Functional Design and Content Development of Online Learning Platforms from the Perspective of Flipped Classroom Trends: A Case Study of MindTap (Postprint)

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Abstract

In recent years, with the advancement of modern network and information technologies, the flipped classroom model has been increasingly and widely adopted across various educational levels and disciplines. This article examines the trends of flipped classroom pedagogy, using the MindTap online learning platform developed by the internationally renowned educational publisher Cengage as a case study, to explore the functional design requirements and key developmental priorities for content resources in online learning platforms that complement textbooks, with the aim of providing references and insights for relevant practices among domestic publishers.

Full Text

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Abstract: In recent years, with the development of modern network and information technology, the flipped classroom has emerged as a new pedagogical model increasingly applied across various educational levels and disciplines. This article examines trends in flipped classroom implementation, using the MindTap online learning platform developed by the internationally renowned educational publisher Cengage as a case study. It explores the functional design requirements and key priorities for content resource development in textbook-integrated online learning platforms, aiming to provide reference and insights for domestic publishers' related practices.

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The concept of the flipped classroom was first introduced from abroad. This pedagogical approach inverts traditional course structures by having students engage in autonomous learning before class through e-books, audio, and video materials, followed by in-class sessions dedicated to Q&A and interactive discussions, thereby facilitating "knowledge internalization."Compared to conventional classroom instruction, the flipped classroom model is characterized by its shift from "teaching-centered" to "learning-centered" approaches, positioning students as the primary agents of learning activities while teachers transition into roles as resource providers, activity designers, and learning facilitators. Consequently, the flipped classroom represents not only a disruption of traditional classroom structures and processes but also a return to the fundamental essence of education [1].

In recent years, the deepening integration of technology and curriculum, driven by advances in network and information technology, has made the implementation and popularization of flipped classroom models feasible. These models manifest in various forms, including e-textbooks, live or recorded online courses, micro-lectures, MOOCs, and intelligent online learning platforms. The COVID-19 pandemic that began in early 2020 significantly accelerated the pace of online education [2]. However, it also revealed that many digital courses and textbook resources deployed during this period were relatively simplistic, lacking interactivity, extensibility, and learning support—essentially emergency measures for extraordinary times. In the long term, domestic educational publishers must develop professional, intelligent online learning platforms and create diversified digital resources integrated with paper textbooks to align with the overarching trends of flipped classroom pedagogy. Leading international educational publishers have long been strategically positioning themselves for digital transformation, evolving from textbook publishers to providers of comprehensive digital education solutions. They have developed sophisticated online learning platforms such as Pearson' s Revel, McGraw-Hill' s ALEKS [3], Cengage' s MindTap, and Wiley' s WileyPLUS, among others.

Taking Cengage's MindTap platform as an example, this platform was developed in conjunction with paper textbooks, leveraging e-books, videos, audio, interac-

tive experiments, and infinitely extensible third-party applications to facilitate flipped classroom implementation. Currently, over 1,300 textbook resources are available on the MindTap platform across multiple disciplines, receiving positive user feedback. Notably, the 8th edition of Mankiw' s *Principles of Economics* (published by Peking University Press) was the first to include a streamlined version of this platform. The platform' s distinctive features in content resources and functional design may offer valuable reference points for domestic educational publishers.

1. Functional Design of Online Learning Platforms

To achieve the objectives of flipped classroom pedagogy, online learning platforms should generally meet the following functional design requirements.

1.1 Accommodating Personalized Instruction and Individualized Learning

First, platforms must exhibit flexibility and openness, enabling instructors to augment, delete, and reorganize existing resources according to their pedagogical objectives and teaching styles, and to optimize instructional design using platform functionalities to create customized learning environments. On the MindTap platform, for instance, instructors can edit or hide existing text and video content, add annotations on key and difficult concepts to share with students, and import external resources through application panel tools—such as adding news links or videos via the "RSS Feed" App, or importing PowerPoint presentations, text documents, Excel spreadsheets, and PDFs through the "My Content" App as supplementary classroom materials.

Second, platforms should provide diverse and tiered learning resources that allow students to develop study plans according to their individual habits and capabilities. They should also feature online testing with immediate feedback functions to enable self-assessment of knowledge mastery. MindTap' s Adaptive Test Prep module, for example, allows students to select any chapter from the textbook to generate personalized assessments, with each knowledge point supported by an extensive question bank that randomly generates test items. Upon completing each online test, students receive precise instant feedback including scores, error analysis, direct references to corresponding textbook sections, and even instructor explanation videos titled "Quick Coach." These adaptive tests can be repeated indefinitely until students achieve mastery.

1.2 Process Recording, Achievement Display, Task Reminders, and Monitoring Functions

To establish a successful online learning platform and complete the instructional loop, task tracking systems and analytical tools are essential. On one hand, instructors can assign learning tasks with specific content, requirements, and deadlines through the platform, and monitor student progress through backend

management software to provide timely diagnostic feedback and recommendations. On the other hand, learning support tools such as task reminders and learning calendars help students complete assignments more effectively. For example, MindTap' s "Aplia" App generates detailed analytical reports on student task progression, while the "Pathbrite" App enables students to create personal portfolios documenting and showcasing their learning achievements in document, image, and video formats, preserving and sharing their knowledge and skill acquisition processes [4].

1.3 Diversified Assessment Functions

To establish a scientific and effective comprehensive evaluation system, instructional platforms should incorporate diversified assessment functions that attend to both learning processes and outcomes, feature automatic scoring and grading capabilities, and provide sufficient flexibility in scoring mechanisms and evaluation frameworks for instructors. Additionally, platforms should possess analytical functions capable of aggregating, analyzing, and computing various data sources to generate comprehensive evaluation reports.

MindTap' s "Progress" App, for instance, records student performance on homework assignments and unit tests, generates class gradebooks, and produces scatter plots illustrating relationships between student achievement, participation levels, and time spent on specific learning tasks. These visualizations reveal both class-wide performance patterns and whether individual students' performance significantly exceeds or falls below average. Moreover, the platform grants instructors considerable flexibility in evaluation frameworks, allowing them to categorize learning tasks and assign different scoring weights to various task types, as well as manually grade certain assignments. Upon completing these configurations, the system generates final grading and analytical reports.

1.4 Accessibility

To facilitate student autonomous learning, many international educational publishers have developed mobile applications integrated with their online learning platforms, such as Pearson' s REVEL mobile App and Cengage' s Cengage mobile App. These applications enable students to access platform resources, complete exercises, and take online tests anytime and anywhere, with seamless switching between smartphones, tablets, and laptops, thereby enhancing resource utilization and improving student engagement and learning efficiency.

2. Development of Content Resources for Online Learning Platforms

Beyond functional design, content resource development is paramount in building online learning platforms. Textbook-integrated online learning platforms typically require the following content resources.

2.1 E-Textbooks: Functional Extensions of Paper Textbooks

To support student autonomous learning, e-textbooks integrated with paper textbooks constitute essential resources for online learning platforms. Such e-textbooks should not merely replicate paper content but offer extensive functional extensions, constituting "enhanced"or interactive digital textbooks. Many international publishers and distribution groups have developed these resources to optimize user reading experiences. MindTap' s core resource, its Interactive Book, allows students to read online, access integrated dictionaries, highlight key content, and add notes (which are stored in a personal learning center called "StudyHub"for convenient review). Additionally, students can utilize the e-book' s ReadSpeaker text-to-speech functionality to "listen" to textbooks anytime and anywhere.

2.2 Derivative Resources Developed from Paper Textbook Content

Beyond enhanced e-textbooks, diversified derivative resources such as animations, audio-video materials, and interactive simulations represent the most distinctive features of online learning platforms. The development process typically involves publishers initiating digital content creation concurrently with textbook finalization (often during proofreading). Editorial teams first identify key and difficult concepts, after which authors collaborate with technical teams to develop these resources in multiple formats, with final review and approval by the editorial team before launch.

The specific types of derivative resources should be determined according to disciplinary and course characteristics. In economics, for example, student challenges include: abstract concepts that are difficult to comprehend, theories and models requiring graphical illustration, and extensive calculations. Addressing these challenges, the MindTap platform for *Principles of Economics* includes several specialized resources: (1) "Concept Clip" animations that explain abstract economic concepts through vivid, intuitive visualizations; (2) "Video Lessons with Quick Quizzes" that embed multiple-choice questions within videos, requiring students to respond while watching to continuously assess their understanding and determine whether to proceed or review; (3) "Graph Builder" learning tools that demonstrate how complex economic graphs are constructed step-by-step and allow students to practice drawing them independently; and (4) "Video Problem Walk-through" tutorials that provide step-by-step demonstrations of calculations and solutions for typical chapter problems.

These derivative resources, with their visual and interactive characteristics, can substitute for traditional blackboard instruction, thereby truly achieving flipped classroom objectives. In addition to e-textbooks, audio-video materials, and interactive simulation tools, platforms should also include supplementary and extended learning resources tailored to specific disciplines and courses, such as extended chapters and datasets that cannot be accommodated in paper textbooks due to space constraints, as well as synchronized teaching resources in-

cluding homework question banks, self-test exercise libraries, and study guides for students, plus examination question banks, PowerPoint presentations, and instructor manuals for teachers. These resources require not only substantial quantity but also high accuracy and alignment, typically necessitating development by professional supplementary material teams.

3. Implications for Domestic Educational Publishers Developing Online Learning Platforms

First, modern online learning platforms should provide not only rich content resources but also comprehensive instructional solutions encompassing teaching support systems, intelligent management systems, context creation systems, and diversified evaluation systems. In this regard, domestic educational publishers might consider partnering with high-tech companies to combine respective resource and technological strengths in creating all-encompassing intelligent educational solutions.

Second, for publishers, high-quality digital resources suited to flipped classroom pedagogy constitute the most fundamental and important competitive advantage. Therefore, domestic educational publishers should, on one hand, fully leverage their content and author resources to meticulously develop diversified digital resources tailored to different disciplines' characteristics, focusing on key subjects and core textbooks. On the other hand, they must vigorously strengthen cultivation of digital publishing talent, including digital editors, digital product managers, and content implementation managers, while 适时 establishing professional digital editing platforms to provide infrastructure and technical support for digital content development and production.

Finally, efforts should be made to achieve integration among online learning platforms, mobile Apps, and paper textbooks. While developing the main platform, publishers can simultaneously create mobile Apps for portable use. They should also modularly adapt paper textbook content to align with online learning pathways and incorporate QR codes in paper textbooks to grant students access to selected platform resources. Through these approaches, publishers can work toward realizing a "trinity" publishing model featuring integrated online learning platforms, mobile Apps, and three-dimensional paper textbooks.

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Note: Figure translations are in progress. See original paper for figures.