Educational New Infrastructure, Digital Pedagogy, and Resource Self-Supply: Drivers and Pitfalls of Digital Textbook Publishing in Chinese Universities—Postprint

Authors: Wang Jun

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Abstract

[Purpose] To encourage educational publishers to enter the university digital textbook publishing sector more rationally. [Method] This article examines the driving mechanisms through which the "hard environment"of domestic education new infrastructure and the "soft environment" of digital pedagogy promote digital textbook development, based on policy text analysis of education new infrastructure and surveys of university teachers during the pandemic. [Result] It identifies copyright risks emerging from higher education teachers'"self-supply" of teaching resources. Conclusion It emphasizes that domestic university digital textbook publishing exhibits not only a unified development trend under the macro-era backdrop, but also local characteristics rooted in national conditions.

Full Text

Preamble

Educational New Infrastructure, Digital Pedagogy, and Resource Self-Supply: Drivers and Hidden Risks in University Digital Textbook Publishing in China (Peking University Press, Beijing 10000)

Abstract

This study aims to encourage educational publishers to enter the university digital textbook publishing arena more rationally. Through an analysis of relevant policy documents on educational new infrastructure and surveys of university teachers during the pandemic, this article examines the driving mechanisms of digital textbook development by both the "hard environment" of domestic educational new infrastructure and the "soft environment" of digital pedagogy. The

research identifies copyright risks emerging from the "self-supply" of teaching resources by higher education teachers, and concludes that domestic university digital textbook publishing exhibits not only a unified development trend against the backdrop of a major era, but also local characteristics rooted in national conditions.

Keywords: digital textbooks; educational new infrastructure; digital pedagogy; resource self-supply

Introduction

The three recommended national standards for digital textbooks– "Basic Processes for Publishing Primary and Secondary Digital Textbooks," "Metadata for Primary and Secondary Digital Textbooks," and "Quality Requirements and Testing Methods for Primary and Secondary Digital Textbooks" –approved and released by the State Administration for Market Regulation (Standardization Administration) were officially implemented on November 1, 2022 [1]. Meanwhile, standards and specifications for university digital textbooks are being actively formulated, and another track in domestic university textbook publishing—digital textbooks—is taking initial shape. Simon Allen, CEO of the world-renowned educational publisher McGraw-Hill, stated in November 2020, "By the end of 2019, approximately 75% of our higher education textbooks had adopted digital publishing. In the first few months of 2020, this figure rapidly grew to 89%, and I believe this number will continue to be maintained after the pandemic. We have seen tremendous growth in online learning, which I think would have taken at least five years to achieve without COVID-19" [2]. Additionally, according to a 2022 U.S. survey report, student spending on course materials (including textbooks and digital materials) declined by 22% during the 2021-2022 academic year, representing a 44% decrease over the decade from 2011-2012 to 2021-2022. In the 2021-2022 academic year, average student spending on course materials was $314, with $101 for new print textbooks, $69 for used print textbooks, $47 for rented print textbooks, and $97 for eTextbooks—a 156% increase for eTextbooks [3]. Over the past decade, the development of foreign digital textbooks has effectively addressed the cost pain points troubling students, and the global COVID-19 pandemic in 2020 accelerated foreign digital textbook publishing, alleviating pressures on offline teaching while accelerating the overall digital transformation of foreign educational publishing.

Relative to the publishing landscape of foreign university digital textbooks, domestic university digital textbook publishing exhibits not only a unified development trend against the backdrop of a major era, but also local characteristics rooted in national conditions. Publishers entering this field need to understand the driving forces and hidden risks of digital textbook publishing in the current domestic market to enter the university digital textbook publishing arena more rationally.

In July 2021, the Ministry of Education and five other departments issued the

"Guiding Opinions on Promoting New Infrastructure for Education and Building a High-Quality Education Support System," heralding the era of educational new infrastructure. Educational "new infrastructure" will greatly expand traditional educational spaces through the construction of digital new infrastructure represented by 5G, cloud computing, educational big data, and artificial intelligence, enriching teaching media forms and triggering digital transformation and intelligent reform throughout the entire teaching process and all its elements. The integration of online and offline teaching paradigms during the "pandemic era" has become an accelerator for China' s educational new infrastructure, and using online educational resources for teaching and learning has become the new normal [4]. Multimodal learning analytics, subject knowledge graph technology, machine learning for digital resources, and blockchain management technology have more opportunities to integrate with textbook knowledge systems, production systems, and distribution systems, making it imperative to upgrade and transform textbooks as important carriers of teaching content.

Textbooks are essentially constituted by media—no media, no textbook. At the macro level, textbook forms are always carried by some medium and influenced by media forms, exhibiting the morphological characteristics of the medium itself and governed by the evolution laws of media forms. New media promotes the emergence of new textbooks, and new infrastructure drives the development of new media. More fundamentally, this round of educational new infrastructure highlights a digital new infrastructure that will change the interactive relationship between humans and the natural environment, forming a fully connected state of "human-machine symbiosis" and "integration of all things," which will transform the conditions and methods of knowledge production [5]. "Digital new infrastructure will bring changes to the knowledge industry from aspects such as cognitive representation, data collection and research paradigms, and knowledge expression and organization, promoting the innovative development of the knowledge industry" [6]. "Educational new infrastructure is a powerful driving force for educational transformation in the era of artificial intelligence" [7], and will promote comprehensive changes in the textbook publishing ecosystem.

Educational new infrastructure will enable more diverse representations of textbook content, entering a service field that is cross-functional, cross-scenario, and personalized. "Communication technology innovation drives media form iteration" [8], and with the help of technologies such as virtual reality (VR), augmented reality (AR), artificial intelligence, and human-computer interfaces to represent cognitive objects, integrating "virtual-real fusion teaching scenarios, intelligent tutoring systems, intelligent teaching assistants, intelligent learning companions, and educational robots" [4] into new resource development. This will not only enable textbooks to intervene in students' deep learning experiences and knowledge construction, but also extend to the entire teaching process chain, expanding to skill training, communication and collaboration, feedback and evaluation that accompany learning. Previously, textbooks could only serve as knowledge carriers without attending to more teaching activity links. Through different representation methods of learning content, new communi-

cation channels will be created and textbook application scenarios expanded. The diversified representation of textbooks "enables compatibility and adaptation with various information-based teaching scenarios such as the Internet of Things, intelligent teaching terminals, and VR/AR," breaking through the limitations of classroom teaching scenarios. In special scenarios, teaching can also "use various multimodal sensory enhancement and gesture perception enhancement technologies to strengthen the interactivity, immersion, and perceptibility of knowledge presentation and skill training, adapting to personalized learning needs" [4]. Through online-offline blended teaching methods, basic knowledge transmission can be completed while meeting students' personalized learning requirements [10]. These new teaching practices have promoted changes in textbook forms.

Educational new infrastructure can record massive amounts of data generated during the teaching process in real time, thus creating new data collection and analysis paradigms with breakthrough significance for both explicit and implicit learning research. Through educational new infrastructure, offline learning in smart classrooms and emotion sensing systems can monitor students' natural physiological and emotional changes throughout the teaching process, with software systems automatically, continuously, and in real time recording student learning behaviors and assessment results. Online learning, through various web-based learning tools, can continuously "record learner behavior data, enabling teachers to use data analysis technology to mine deep-level information behind the data and extract required information from massive, multi-source heterogeneous data." With the help of cognitive graph technology, teachers can "understand the mastery of each knowledge point on students' knowledge graphs, more accurately construct learner knowledge portraits, and thus more accurately recommend appropriate learning paths and resources to learners" [9].

Educational new infrastructure will make the expression, organization, and arrangement of old knowledge more technologically distinctive, forming "information technology-supported overlapping knowledge forms" [4], thereby breaking the original knowledge division of labor and creating new professional divisions and curriculum systems. "Information technology-supported overlapping knowledge forms" have obvious overlapping and fusion characteristics: first, the fusion between multi-disciplinary and multi-level principle knowledge—knowledge and methods from single disciplines need to be transferred and blended across multiple disciplinary fields, and problem-solving requires using knowledge and methods from different disciplines; second, the direct organizational fusion between multi-disciplinary principle knowledge and information technology—new interdisciplinary knowledge fusion expressions require the help of many other technical information processing to be understood; third, universal knowledge principles need to be integrated with special local knowledge and cases, and different platform algorithms may produce different technical routes or knowledge ecologies [4].

Digital Pedagogy: The 'Soft Environment'Driver for Digital Textbook Publishing

As the carrier of teaching content expression and dissemination, textbooks are also influenced by changes in teaching scenarios. Previously, teachers lectured and students took notes, with the entire learning process unfolding in a relatively limited and discrete tool and technical environment. Today' s learning environment is much more complex. The first wave of "laptop universities" emerged in the mid-1990s, followed by the wave of wireless and networking, and we are now in the third wave of mobile and handheld digital tools. Learning environments based on laptops and other mobile tools can change teaching and learning experiences. At the same time, students use email and social media tools for communication, and have discovered community building and network interaction capabilities in discussion boards, online forums, blogs, and wikis. These media technology tools are dramatically changing the communication patterns and teaching relationships between learners and teachers, thus also dramatically changing the carrier of this teaching communication model—the textbook.

"Pedagogy is a set of principles and methods for implementing teaching practice to meet society's talent needs in a specific ecological environment. It is influenced by external factors such as society and politics, while simultaneously selecting resources, tools, and other teaching elements from the external environment to arrange and organize the teaching process" [8]. Using the "Environment-Pedagogy" four-quadrant analysis designed by scholar Guo Wenge, different external environments paired with different pedagogies reflect different approaches to talent cultivation (see Figure 1 [Figure 1: see original paper]). The biggest difference between "digital pedagogy" and "teaching technology" is that "the former uses digital technology to cultivate digital literacy capabilities, while the latter uses digital technology to improve the efficiency or effectiveness of traditional pedagogy and cultivate talents with print literacy" [7]. Digital ecological environments and print ecological environments have their own distinct media ecological environments, which when paired with different teaching methods, nurture different teaching practices with different internal teaching components. Only by combining both the hardware environment and the matched pedagogy in the environment can we truly cultivate talents adapted to the characteristics of the new media era; otherwise, it will only be "old wine in new bottles."

For example, a "Hackathon" platform network course has currently emerged in foreign digital ecological environments (see Figure 2 [Figure 2: see original paper]). In teaching, some resources from MOOCs or online course platforms are integrated into the Chaoxing platform for use. Many online resources are small knowledge points paired with small cases, concise and powerful. "Teachers basically arrange various materials accumulated over the years, including online or offline, into their course content according to teaching objectives. It' s almost 'use as you download,' and teachers themselves emphasize that they only provide account and password access to their own course students, not involving large-scale network dissemination." In the electronic version of text-

books, there are also cases where teachers scan and use materials themselves. Is this network usage of resources legal? According to the basic principles of China' s Copyright Law, works are protected by China' s Copyright Law from the moment of creation. Therefore, teaching videos or text content belong to the exclusive copyright that the copyright owner should enjoy. According to Article 2, Item 6 of China' s Copyright Law: "In the following circumstances, a work may be used without the permission of the copyright owner and without payment of remuneration, but the author' s name and work title shall be indicated, and the copyright owner' s other rights under this Law shall not be infringed: (6) For school classroom teaching or scientific research, translating or reproducing small amounts of already published works for use by teaching or scientific research personnel, but not for publication and distribution." Therefore, this provision creates a statutory licensing space for classroom teaching.

However, according to current teachers' usage, even if provided for free, it should constitute infringement. First, the above provision clearly stipulates "for use by teaching or scientific research personnel," and in combination with the legislative background, this refers to use by teaching personnel or scientific research personnel. In other words, use by students is not permitted. Second, the law allows only small amounts of reproduction of already published works; if too much content is copied, it is similarly not permitted. Finally, according to the legislative intent, allowing teaching personnel to use small amounts of reproduced works considers that in relatively closed classroom teaching venues, the impact on copyright owners is limited. However, if teaching personnel use them in their own online courses, although only provided to students, the impact on copyright owners is obvious based on the internet attributes of network dissemination. Therefore, using others' teaching videos or text content in online courses for student use is illegal. However, since it is generally "provided to students for free," copyright owners mostly do not actively file infringement claims.

For publishing institutions, if they develop digital textbooks, they need to pay copyright fees for various videos, audio, pictures, texts, etc. If publishing institutions develop them themselves, they may also be illegally used, and there is not much innovation motivation for the business entity of the publishing house. A 2021 German survey found that the German Publishers and Booksellers Association discovered that the loosening of legislation regarding teaching use of textbook resources has significantly affected university textbook sales. Since Germany' s Copyright Law first allowed free use of work excerpts in 2003, teaching media sales have declined by 30%. With the expansion of license-free use under the 2018 new Knowledge Society Act (UrhWissG), the decline in textbook sales has accelerated. "If authors and publishers of high-quality teaching media continue to lose sales, they cannot provide high-quality textbooks" [12].

A teacher from a Guangdong vocational college introduced: "I built my own Chaoxing online course (see Figure 2 [Figure 2: see original paper]). Many online resources are small knowledge points paired with small cases, concise and powerful. Teachers basically arrange various materials accumulated over

the years, including online or offline, into their course content according to teaching objectives. It' s almost 'use as you download,' and teachers themselves emphasize that they only provide account and password access to their own course students, not involving large-scale network dissemination."

A Chinese teacher teaching Chinese as a foreign language at a U.S. university introduced: "During the pandemic teaching process, I mainly used my own Fun Fun Mandarin video technology teaching platform (see Figure 3 [Figure 3: see original paper]), which includes video animations, AI artificial intelligence, and intelligent technology tools to assist Chinese character writing. Students generally purchase accounts to learn anytime, anywhere. I usually choose teaching resources with comprehensible input, strong interactivity, or convenience for whole-class demonstration that can help teachers save time in lesson preparation. Excellent or multifunctional teaching resources are generally obtained through purchase. There are also free versions of resources, but these usually have limited functions." Foreign teachers generally have a clear boundary between paid and free teaching resources, and increasingly recognize that using excellent or better-functioning teaching resources requires payment. For them, "the lesson preparation time saved" may be more valuable.

Conclusion

Overall, textbooks are determined by two processes: one views textbooks as carriers of teaching, the other views textbooks as knowledge products. They are influenced by two types of behaviors: learning behavior (classroom teaching behavior is one form of learning) and knowledge production behavior. Both behaviors are also influenced by knowledge dissemination scenarios. French historian Fernand Braudel believed that the contouring transitions of history can only be seen over very long periods, like rivers slowly forming banks. The current push of domestic digital "hard environment" and teaching "soft environment" on university digital textbook publishing will have a certain impact on the future development direction of the university digital textbook publishing ecosystem.

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Author Biography

Wang Jun (1976-), male, from Wuhan, Hubei, Ph.D., Associate Editor, Deputy Director of the Teaching Service Center at Peking University Press. Research interests: university textbook publishing, history of textbook media development.

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