized content, data tracking, and dynamic updating; these inner qualities show their innovative value and lead new business textbooks to go beyond traditional format restrictions.

Using international experience, technologies like AI and edge computing help to further boost this innovation [17]. For instance, there is a built-in virtual assistant, shown by the TAUDT system, which is put right into the digital reading interface through two ways to call it: a floating button at the top of the textbook page and a key combination (Ctrl+Q). When reading, students can start the assistant at any time by using either way, and then they can ask questions by typing, speaking, or taking screenshots. The system gives a reply in less than two seconds. For example, if a student asks about "improving cross-border e-commerce logistics," the assistant not only gives an answer based on the textbook but also points to certain pages (89--92) and the video at the time mark 05:12--08:45; in addition, it has a one-click jump feature that goes directly to the related content, so that the operation path and the connection logic are smoothly linked [13].

The flexible learning platform also has a hidden data collection part that is placed quietly at the end of each chapter; this part records student performance in real time, including measures like correctness in marketing case studies and time used for financial modeling tasks. The system uses a memory-enhanced algorithm to change the following exercise items based on three difficulty levels: basic (below 60% correct), middle (60%--80%), and high (above 80%). More specifically, when correctness is below 60%, the platform gives basic problems that focus on breaking down cases and step-by-step help; when correctness is above 80%, it opens up high-level exercises that need combining multiple situations. This flexible change is closely related to the operation path and connection logic, so that the move from checking performance to giving targeted practice remains consistent and fits the context [8].

2.2. Supporting High-Quality Educational Development

Digital textbooks adjust how knowledge is shown to fit different subjects and student preferences, and finding and building different skills is the main basis for making them, so for new business fields they are active, specific, varied, and interactive, allowing students to use their strengths, change modules, and learn deeply, which boosts inner drive and self-awareness [15]; they also update in real time to reflect new findings and practices, keeping teaching timely and laying a base for long-term growth, and in their content design they combine small units with layers, using a three-level model to fit different speeds, so that basic goals are met and top students can develop higher skills.

For example, in a new business marketing digital textbook:

The foundational layer delves into core concepts (e.g., user portrait construction) with AI-powered concept clarification tools [13];

The core layer features interactive case analyses (e.g., Starbucks digital marketing strategy simulation) and scenario-driven strategy exercises, supported by Moodle-based collaborative platforms [14];

The extension layer links to cutting-edge resources such as Google Analytics teaching editions and real-time industry reports, aligned with the scenario-driven design logic of international leading platforms like Pearson MyLab [11].

This layered design maximizes the advantages of personalized learning, providing robust support for high-quality education development.

2.3. Stimulating Student Initiative and Interaction

Strong interactive features are built into these digital textbooks, and these books use technology-based methods to raise student interest and their readiness to learn; they are not like the older single-format books because they place more weight on independence and new ideas; with these digital tools, teachers and students can have a two-way relationship that is active and dynamic; teachers can follow learning progress in real time and give personalized help based on data like study time, completion rates, and error patterns [12]; students can also contact their instructors and have discussions; this interaction makes a positive cycle, where teaching gives feedback and feedback then helps to improve teaching [13].

Notably, interactive design extends beyond basic student--instructor interaction to multi-dimensional engagement:

Student-textbook interaction: Through click-triggered knowledge explanations, virtual simulation experiments (e.g., cross-border e-commerce store operation), and interactive exercises, students can deepen understanding through hands-on practice [20];

Peer interaction: Digital avatarsembedded in textbooks enable collaborative tasks—such as forming virtual teams to complete supply chain optimization projects—with system-generated reports on team collaboration efficiency [11];

Technology-assisted interaction: AI chatbots (e.g., Cengage's intelligent assistants) provide instant explanations and resource recommendations during self-study, reducing reliance on instructor availability [16], while voice interaction and operation-based tasks (e.g., financial model building) enrich interaction formats [14].

These interactive mechanisms transform passive learning into active engagement, fully stimulating students' learning initiative.

3. Key Considerations for Digital Textbook Development in New Business Disciplines

New business disciplines are reshaping how digital textbooks are built, and this happens against a background of high-quality development in digital learning resources; by combining different subjects and making sure the content across areas is consistent, this approach makes textbooks more useful and easier to adjust, and that helps to improve teaching outcomes.

3.1. Meeting the Needs of College Students' Technology-Enhanced Learning Behaviors

A core goal in developing digital textbooks is to promote college students' autonomy, exploratory learning, interactivity, and hands-on abilities; a well-rounded approach is necessary, but digital technologies can reduce the limits of human thinking and practical skills through their extra features [14]; further, the student-centered teaching view means that digital textbook design should pay attention to the special ways that university students learn with technology.

To fit how students learn with technology, textbook developers should include flexible content structures, give clear learning suggestions, and build personal study paths; these actions strengthen students' control over their learning, identify their individual strengths and differences, and finally help develop key skills.

Digital textbook developers also need to make full use of big data and AI tools; by combining students' personal needs with the different behaviors seen during learning, they can design various recommendation systems and rules to give teaching advice that fits the situation, and this is meant to boost students' interest, active participation, and lasting motivation.

3.1.1. Figure Descriptions. Multi-Dimensional Learning Data Acquisition System

The digital textbook system sets up a full data collection framework that covers three main areas, and this framework is meant to give precise personalized suggestions and to support later analysis and resource matching using algorithms [18]; one area deals with learning behavior data, tracking how long students spend on each chapter, such as time on cross-border e-commerce modules versus financial model ones, and also tracking how often they interact with elements like virtual simulations, discussion boards, and calculation tools, as well as recording their decision paths in scenario tasks like supply chain simulations; another area is learning outcome data, which records accuracy on in-text questions and case analyses, sorts error types into conceptual, operational, or logical categories, and evaluates how well students apply knowledge to practical situations, like the completeness of store plans or the rationality of investment portfolios; the third area is learning preference data, which captures clicks on extra resources, for example, industry reports on policy changes or tutorials on digital marketing tools, observes study time patterns, whether fragmented or fixed, and picks up frequent query keywords such as "overseas warehouse cost control" or "cross-border logistics risk avoidance".

3.1.2. Logic and Implementation of the Hybrid Recommendation Algorithm

This recommendation system uses a mixed method that combines both collaborative filtering and content-based models, and it takes advantage of both to make suggestions more accurate and useful [18]; the collaborative filtering part looks at the learning patterns and resource choices of students who have similar backgrounds and skill levels, for instance, if most students doing well in the "product selection" module often go to the "logistics channel comparison" extra materials, then the system will suggest those materials to other students who are currently studying selection but have not looked at logistics yet; the content-based model, on the other hand, pushes related resources based on how knowledge points are connected and how well they match learning goals, so after a student finishes the "platform rule" section, the system pulls out key words and builds a knowledge network to recommend things like "penalty avoidance" and "compliance cases"; to make the algorithm better, the system also uses LSTM networks to study the order of student actions and predict what they might be missing, for example, if a student keeps getting pricing exercises wrong, the algorithm guesses that he or she does not fully understand cost accounting or exchange rate changes, and then it pushes relevant basic modules ahead of time.

3.1.3. Recommendation Strategy Adaptation for New Business Discipline Features

Combined with the interdisciplinary and practical characteristics of new business disciplines, the personalized recommendation system further optimizes the matching logic for core knowledge domains such as cross-border e-commerce, integrating industry-specific data dimensions to enhance the practical value of recommendations [17]:

Cross-border e-commerce knowledge recommendation: The cross-border e-commerce knowledge recommendation system establishes a three-dimensional association model that integrates product selection, logistics, and marketing. This model is operationalised through a fixed knowledge graph component embedded in the chapter sidebar. When a student clicks on the core node "product selection", the graph automatically highlights the linked nodes—namely, "international trade regulations (law)", "logistics cost data (management)", and "market data mining (data science)". The colour of each node reflects the learner's mastery status: grey for unlearned, blue for learned, and yellow for content that requires consolidation. Moreover, clicking on a node enables direct navigation to the corresponding chapter or to real-time industry data interfaces—for example, Amazon's sales trends for similar products or overseas warehouse cost comparison tables—thereby achieving a seamless binding between theoretical knowledge and practical operational data [17].Scenario-oriented dynamic adjustment: According to the actual application scenarios of new business knowledge, adjust the recommendation focus in real time. For instance, in the "cross-border e-commerce crisis public relations" simulation scenario, if a student's handling plan lacks consideration of international trade policy constraints, the system immediately recommends relevant content in the textbook on "cross-border trade policy interpretation" and supplements with recent industry crisis public relations cases involving policy factors, enabling knowledge supplementation in situ.

3.2. Emphasizing the Characteristic of Interdisciplinary Integration

There is a risk that traditional teaching models based on a single subject may slow down students' creative thinking, and they might also limit the ability to find new solutions when things change; new business disciplines, on the other hand, combine economics, management, psychology, and other related fields in a very close way, and this combination not only makes students learn a wider range of topics but also gives them more hands-on practice; today, getting knowledge is about being able to adjust to a fast-changing society, and that adaptability is important.

With this in mind, digital textbook design for business courses should go beyond the usual subject limits, and it ought to use ideas and methods from different areas so that it can create a knowledge system that covers multiple fields; for instance, adding modern tools like information technology and data analysis into business teaching can help students understand and use new technologies in actual business settings.

Digital textbook content should also offer many case studies, data sets, and hands-on projects, and these should be shown through a mix of images, videos, and text; because the business world changes fast, these books need to be up-to-date, include the latest ideas in the field, and stay practical; when content matches major national goals and is regularly revised and improved, it can help ensure that the books are timely and forward-looking; these steps can also help students take control of their own learning and keep pace with broader social and industry changes.

3.3. Reconstructing Digital Application Scenarios in Teaching

For digital textbooks used in new business disciplines, the main goal is to improve teaching outcomes and student learning, and also to make better use of educational resources; to get the most out of these tools, two key areas need to be improved at the application level, and these areas focus on using technology, fitting different teaching situations, and creating feedback loops.

3.4. Dual Support Enhancement: Technological Integration and Managerial Adaptation

Digital textbooks for new business courses should combine smart technologies closely with teaching situations, and they also need to deal with management limits so they can be used effectively; when we look at technology use, tools like virtual helpers, learning guidance aids, and digital characters are placed into textbook parts, and they work with case talks, scenario-based practice, and virtual labs; these tools help students better understand the new business knowledge system [20].

Take virtual assistant interaction as an example. These assistants are built into the textbook interface, and they support real-time triggers; students can type in questions while reading or doing tasks, like "How do I design a cross-border e-commerce logistics plan?", and the assistant then pulls exact answers from the textbook's built-in resource library, marks the related chapter pages or video time points, and even provides a one-click jump for direct checking [13]. For example, when students study "financial derivatives pricing models," they can ask right away about "parameter adjustment logic under market volatility," and the answers they get will connect back to case studies in the textbook (P124--P129) and virtual simulation operation guides.

As for scenario simulation and virtual experiments, these tools focus on practical new business activities, such as cross-border e-commerce operations and digital marketing; students can try hands-on tasks like setting up a store, designing a logistics plan, or calculating marketing ROI, and they receive immediate feedback on whether their actions and data are correct. This approach follows the "scenario-driven product design" idea used by international platforms like Pearson MyLab, and it makes knowledge application more practical [11].

In the classroom, instructors can use projection systems and shared digital courseware to combine printed textbooks and electronic materials, which makes teaching more interactive and creates a more active learning environment [8]. It should be noted, however, that digital textbook development needs to keep close ties with subject progress, teaching facilities, and lab building, and this is a key practical issue; on top of that, existing classroom rules, like limits on mobile device use, can sometimes block real-time access. To address this, institutions can set up integrated teaching spaces that mix digital reading with hands-on training, and by equipping these areas with special digital devices, students can look at textbooks and do interactive tasks at the same time during practice sessions [11]. In this way, the gap between textbook development and classroom use can be reduced, and this offers a workable example for putting new business digital textbooks into real situations.

3.5. Establishment of a Long-Term Teaching Evaluation and Feedback Mechanism

A sound evaluation and feedback mechanism is critical to optimizing the quality of digital textbooks and enhancing teaching effectiveness. It relies on bidirectional communication channels and data-driven iterative optimization:

Role transformation of educators: Through efficient teacher-student communication channels, instructors are guided to shift from knowledge transmitters to learning facilitators and collaborators [20]. They can monitor students' learning trajectories (e.g., virtual simulation operation data, case analysis completion quality) via the textbook's background system, provide targeted guidance for individual weaknesses, and adjust teaching strategies based on collective learning bottlenecks [21].

Data-driven learning analysis: Leveraging digital technologies, the system collects and analyzes students' usage experiences and suggestions regarding digital textbooks—including interaction frequency with intelligent tools, difficulty feedback on scenario tasks, and satisfaction with personalized recommendations [18]. Combined with learning outcome data (e.g., case analysis accuracy, model operation proficiency), it forms a comprehensive evaluation of teaching effectiveness [19].

Dynamic optimization of textbooks: By tapping into the dynamic advantages of digital textbooks, personalized instructional designs are implemented while preserving the systematic knowledge framework—balancing the cultivation of students' comprehensive competencies with the development of individual characteristics [20]. For example, if multiple students struggle with "cross-border payment risk control" in scenario simulations, the textbook automatically adds a pre-learning module on "payment tool comparison" and adjusts subsequent scenario difficulty [21]. Through continuous evaluation and feedback, the content, interaction design, and technical functions of digital textbooks are iteratively optimized, forming a closed loop of "application-evaluation-optimization" to continuously enhance teaching and learning experiences [16].

3.6. Strengthen the Interactivity and User Experience of Textbook Development

Digital textbooks come from the deep integration of modern educational technologies with instructional content. They inherit the systematic knowledge structure of traditional textbooks, but they also use distinctive technological architectures to move beyond the limits of physical carriers and timeliness, thereby creating a more flexible knowledge dissemination system. With cloud storage, they enable centralized content management and on-demand access. With real-time update and push mechanisms, they can accurately deliver the latest theoretical advances and frontier business practices to learners. And with interactive presentation formats, they can tailor content based on teaching feedback. This digitally driven dynamic update mechanism does more than keep the content timely and vibrant—it also reshapes the learning ecosystem in a fundamental way. It offers students autonomous, interactive, and immersive experiences, which fully reflect the core value that digital textbooks bring to knowledge dissemination.

To further enhance the interactivity and user experience of new business digital textbooks, the design should focus on technology-empowered multi-dimensional interaction, scenario-based experience optimization, and personalized adaptation, with specific implementation paths as follows:

3.6.1. Multi-Dimensional Interactive Design: From Single Interaction to Collaborative Engagement

Break the limitations of traditional "one-way information transmission" and build a multi-dimensional interactive system covering student-textbook, student-student, and student-teacher interactions:

Student-textbook direct interaction:In the "Cross-border E-commerce Product Selection" chapter, core concepts—such as "platform selection rules"—are equipped with hover-triggered indicators. Clicking on these indicators brings up a mini knowledge-graph window alongside an entry point to real-time market data. Students can then choose to view granular data, such as Amazon sales trends or eBay competitor product analyses, and these data are automatically synchronised with the built-in "product selection decision table" within the textbook (through the operational pathway and binding logic). Meanwhile, the financial model parameter adjustment module supports drag-and-drop variable manipulation coupled with real-time visualisation of results. When students adjust variables like logistics costs or exchange rates, the system automatically generates profit variation curves and simultaneously highlights the corresponding theoretical knowledge points—for example, the "cost-profit elasticity formula" on page 132 (binding logic) [20].

Student-instructor interaction is facilitated via a bidirectional "question-and-annotation" channel embedded in the textbook footer. Students may select specific text passages or charts to submit questions; instructor annotations are then displayed directly alongside the relevant content. Instructors can reply using text, voice, or attachments, and students can click on any annotation to expand the full conversation thread. Moreover, all interaction records are categorised and stored by chapter, enabling convenient review and retrieval (operational pathway and binding logic) [13].

Student-student collaborative interaction: Rely on the textbook's built-in collaborative platform to realize peer interaction around learning tasks. For instance, in the "team operation of cross-border e-commerce" module, students can form virtual teams through digital avatars, jointly complete store operation simulation tasks, and share learning notes, case analysis reports, and problem-solving ideas in real time [17]. The system records each team member's task completion progress and contribution, generating collaborative efficiency analysis reports to support peer evaluation and mutual learning [14].

Student-teacher targeted interaction: Build a real-time feedback channel between teachers and students based on the textbook platform. Teachers can push targeted learning resources and personalized comments to students according to their learning data (such as case analysis accuracy, interactive exercise completion quality) [21]; students can submit questions directly through the textbook interface, and teachers can annotate and reply to specific textbook content, with feedback linked to the corresponding chapters for easy review [13].

3.6.2. Scenario-Based Experience Optimization: From Knowledge Presentation to Immersive Practice

Combine new business practice characteristics to create immersive learning scenarios, realizing the integration of "learning, practice, assessment, and revision":

Virtual simulation scenario embedding. We can embed virtual simulation tools that are closely tied to the professional content. For instance, in a cross-border trade negotiation simulation, students interact with AI-driven virtual overseas partners through voice or text, practicing communication and contract terms negotiation while receiving real-time feedback on language accuracy and strategy soundness [20]. In the "financial risk assessment" chapter, we can include a virtual simulation lab where students operate financial risk models using real market data and see firsthand how policy changes and market fluctuations affect risk indicators [21].

Interactive assessment and instant feedback: Scenario-based quizzes and process-oriented evaluation parts can be used here; for instance, after students finish "digital marketing ROI calculation," they do interactive tasks that use real ad spend data, and the system gives a score right away while also looking at why mistakes were made, like wrong cost figures, and then points back to the related textbook pages for extra review [19]; peer review can also be added, so students look at each other's case reports submitted through the platform, and the system gives scoring templates based on the course goals [14].

Multi-modal content presentation: To fit different learning settings and student likes, different content forms can be used; for theory like "cross-border e-commerce logistics channels," text, animated process clips, and video interviews with experts can be offered, and for skills like "financial model building," step-by-step video guides and interactive instructions that can be replayed and paused for practice are available [20]; the textbook can also change how content is shown based on the device, so mobile screens get shorter text and quick videos, while PCs show full knowledge maps and simulation tools [17].

3.6.3. Personalized Experience Adaptation: From Uniform Presentation to Precision Matching

Big data and AI algorithms can be used to adjust interactivity and user experience based on personal needs, so that students in different situations can get what works for them; the system gathers data from student interactions, like how fast they finish exercises, how accurate they are in simulations, and how often they submit questions, and then it uses this information to change task difficulty as they go [18]; for example, if a student gets over 80% correct on marketing case exercises, the system will open up harder tasks, like multi-channel marketing simulations, but if another student struggles with financial model settings, the system will cut down the number of starting variables and give step-by-step help [21].

Recommendations for interaction paths are also made to fit each student's learning style and skill level; those who like hands-on work get virtual simulation tasks and operation modules first, while students who want to understand theory better are directed to discussion boards and concept tasks [20]; for instance, students who are interested in live e-commerce can receive suggestions for tasks like designing a live script or practicing audience response [18]; in addition, an intelligent assistant is built into the textbook to give help in real time during interactive sessions [13]; students can ask questions by text or voice, for example, "How can I cut logistics costs in this simulation?", and the assistant looks up relevant content and guidance using a system that finds and combines information, then gives exact answers and points to the related interactive modules for quick access [15]; the assistant also keeps track of common problems that come up during interaction and builds personal error logs, so students can go back later to check and strengthen their learning [19].

3.7. Multidisciplinary Integration and Closed-Loop Development of Digital Textbooks

In practice, textbook development needs to focus on frontier orientation and real-time updates, and these goals go along with theory growth and new ideas in practice; as theories expand and models keep appearing in the field, textbook content should cover many things: how basic theories are updated, how new findings are used, and how real business examples are added, which gives a rich knowledge system; digital textbooks can be revised online and in real time, so new technologies and standards can be added quickly, and this keeps teaching content up to date with industry changes, and this matches what new business digital textbooks need in terms of being current and active, and it also provides technical support and practical ways to keep content in line with the changing business world [17].

From international experience in digital publishing, this real-time update ability is supported further by AI and edge computing [11]; for example, digital textbooks can use IoT and AI to take in live industry data, like logistics policy changes or market shifts, and then update related cases and model settings on their own [18]; this fits with the scenario-based design approach used by major platforms like Pearson MyLab, so content stays relevant to real practice [17].

3.7.1. Multidisciplinary Integration: Core Logic of Content Construction

New business disciplines inherently emphasize cross-domain integration, and digital textbooks realize this through three-dimensional content integration, supported by technological tools to avoid fragmented knowledge presentation:

Knowledge dimension integration: Break down disciplinary boundaries to integrate core knowledge from business management, data science, information technology, and law. For instance, in the "cross-border e-commerce operation" module, integrate international trade rules (law), data-driven product selection (data science), and digital marketing tools (information technology) into a cohesive knowledge chain [20].The knowledge graph technology adopts a dual-view design that integrates both global and local perspectives. The global view, accessible via the "Knowledge Graph" entry on the textbook's front page, presents the entire interdisciplinary knowledge association network for New Business disciplines—for example, illustrating the financial, technological, and legal dimensions linked to "digital finance." The local view, embedded at the beginning of each chapter, focuses on the interdisciplinary connections among the core knowledge points specific to that chapter (operational pathway). The graph supports keyword search and difficulty filtering functions. When students search for "cross-border data compliance," the system automatically filters relevant knowledge items from law (data privacy regulations), technology (encryption transmission solutions), and management (compliance procedures). Each knowledge point is further annotated with the corresponding textbook chapter, case number, and practical tools (e.g., a download link for a "compliance self-assessment checklist"), thereby achieving modular binding of interdisciplinary knowledge (binding logic) [21].

Practice dimension integration: Link theoretical knowledge with industry practical scenarios, integrating real enterprise cases, industry project simulations, and vocational competency requirements. For example, in the "digital finance" chapter, embed real-time financial market data interfaces and simulate fintech product development processes, enabling students to apply theoretical knowledge to risk assessment, product design, and operational optimization [16].

Technology dimension integration: Embed intelligent tools across disciplines to support cross-domain knowledge application. For example, virtual assistants (e.g., TAUDT system) help students connect scattered knowledge points during cross-disciplinary learning—such as querying "data privacy compliance in cross-border data flow" and receiving responses that integrate legal norms and technical solutions [13]. Adaptive learning platforms adjust cross-disciplinary content difficulty based on students' performance in comprehensive case analysis, ensuring a smooth learning experience [15].

3.7.2. Closed-Loop Development Framework: Centered on Multidisciplinary Integration

We propose an organizational framework (Figure 1) to visually present the core components and construction logic of new business digital textbooks, built around multidisciplinary integration. The framework defines three core dimensions—technological support, content development, and scenario-based application—with teaching management and evaluation-feedback mechanisms as key supports, making it a closed-loop development system:

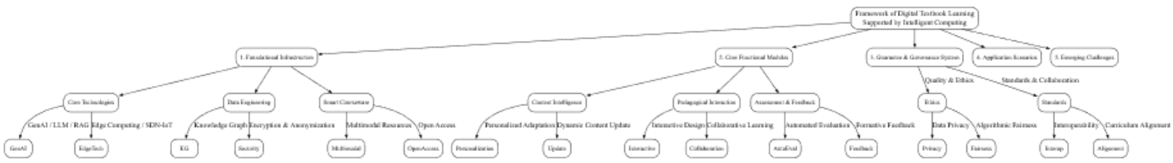

Figure 1. Organizational Framework of Digital Textbook Development

3.7.3. Core Functional Dimensions

For the technological support dimension, we rely on deep learning, cloud computing, and edge computing to lay a solid technical foundation for multidisciplinary integration. This involves tools like knowledge graph construction for cross-disciplinary mapping, virtual simulation platforms for integrated practice, and data analysis engines for tracking learning outcomes across domains. For instance, memory-augmented neural networks can examine students' performance in cross-disciplinary tasks—say, marketing-data integration projects—to pinpoint knowledge gaps [15].

As for content development, we adopt a modular design that allows flexible combination of cross-disciplinary materials. Core modules cover foundational theories from various fields, while optional ones target specialized areas such as "cross-border e-commerce + cross-cultural communication" or "financial technology + regulatory compliance." Content updates follow a "theory-practice-technology" triple-driven model, which ensures we stay aligned with academic progress, industry shifts, and tech innovations [17].

Turning to scenario-based application, we build integrated scenarios that mirror real business needs—for example, full-link cross-border e-commerce operations, multi-channel digital marketing synergy, and supply chain finance risk control. Students work on collaborative tasks via digital avatars, drawing on multiple disciplines to tackle complex problems [17]. The platform then records task completion data to assess their cross-disciplinary application skills [14].

3.7.4. Supporting Mechanisms: Teaching Management and Evaluation-Feedback

For the teaching management mechanism, we can set up a collaborative system that brings together educators, industry experts, and technical developers. Educators focus on designing cross-disciplinary content from a pedagogical angle, industry experts contribute real-time practice guidance and case resources, and technical developers make sure that the intelligent tools run smoothly [11]. This approach echoes the multi-stakeholder collaboration model seen in successful international digital publishing efforts [17].

Evaluation-feedback closed loop: Form a dynamic optimization cycle of "content delivery → learning data collection → evaluation analysis → content iteration":

Data collection: Capture students' learning behavior data (e.g., cross-disciplinary module interaction frequency, comprehensive case completion quality, knowledge transfer application effects) and feedback on content relevance, difficulty, and practicality [18].

Evaluation analysis: Use AI algorithms (e.g., LSTM neural networks) to analyze learning data, identifying weak links in cross-disciplinary integration (e.g., students struggling to apply data analysis knowledge in marketing decisions) and content update needs [18].

Content iteration: Based on evaluation results, update cross-disciplinary knowledge modules, adjust scenario difficulty, and optimize intelligent tool functions. For example, if students lack proficiency in "logistics cost accounting in cross-border e-commerce", add a pre-learning module on "international logistics data analysis" and update relevant case studies with real-time logistics cost data [17].

4. Research on Optimizing Digital Textbook Technologies and Management Strategies

How can we effectively support the practical application of digital textbooks in new business disciplines? Drawing on the analysis above, we can answer this by reinforcing both pedagogical support mechanisms and managerial systems—ensuring that teaching practice and institutional governance move forward together.

4.1. Integrating Students' TEL Behaviors with the Disciplinary Characteristics of New Business Disciplines Education

From a technological perspective, innovative teaching methods and instructional approaches should support the effective application of digital textbooks, with a core focus on aligning TEL (Technology-Enhanced Learning) behaviors with the interdisciplinary, practical, and dynamic characteristics of new business disciplines. The integration aims to transform passive knowledge reception into active, collaborative, and personalized learning, with specific implementation strategies as follows:

4.1.1. Interaction and Collaboration Design for TEL Environments

Targeting new business students' needs for interactive participation and collaborative problem-solving in TEL contexts, digital textbooks should embed scenario-driven interaction and multi-dimensional collaboration mechanisms:

Case-based interactive participation. We can design interactive case modules tailored to specific disciplines—for example, cross-border e-commerce dispute resolution or digital marketing campaign planning. Through these modules, students can trigger real-time discussions by annotating key points, submitting analysis drafts, or commenting on peers' insights. Take "cross-border logistics risk control" as an example: students can mark potential risk points in the case materials and initiate group debates, while the textbook automatically aggregates opinions and links back to relevant theoretical chapters [14].

Team-based collaborative learning. With the textbook's built-in collaborative platform, we can facilitate online team projects and group assignments. Students can form virtual teams using digital avatars, working together on tasks like "supply chain finance program design" or "live e-commerce operation simulation," with tools for document sharing, progress tracking, and role assignment in real time [17]. The system records each member's participation and generates collaboration efficiency reports, linking to the textbook's "team management" knowledge modules for targeted improvement [20].

Cross-device collaborative interaction: Support seamless collaboration across multiple devices (PC, mobile, tablet) to adapt to new business students' fragmented learning behaviors, ensuring data consistency across scenarios [11].

4.1.2. Integration of Intelligent Technologies to Meet Personalized Needs

Combine new business disciplines' emphasis on practical application and individualized development with intelligent technologies, embedding smart tools into the entire learning process:

Smart virtual assistants for interactive Q&A. We can integrate AI-powered virtual assistants, such as the TAUDT system, to handle subject-specific questions with answers grounded in both textbook content and real-world data [13]. For instance, when a student asks, "How do I calculate ROI for cross-border e-commerce social media marketing?" the assistant walks through the formula (textbook P126), pulls in current industry data, and links to interactive calculation tools [18]. It also supports voice input and follow-up questions, making it adaptable to different ways of asking.

Scenario-based intelligent learning guidance. We can develop immersive scenario modules that reflect real business practice—like "virtual corporate internships" or "cross-border trade negotiation simulations." The intelligent guidance system analyzes students' operation data and offers targeted feedback. For example, if a negotiation hits a deadlock, it might remind students to consult the "international trade terms" section [8].

Adaptive learning platforms for personalized analytics: Build adaptive platforms based on memory-augmented neural networks, collecting and analyzing students' TEL behavior data (e.g., case completion speed, interactive exercise accuracy) [21]. For core new business areas:

Cross-border e-commerce learners: If data shows low accuracy in "logistics cost accounting," the platform pushes foundational modules and customized practice tasks (e.g., comparing FBA vs. self-operated overseas warehouse costs) [17].

Digital marketing learners: If students focus on "short video marketing," the platform recommends advanced modules and 2024 industry trend reports [18].

4.1.3. Disciplinary Characteristic-Oriented TEL Optimization

We can further tailor integration strategies to the specific characteristics of new business disciplines in the following ways:

Interdisciplinarity adaptation. We design TEL interactions that cut across multiple fields—for example, "fintech product design" brings together finance, information technology, and law—with cross-disciplinary knowledge maps that link relevant chapters [20].

Real-time practice connection. We embed live data interfaces and practice tools, such as Amazon seller central simulations for cross-border e-commerce or real-time stock market feeds for financial analysis [11].

Dynamic feedback iteration. We set up a closed loop that goes from "interaction data collection" to "disciplinary needs analysis" to "function optimization," refining TEL integration along the way. For instance, if students are having trouble with "data-driven marketing decisions," we update case materials with step-by-step data analysis tutorials [18].

4.2. Transformation Paths of Digital Textbooks under New Business Scenarios

New business disciplines are marked by interdisciplinary integration, strong practical orientation, and fast industrial iteration—and these traits place distinct demands on the transformation of digital textbooks. This transformation must stay closely tied to core areas like cross-border e-commerce, digital finance, and supply chain management. The key is to break down the wall between theoretical knowledge and hands-on application, while achieving a real integration of technological empowerment, content refinement, and contextual adaptation. The specific paths for this transformation are as follows:

4.2.1. Scenario-Driven Content Reconstruction: From Disciplinary Segmentation to Cross-Domain Integration

We should move beyond the traditional segmentation of disciplinary knowledge and rebuild textbook content around core new business scenarios, so that multi-dimensional knowledge can be truly integrated.

To start, we can build scenario-based knowledge modules. Centered on typical business scenarios like "full-link cross-border e-commerce operations" and "digital marketing campaign planning," we bring together knowledge from various fields. For instance, a "cross-border e-commerce product selection" module might combine international trade rules (for legal compliance), data science (for market data mining), and logistics management (for overseas warehouse cost control)—forming a closed-loop knowledge chain that spans theory, practice, and technology.

Next, we need to dynamically integrate industry frontier content. By tapping into the real-time update capability of digital textbooks and connecting to dynamic industry data feeds, we can incorporate emerging business models, policy changes, and technology applications as they happen. For example, in the digital finance module, we can add content on blockchain-based cross-border payments and digital RMB settlement practices; in the supply chain module, we can supplement cases on IoT- and big-data-driven intelligent scheduling.

Finally, we should embed practical operation guidelines into each core scenario. These would outline standardized processes and hands-on guides. Take "cross-border e-commerce store operations" as an example: we can walk through the entire workflow—from platform account registration and product listing optimization to after-sales dispute handling—and embed links to simulation tools, so students can practice as they learn.

4.2.2. Technology-Enabled Teaching Innovation: From Passive Acceptance to Immersive Practice

We can use digital technologies like AI, virtual simulation, and edge computing to innovate teaching formats and make textbooks more practical and interactive.

First, we can develop scenario-based simulation labs tailored to new business contexts. For example, in a "cross-border trade negotiation" scenario, we build an AI-driven virtual negotiation platform where students interact with virtual overseas partners to practice communication and contract terms. The system gives real-time feedback on language accuracy and negotiation strategy [20]. In a "financial risk assessment" scenario, we can integrate live market data interfaces, allowing students to operate risk models and see how policy changes might affect investment returns [21].

Second, we can put in place intelligent support tools, such as virtual assistants and adaptive learning platforms, that fit different scenarios. Take the "digital marketing" module: the virtual assistant can answer questions like "How do I optimize TikTok ad delivery algorithms?" by linking textbook theory with real-time platform data [13]; meanwhile, the adaptive platform adjusts the difficulty of scenario tasks based on students' performance in ROI calculation exercises and pushes out targeted supplementary materials [18].

Third, we can enable seamless collaboration across multiple devices, supporting access and data sync so that learning fits into fragmented schedules. Students might start a scenario simulation on a lab PC, continue annotating key points on a mobile device during a commute, and finish group tasks on a tablet—keeping the learning flow intact across real-world settings [11].

4.2.3. Demand-Oriented Service Upgrade: From Uniform Delivery to Personalized Adaptation

Aim at the differentiated learning needs of students and the diverse talent training goals of new business disciplines, and upgrade the service capabilities of digital textbooks:

We can customize learning paths to match each student's professional focus and career goals. For those aiming at cross-border e-commerce, we can give priority to modules like overseas market development and logistics optimization. For students in digital finance, we can emphasize financial product design and risk control models [18]. The adaptive system can also adjust the learning sequence and difficulty based on each student's interaction data and task performance [21].

Build a collaborative learning community: Centered on scenario tasks, build a collaborative platform within the textbook. Students can form virtual teams through digital avatars to complete group tasks such as "supply chain finance program design" and "cross-border e-commerce team operation," sharing resources and collaborating in real time [17]. The system records each member's contribution and generates collaborative efficiency reports to support peer learning and evaluation [14].

Establish a closed-loop feedback mechanism: Collect students' learning feedback and enterprise practice needs in real time through digital tools. For example, if students reflect that the "cross-border e-commerce policy interpretation" content is outdated, the textbook updates relevant modules in a timely manner based on the latest customs regulations and tax policies; if enterprises put forward higher requirements for students' data analysis capabilities, add special training on data visualization tools in corresponding scenarios [16].

4.2.4. Industry-Academia Synergistic Co-Construction: From Single-Sided Development to Ecological Coordination

Establish a synergistic co-construction mechanism involving universities, enterprises, and technical teams to ensure that the transformation of digital textbooks is closely aligned with industrial needs:

Introduce enterprise practical cases and experts: Invite front-line practitioners from leading enterprises to participate in textbook compilation, embed real enterprise cases and practical problems into teaching content, and set up "enterprise expert lectures" modules to share industry insights and practical experience. For example, cooperate with cross-border e-commerce platforms to introduce real store operation data and success cases; invite financial technology enterprise experts to interpret the application of AI in risk control.

Jointly develop practical training resources: Cooperate with enterprises to develop textbook supporting practical training resources, such as simulated operation platforms, industry-specific data sets, and certification training courses. For instance, cooperate with logistics enterprises to develop a supply chain simulation system, allowing students to practice intelligent scheduling and inventory optimization through the textbook; cooperate with digital marketing platforms to access teaching versions of data analysis tools, enabling students to conduct real data-driven marketing plan design.

Build a dynamic update mechanism with industry linkage: Establish an industry demand tracking team to regularly collect the latest development trends and talent demand standards of the industry, and form a textbook content update roadmap. For example, track the development of cross-border e-commerce live streaming and short video marketing, and update relevant teaching content and practice tasks every six months to ensure that textbook content is synchronized with industrial development [17].

5. Research on Learning Effectiveness Evaluation of Digital Textbooks in New Business Disciplines

We should base the evaluation of learning outcomes from digital textbooks on their core characteristics. A keyword cloud (Figure 2) offers a clear visual summary of the main evaluation dimensions. We generated this cloud by consolidating key terms drawn from over ten academic studies on digital textbooks. As we can see from the figure, terms like "Data Tracking," "Dynamic Update," "Personalized Teaching," and "Interactive Experience" appear frequently. These high-frequency keywords not only align closely with the defining features of digital textbooks, but they also help us pinpoint the key dimensions for assessing learning effectiveness—giving us a solid foundation for designing and applying evaluation indicators later on.

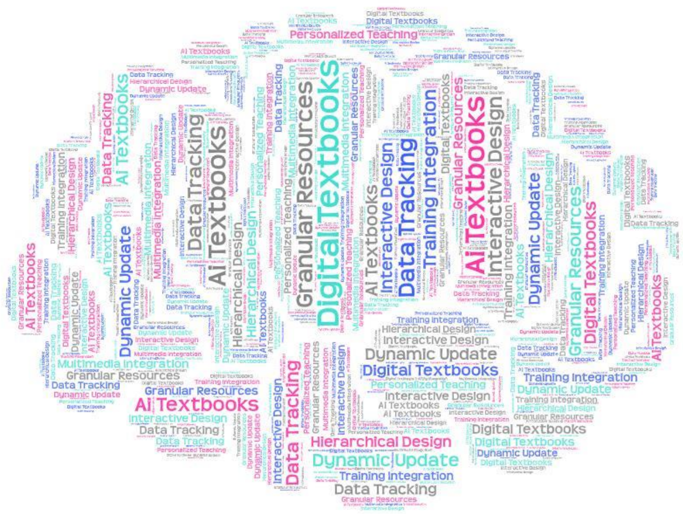

Figure 2. Keyword Cloud for Evaluating Learning Outcomes of Digital Textbooks

5.1. Core Element Correlation Mechanisms in Evaluation

To ensure the comprehensiveness and accuracy of learning effectiveness evaluation, it is necessary to clarify the intrinsic correlation between the core elements of new business digital textbooks, which provides a logical basis for the design of evaluation indicators:

5.1.1. Interdisciplinary Integration and Technological Support

Interdisciplinary integration is a core feature of new business disciplines, and it depends heavily on technological tools to prevent fragmented knowledge presentation and content redundancy. These issues, in turn, directly affect how deeply students grasp the material—which is exactly what we need to evaluate. We can draw on the knowledge graph technology proposed in Exploring the Framework for the Development of Intelligent Digital College English Textbooks in the Era of Generative AI [20], which allows digital textbooks to organize core knowledge from business management, data science, law, and related fields into modular units. Take the "cross-border e-commerce operation" evaluation dimension as an example: the knowledge graph can visualize how international trade rules (law), data-driven product selection (data science), and digital marketing tools (information technology) are all connected. This enables us to assess not only students' command of individual disciplines but also their ability to pull together cross-disciplinary content [21]. With this technological support, we can make sure that interdisciplinary evaluation goes beyond rote memorization and focuses instead on practical integration skills.

5.1.2. Application Scenarios and Content Development

The design of digital textbook content is shaped by real-world new business application scenarios, and this interplay should also be reflected in how we evaluate learning outcomes. We can take inspiration from the scenario-driven design logic discussed in The Inspiration and Reference of International Digital Educational Publishing [17]. New business digital textbooks are designed with "fragmented learning" scenarios in mind—such as commuting or short breaks between classes—so we split core knowledge into structured micro-modules. For instance, we can break down "short video marketing" into 3- to 5-minute self-contained units covering account positioning, content scripting, platform algorithm adaptation, and data effect analysis. In the evaluation phase, we can use indicators like module completion rate, cross-module knowledge transfer accuracy, and scenario-based task completion quality to determine whether students can effectively absorb structured content in fragmented settings and put it to use in practical tasks.

5.1.3. Analyzing Students' TEL Capabilities through Their TEL Behaviors

This process mainly covers several dimensions, and we can link our evaluation indicators closely to the core elements we care about.

For knowledge mastery evaluation, we use online tests and assignment submissions to check how well students grasp key concepts in interdisciplinary modules—say, integrating cross-border e-commerce product selection with logistics cost accounting—as well as in structured micro-modules. By analyzing performance data, we can pinpoint gaps in cross-disciplinary integration or scenario-based application and then adjust our teaching strategies accordingly.

For practical application evaluation, we look at project work and simulation exercises—such as cross-border e-commerce full-link operation simulations or digital marketing campaign designs—to see whether students can apply integrated knowledge in practice. We pay special attention to whether they can use technological tools, like knowledge graph query functions, to solve real problems in scenario-based tasks.

For learning behavior analysis, we collect TEL data, including online study time for micro-modules, participation in interdisciplinary discussion forums, and engagement with interactive content. We then analyze students' learning habits in fragmented settings and any difficulties they might face with cross-disciplinary work. This helps us offer personalized support and also adds to the evidence base for our overall evaluation of learning effectiveness.

5.2. Employing Multiple Methods to Evaluate the Effectiveness of Digital Textbook Development

We can evaluate the effectiveness of digital textbook development through several complementary approaches that cover content quality, technological application, and user experience.

First, for data-driven analysis, we use big data and AI to examine students' learning process data—including their accuracy in integrating interdisciplinary knowledge, how efficiently they complete micro-module learning, and how they perform in scenario-based tasks. By digging into patterns in learning behavior and outcomes, we can assess whether the textbook's interdisciplinary design and scenario-driven content actually meet students' needs [18].

Second, multi-subject evaluation brings together peer assessment, self-assessment, and teacher evaluation. Peers can assess each other's work in cross-disciplinary collaborative tasks; students can reflect on their own grasp of micro-module content and scenario application skills; and teachers can provide a comprehensive view of how well interdisciplinary integration and technological tools are working. This mix helps foster students' initiative and autonomy.

Third, we collect user feedback through post-course surveys, asking students about their satisfaction with interdisciplinary content integration, their experience using technological tools in fragmented learning scenarios, and any suggestions they have for improvement. This feedback gives us a valuable basis for judging development effectiveness and guiding future revisions.

5.3. Potential Problems and Corresponding Solutions in Evaluation

In the process of learning effectiveness evaluation, potential problems related to textbook design and application need to be addressed to ensure the objectivity and comprehensiveness of evaluation results:

Problem 1: Difficulty in interdisciplinary knowledge integration. Students come from different disciplinary backgrounds, so some may find it hard to connect cross-disciplinary content, which in turn can make it difficult to accurately evaluate their practical application skills. To address this, we can refer to the modular design concept from The Inspiration and Reference of International Digital Educational Publishing [17] and adopt a "core module + optional module" structure for digital textbooks. The core modules cover the basics of interdisciplinary knowledge, while the optional ones target specific specializations, such as "cross-border e-commerce + cross-cultural communication." In evaluation, we can set differentiated indicators based on module choices, rather than applying a one-size-fits-all standard.

Problem 2: High cost of technological application affecting evaluation coverage. Technologies like knowledge graphs and scenario simulation can raise costs for some institutions, which may limit how widely data-driven evaluation can be applied. One solution is to set up a collaborative investment mechanism involving government, enterprises, and universities [17]. Governments can offer policy support and funding, enterprises can contribute to technology development and resource sharing, and universities can focus on teaching application and feedback. This approach spreads the cost burden and helps ensure that more students have access to these tools, improving both the comprehensiveness and representativeness of evaluation data.

A third concern is incomplete evaluation of fragmented learning effects. Fragmented learning happens in scattered settings, which makes it hard to fully track the process and assess outcomes. To tackle this, we can optimize the textbook's data tracking function to record micro-module learning progress, time intervals, and review frequency in real time. We can also combine formative evaluation—such as short quizzes after each micro-module—with summative evaluation, like scenario-based comprehensive tasks, so we get a fuller picture of how effective fragmented learning really is.

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