Development of Digital Textbooks Based on the MOODLE Platform

——An Example of EFL Course Textbooks in China's Higher Vocational Colleges

Juhua Dou[1,2], Weili Wang[1,*]

[1]School of International Cooperation Guangdong Polytechnic of Science and Technology, Zhuhai, China
[2]Business School Universiti Kuala Lumpur Kuala Lumpur, Malaysia

dou.juhua@s.unikl.edu.my, *vanessa1014@163.com

Abstract: The digital transformation in education has brought forth new demands for textbook reform, with digital textbooks emerging as the priorities of innovation. This paper provides an overview of the developmental process and essential features of digital textbooks. Furthermore, it illustrates the development of a course-specific digital textbook by integrating the strengths of the MOODLE platform with EFL course materials used in higher vocational colleges in China. The effects of its implementation demonstrate that digital textbooks exhibit characteristics such as a flexible structure, prompt updates, extensive resources, real-time interaction, multidimensional presentation, and user-friendliness. These attributes align with the requirements of ICT teaching and have a positive impact on enhancing curriculum instruction quality.

Keywords: MOODLE Platform, Digital Textbooks, Higher Vocational Colleges, ICT Teaching.

1 Introduction

The global shift towards digitalization in education has propelled educational systems worldwide, marking the development of digital textbooks as a a crucial parameter of this transformation. In this new digital educational landscape, textbooks are transitioning from a static mode to a dynamic one: moving away from primarily text and image-based presentations towards multimedia engagement, shifting from unidirectional transmission to multisensory interaction, transitioning from abstract conceptualization to concrete sensory expression, and evolving from a mere tool for dissemination to an interconnected teaching and learning service system [1]. In China, the Ministry of Education highly values the development of digital textbooks. In 2018, the Ministry explicitly outlined the development, pilot, and promotion of new forms of textbooks, digital textbooks for example, in the Project on Textbook Reform and Quality Standards [2]. In 2019, the Management Measures for Vocational College

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Textbooks issued by the Ministry specifically advocated for the development of new forms of textbooks, emphasizing loose-leaf and workbook-style formats [3]. The Specification for Digital Campus Construction in Higher Education Institutions in 2021 urged the use of digital textbooks in teaching and supported teachers in self-developing such materials [4]. In 2023, the Ministry emphasized the rational application of digital technology to the development of new forms of textbooks, including digital textbooks[5]. These initiatives undoubtedly expedited the digitization of education and propelled the advancement of digital textbooks.

Digital textbooks exist in a digital format, capable of being loaded onto digital reading devices, dynamically updating content, and promptly recording interaction traces[6]. This new type of textbooks possesses various advantages:

1. they employ multi-modal symbols for content presentation, ensuring strong interactivity;
2. they arrange content based on knowledge points, enabling teachers to remix diverse resources;
3. they can be integrated into teaching platforms, facilitating teachers in conducting multi-scene, blended teaching, and analyzing learners' learning behaviors, thereby providing precise teaching support services;
4. students can simultaneously access external resources, allowing for dynamic content updates and expanding their acquired knowledge. These advantages align with the learning styles of students in the digital age and introduce new possibilities for digital education and teaching.

Despite significant progress in the conceptualization [7], policy promotion [8], and practical experiences [9] in digital textbook development both domestically and internationally, there remains a lack of exploration on integrating the advantages of teaching platforms into the development of digital textbooks. Therefore, this research aims to utilize the various learning plugins available on the open-source platform MOODLE, taking EFL Course Textbooks in China's Higher Vocational Colleges as an example, to explore the design, development, and implementation of digital textbooks integrated within the teaching platform with the aim of merging teaching, learning, training, assessment, and management and providing practical experiences in the development of integrating digital textbooks within teaching platforms. This study contributes to serve as a reference for fostering innovative teaching models powered by digital technology, thereby advancing the transformation of digital teaching in the field of education.

2 Literature Review

2.1 What is a Digital Textbook?

The digital textbooks addressed in this paper represent a new form of teaching materials, distinct from e-books. These materials are formatted digitally, organized around discrete points of knowledge, enabling dynamic updates and structural adjustments.

They are designed to incorporate multimedia elements such as videos, audios, interactive content, and make use of emerging educational tools and platforms like online learning systems and virtual reality technology, aiming to provide a more enriched, interactive, and personalized learning experience [6,10]. This new form of textbook mainly encompasses loose-leaf textbooks, workbook-style textbooks, and multimedia textbooks.

Ding Xigang, a Chinese scholar[11], outlined the key characteristics of digital textbook in vocational education as follows:

1. the content framework is specifically designed for specific vocational positions, using typical work tasks as foundational units;
2. these content materials can be dynamically and flexibly updated, optimized, combined, and further developed;
3. they offer multi-modal resources with strong interactivity, linking to diverse media like videos, podcasts, live hyperlinks, and supplementary resources;
4. they serve as integral components of an interconnected teaching and learning ecosystem, collaborating with online platforms and teaching tools to provide students with comprehensive learning support and resources, while also meeting the demand for personalized teaching and learning;
5. they generate learning profiles, adaptive learning assessments, student portfolios, data on teacher-student or student-student interactions.

2.2 Brief Review of Digital Textbook

Since 2011, China's Ministry of Education has been advancing the progress of digital textbooks, encouraging the reasonable application of digital technology, and exploring the development of new forms of educational materials such as digital textbooks. Numerous courses have started to adapt into loose-leaf textbooks, workbook-style textbooks, and multimedia textbooks. Through literature review, it is found that research on new forms of textbooks in China mainly focuses on four aspects [12]:

1. Introduction of its conceptualization, connotation, and characteristics;
2. Theoretical studies on textbook development;
3. Practical experience on textbook design and application based on specific courses;
4. Discussion on textbook quality and evaluation standards.

Despite changes in textbook layout, paper-based textbooks remain predominant, and the promotion and application of e-versions are still in the initial stages, yet to enter the phase of developing and applying digital textbooks integrated within teaching platforms. The advantages of digital textbooks are still to be continuously explored. Yang Hao emphasized that being digital is the most crucial element of new types of textbooks[13]. Digitalized teaching places greater emphasis on the interactivity of textbooks, emphasizing personalized learning design for learners. Therefore, the development of intelligent digital textbooks based on teaching platforms is considered one of the important trends.

Some developed countries exhibit a leading edge in the conceptualization, promotion, and practical experience of digital textbooks. In 2012, the U.S. Department of Education and the Federal Communications Commission established the Digital Textbook Collaborative Group, offering guidance for the development of digital textbooks across schools, districts, and states. That same year, the group released the Digital Textbook Playbook, regarded as the blueprint for the development of digital textbooks in the United States. The U.S. Department of Education initiated the Open Textbooks Pilot Program (OTP) in 2018, which is a federal funding initiative supporting eligible higher education institutions in creating new open textbooks[14]. South Korea's Ministry of Education published the Action Plan on Promoting SMART Education (2011-2015) in 2011, with one of its primary tasks being the development and application of digital textbooks. Starting in May 2013, the implementation of the Development and Activation Plan of Digital Textbooks aimed to establish a complete digital textbook system, connecting classroom and home learning. By 2021, South Korea had 10,755 primary and secondary schools using digital textbooks[15]. In German vocational education, the development, approaches, and quality standard evaluation of chart-based workbook-style textbooks have formed a closed-loop system[16]. The modular-based "loose-leaf textbooks + reference books" textbook series in France is notably distinctive [17].

Their exploration and experiences in the development and application of new teaching textbooks have laid a solid foundation for the development of digital textbooks and their integration with teaching platforms. With the widespread use of AI tools, MOODLE, as an open-source teaching platform with numerous AI plugins, leverages this unique advantage. It facilitates developers or educators to explore and implement the development of integrated digital textbooks on the platform, promoting the intelligent development of digital textbooks.

2.3 Overview of MOODLE Platform

MOODLE (Modular Object-Oriented Dynamic Learning Environment) is a widely adopted educational management platform used globally. It is compatible with various operating systems such as Windows, Linux, and MAC, providing teachers and students with services related to course development, online teaching, and instructional management. As an open-source software, the MOODLE platform possesses remarkable scalability. By installing various plugins, users can expand and enhance the platform's functionality, thereby meeting their diverse needs.

3 Design of Digital Textbooks for EFL courses in Higher Vocational Colleges

3.1 Framework of module-based digital textbook

Based on national teaching standards, the instructional content is modularized to create typical work tasks. Following the principles of language acquisition, the learning

and training of English language skills—listening, speaking, reading, writing, translating, and viewing—are presented through multimodal formats. Leveraging the strengths of language learning plugins on the MOODLE platform, this approach innovates traditional language teaching methods. It profoundly embodies the student-centered educational philosophy, allowing students to immerse themselves in authentic language environments to complete the second language acquisition process, thereby integrating teaching, learning, assessment, and management seamlessly. The framework of the module-based digital textbook is illustrated in Figure 1, including reference standards, cultivated language skills, types of multimodal materials, and platform plugins.

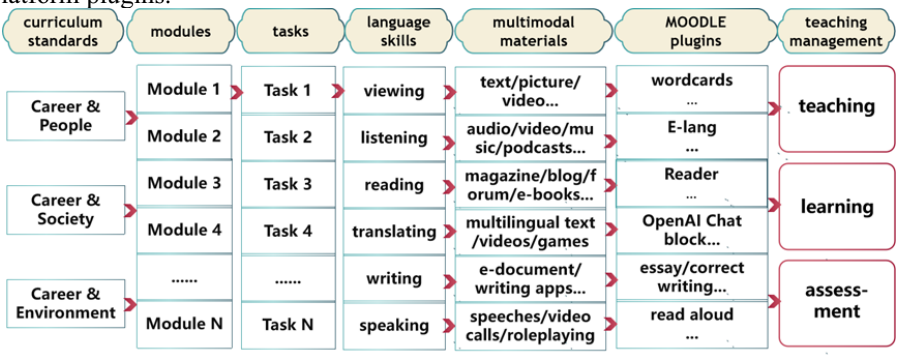

Fig. 1. Design of the digital textbooks for EFL Course in China

3.2 Underpinning Theory

The design and development of digital textbooks for this course is grounded in the Anchored Instructional Model and the Input-Output Theory of language learning. The Anchored Instructional Model aims to provoke students' active learning and inquiry by introducing problems or scenarios that spark their interest and deep thinking, encouraging them to raise questions and seek solutions using various tools. This teaching model helps stimulate students' learning motivation and autonomy, fostering deeper learning and comprehension [18].

The Input-Output Theory of language acquisition emphasizes that learners require exposure to rich, diverse, and effective language input to better apply language knowledge, thereby generating more accurate and enriched language output. This process helps reduce learners' language acquisition anxiety [19].

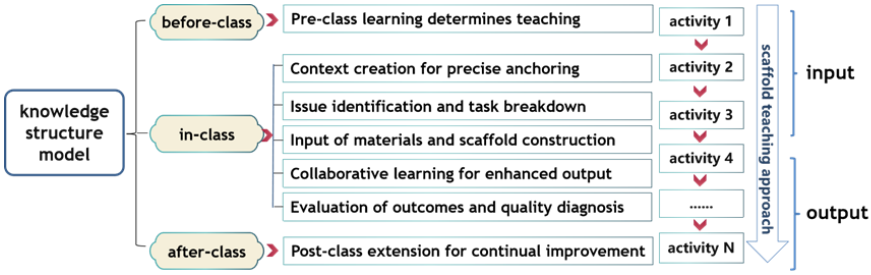

Fig. 2. Knowledge Structure Model of Platform-based Digital Textbook

Combining the Anchored Teaching Model and Input-Output Theory in textbook design creates an engaging, challenging, and exploratory learning environment, which provides ample language input while encouraging active engagement, thereby enhancing students' language output and motivation. Consequently, these theories significantly impact the creation of new digital textbooks integrated with teaching platforms, aiding designers in better meeting students' learning needs and fostering comprehensive improvement in language skills. The knowledge structure model of the digital textbook based on the underpinning theories is presented in Figure 2.

3.3 Envisaged Effects of Digital Textbooks

Digital textbooks, as a valuable supplement to traditional paper-based textbooks, should demonstrate their advantages in non-linear content restructuring, multimedia content presentation, diverse teaching methods, digitalization of the teaching process, and visualization of teaching management, which is to compensate for the shortcomings of paper-based textbooks.

In terms of organizing course content, digital textbooks should be highly flexible, allowing for easy adjustments and additions to reflect the timeliness and interactivity of the curriculum. They are presented as interactive textbooks, resembling a collection of dynamic pages.

The presentation of digital textbooks should be multimedia-oriented, incorporating various forms such as text, images, videos, animations, audio, and augmented reality (AR) to enrich learners' sensory experiences.

The functionality of digital textbooks should not be limited to content presentation but also serve as assistants and catalysts in the teaching process for both teachers and students. They provide various features such as attendance tracking, announcements, quizzes, exams, real-time Q&A, and other means of information support for course instruction. Additionally, they record various data in real-time to provide a data-driven foundation for teaching reflection.

4 Implementation of Digital Textbook Based on the MOODLE Platform

4.1 MOODLE Platform Deployment

To enable teachers and students to access digital textbooks anytime and anywhere, the EFL Coursebook digital textbook utilizes a B/S (Browser/Server) architecture (as shown in Figure 3). The MOODLE platform is deployed on a web server, enabling visitors to access it through computer terminals or mobile apps, which greatly enhances the convenience of teaching for both teachers and students, showcasing the full potential of digital textbooks.

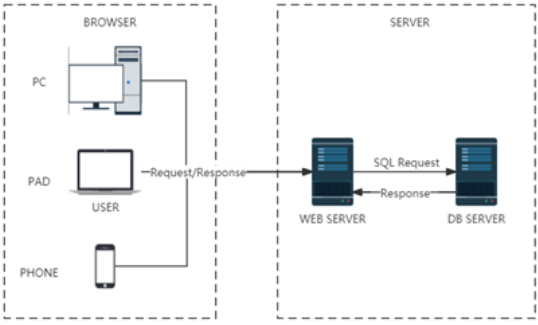

Fig. 3. The Service Deployment of the MOODLE Platform

The MOODLE platform is constructed utilizing the LAMP (Linux, Apache, MySQL, PHP) stack. The server operates on the Centos 8 operating system, while the MYSQL 8.0 database is employed. The platform is hosted on the APACHE web server and operates within the PHP environment. Regarding the server hardware, it features an Intel Xeon Platinum 8361HC CPU (2.60GHz), accompanied by 16GB of RAM, a 500GB hard drive, and a network bandwidth of 100M.

4.2 Development of Digital Textbook for EFL Courses

Firstly, it is necessary to create a course titled EFL Course Textbooks on the MOODLE platform, along with a comprehensive outline for each chapter. Subsequently, the chapters should be populated with relevant and appropriate content.

The MOODLE platform offers a diverse range of resources for presenting course content. Course materials can be displayed in various formats, including HTML, PDF files, as well as multimedia formats such as images, audio, video, and animations. Additionally, external supplementary resources or references can be incorporated as hyperlinks directly into web pages, providing a versatile range of presentation methods.

To facilitate learners' acquisition of language skills, the MOODLE platform provides two assessment methods: quizzes and exams. Quizzes are employed to evaluate

learners' comprehension of specific modules or knowledge points after completing the learning process. These quizzes typically consist of a limited number of questions, efficiently assessing learners' mastery of the knowledge points.

For pivotal and challenging concepts within the course, the MOODLE platform also supports the flipped classroom teaching model. Teachers upload micro-lesson videos covering essential and challenging content on the platform and assign corresponding quizzes. Learners can repeatedly view the micro-lesson videos to continuously evaluate their understanding and proficiency in the knowledge points until they successfully pass the quizzes.

The digital textbooks also incorporate a communication platform where announcements pertaining to the materials can be shared, ensuring learners are updated with the latest information. In the event of any queries or concerns during the utilization of the digital course, learners can pose questions on the communication platform or directly interact with the instructor who can promptly respond to messages and address common questions through the Q&A section.

Leveraging the versatility of the MOODLE platform, the EFL digital textbooks can also offer language skills training in listening, speaking, reading, writing, and translation through the integration of plugins such as Essay, E-lang, ReadAloud, and OPENAI CHAT, which enable learners to effectively enhance their language skills.

4.3 Effects of Applying EFL Digital Textbooks

Once the content of the EFL Coursebook digital teaching materials has been developed on the MOODLE platform, users can conveniently access the materials either through the web or the dedicated mobile application. The user interface for accessing the materials on the app is illustrated in Figure 4.

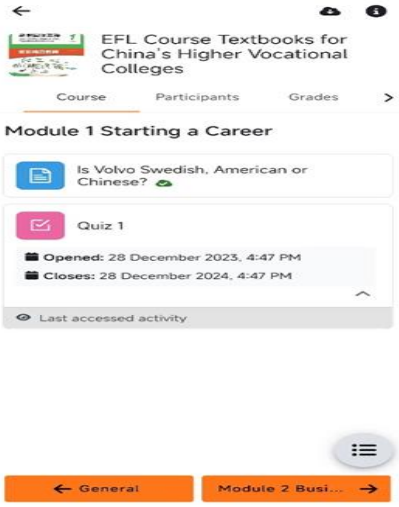

Fig. 4. Browsing EFL Digital Textbook on the Mobile App

In order to provide learners with timely feedback and constant guidance from instructors, the EFL digital textbooks have incorporated the OPENAI CHAT plugin, which integrates with CHATGPT, enabling real-time, rapid, and accurate responses to the questions learners encounter during their learning process (as shown in Figure 5).

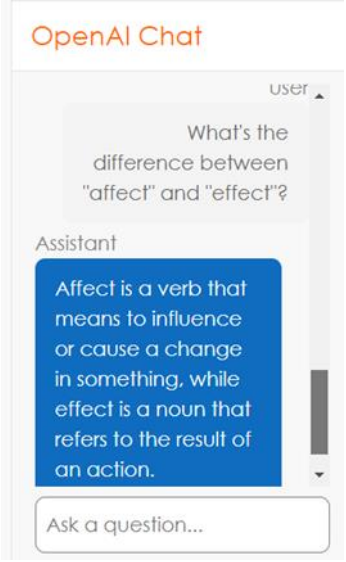

Fig. 5. Real-time Question-Answering with OPENAI CHAT

Dictation skills are a major challenge in language learning. The EFL digital textbooks utilize the E-Lang plugin to facilitate dictation training with short videos (as shown in Figure 6).

Fig. 6. Vocabulary Dictation Training with E-Lang

5 Conclusion

Digital textbooks are the future trend of educational resources and an essential component of the digital transformation in education. The EFL digital textbooks, built on the MOODLE platform, effectively address the limitations of traditional printed textbooks in terms of chapter organization, content presentation, and instructional applications. They offer flexible organization, rapid updates, abundant resources, multidimensional displays, real-time interaction, and convenient usage. These characteristics meet the demands of teachers and students for ICT teaching in the digital era, making it a beneficial exploration in the digital transformation of education.

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