

A Literature Review of the Current Status of Digital Teaching Material Research in China

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Abstract: In the context of the digital era, various forms of digital teaching materials have emerged. This paper attempts to summarize and reflect on the contributions of previous researchers by means of literature analysis to grasp the existing research results and future research directions in the field of digital teaching materials. By sorting out the concepts related to digital teaching materials, outlining the research results of teaching theory and practice, summarizing the shortcomings of domestic digital teaching materials research, and proposing that in-depth research can be carried out in the future on the corresponding teaching models and teaching environments.

Keywords: Digitization; Digital textbook; Literature analysis.

1. Introduction

With the development of science and technology and educational reform, digital teaching materials have gradually appeared in people's view, and research on digital teaching materials teaching, publication design and related information technology development has appeared one after another. The new curriculum reform puts forward three major concepts - focus on student development, emphasize teacher growth, and focus on learning to teach, this reform requires that classroom teaching is no longer teacher-centered, emphasizing the one-way output of knowledge, but more concerned about the development of students, advocating student-centeredness, and paying more attention to the interactive effect of the classroom, and the paper version of the teaching materials due to the relatively fixed content of the learning process, which can't be changed according to the needs of students, and the learning mode is based on students receiving the input of knowledge, resulting in the development of digital teaching materials and the development of related information technology. As well as the learning mode to students to accept the input of knowledge, resulting in students' mastery of knowledge is not sufficiently three-dimensional characteristics, can no longer meet the needs of today's teaching, the generation of digital teaching materials is necessary. However, in the case of the massive development of digital teaching materials, there are also a lot of difficulties, such as the lack of educational theory in the preparation of guidance, inappropriate use in teaching practice, teachers and students do not have a good enough understanding of digital teaching materials, in the publication, distribution and promotion of the difficulties, the cost is expensive, and the lack of relevant regulations in the overall control of the management, and so on.

2. Literature Review

2.1. Conceptual definition and morphological development

Digital textbooks first appeared in the mid- to late 1990s, but nowadays researchers have different definitions of the concept of digital textbooks, and there is no systematic

distinction between e-textbooks, digital textbooks, multimedia textbooks, and rich-media textbooks, etc. Therefore, we adopt digital textbooks as the collective term for this series of concepts in this article.

Therefore, in this article, we adopt digital teaching materials as a collective term for this series of concepts. First of all, different researchers have their own definitions of the concepts and characteristics of digital teaching materials. Chen and other scholars (2012) believe that e-teaching materials are a kind of e-books or reading materials that follow the law of students' reading, facilitate the organization of learning activities, conform to the requirements of curriculum objectives, and are arranged in accordance with the style of books. Bi Haibin and other scholars (2012) proposed that the basic characteristics of digital textbooks are paper-based textbooks as the basis for the core of the course teaching, multimedia network as a means; in the structure of the main electronic textbooks, teaching resources, learning tools, question bank assessment, animation games, and interactive environment and so on six aspects.

With the development of science and technology, the concept of rich-media teaching materials gradually appeared, Wu Dan (2015) believes that rich-media teaching materials is a new form of digital teaching materials, supported by rich-media related technology, video, text, images and other rich-media resources into one, the content design in line with the syllabus, curriculum standards, teaching materials preparation specifications, containing advanced teaching concepts and personalized learning path, learning mode The learning mode is more free, which can greatly enhance the participation of learners and the adhesion of resources. According to Fu Wei (2011), rich media technology is used to give traditional media friendly interactive functions and complex visual embodiment, and it is an emerging media form that combines traditional media technology and interactive technology, with rich and diverse UI (user interface) presentation, in-depth user interaction, real-time response and dynamic drive. Rich media teaching materials pay more attention to the application of media resources on the basis of digital teaching materials, not only the presentation of media materials, but also pay more attention to the interactivity of students' learning process, which is

more conducive to the student-centered teaching method. This type of teaching materials has advanced technologically, but there is no great change in the teaching concept as well as the writing standards. Li Yazheng and other scholars (2016) pointed out that with the development of technology and the popularization of mobile devices, in recent years, the media-rich digital teaching materials that pay more attention to the interactive experience and integrate graphic animation and audio-visual interaction have been rapidly developed at home and abroad.

Meanwhile, some researchers have proposed the concept of interactive digital textbook. Du Ruo and other scholars (2018) believe that interactive digital textbook is a more interactive digital textbook, and its concept should be based on the concept of digital textbook. Yazheng et al. (2016) defined interactive digital teaching material as a kind of digital teaching material that is suitable for mobile reading terminals, integrates multimedia resources such as graphic, audio, video, animation, and multiple interactive modules, has a systematic teaching content system, conforms to the laws of digital publishing arrangement, design and development, and has a stronger interactivity. According to Bi et al. (2012), interactive textbooks are based on paper textbooks, with course teaching as the core and multimedia network as the means. Therefore, only from the conceptual point of view, there is no obvious difference between interactive digital teaching materials and media-rich teaching materials in the definition, which are also based on the concept of digital teaching materials, using a variety of media technologies, and focusing more on interactive functions: the difference is that media-rich teaching materials are more oriented to the name.

The difference is that rich media teaching materials are more oriented to the application of rich media technology in their names, while interactive digital teaching materials add the use of mobile terminals and pay more attention to the interactive function of teaching materials. Meanwhile, in terms of teaching functions, interactive digital textbooks have developed on the basis of digital textbooks. According to Zhang Ruijing et al. (2017), unlike static digital textbooks and multimedia digital textbooks that focus on "teaching", the function of mobile interactive digital textbooks is mainly manifested in the link of "learning".

Zhuang Hongquan proposed the concept of new form teaching materials in 2020 and summarized it as teaching materials that can adapt to the needs of teaching under the conditions of informatisation, meet the needs of learning in the Internet era, and have rich expressive power through the integrated use of multiple media. Researchers have explained the definition of new form teaching materials from the aspects of form, content display form, effect and specific form, which shows that the new form teaching materials can be used as a general term for teaching materials produced in the era of informatisation. First of all, they do not restrict the use of mobile terminals, add digital resources on the basis of traditional digital teaching materials, adapt to the development of information technology and education teaching, and at the same time meet the needs of learning in the Internet era. New form teaching materials is a general term for teaching materials produced in the era of information technology, but they can be constantly updated with the development of technology. According to the definition of new teaching materials, researchers have categorized the new forms of teaching materials into: electronic teaching materials, rich media mobile interactive teaching materials, and

curriculum-centered fusion teaching materials. The definition of electronic teaching materials is the same as that of previous researchers, i.e., the simple electronicization of paper teaching materials: "Internet+" teaching materials are the combination of paper teaching materials and digital teaching materials, and the "Internet+" teaching materials are the combination of paper teaching materials and digital teaching materials. The "Internet+" textbook is a combination of paper textbook and digital textbook, which is linked to network resources through QR code technology to make the textbook more three-dimensional; the concepts of rich-media textbook and mobile interactive textbook are merged, pointing out that they are the upgrading of electronic textbook, and at the same time, focusing on the use of rich-media technology and the presentation of interactivity, which can increase the students' interest in learning and the learning effect; last but not least, the main difference of the course-centered integrated textbook comparing to the previous three forms is that it has added "assessment". Finally, the main difference between the curriculum-centered integrated teaching materials and the previous three forms of teaching is the addition of the "assessment" function, which is not limited to the form of teaching, but focuses on the curriculum standards as the center, integrates the content and advantages of the previous three teaching materials, and is more flexible, and supports the functions of teaching, learning, testing, practicing, and evaluating at the same time.

For the development lineage of digital teaching materials, different researchers have also sorted it out, Hu Shian and other scholars (2014) proposed that digital teaching materials are divided into three forms: static media digital teaching materials, multimedia digital teaching materials and rich media digital teaching materials, and the richness, interactivity, and dynamics of their media resources are constantly increasing with the development of the technology; Dong Jianqiao and other scholars (2002) summarized the media changes of textbook teaching materials into four forms: printed paradigm textbook teaching materials, audio-visual and electronic teaching materials, hypermedia interactive teaching materials, and digital network teaching materials. According to Zhong Cenzen (2016), the overall development shows "emphasizing the digital restoration of the content of paper textbooks, supporting rich and dynamic media forms, effectively integrating various media resources, integrating content resources, terminal devices, teaching tools and other media. The integration of content resources, terminal equipment, teaching tools and service platforms".

From this, we can see that digital teaching materials are a kind of teaching materials that have been gradually developed in the information age, which are structured in accordance with the traditional style of books and have some innovations, and integrate a variety of multimedia contents into one, which can provide an interactive learning environment, satisfy the teaching standards of the curriculum and are conducive to the realization of the teaching objectives. In the course of development, it basically observes from the simple digitalization of paper textbooks, such as directly converting them into PDF form, to the multimedia digital textbooks focusing on interactive experience, including graphic animation and audio-visual effects, to the interactive textbooks based on mobile terminals, and then to the integration of textbooks centered on curriculum teaching.

2.2. Characteristics

China's research on digital teaching materials has the following characteristics: 1. media-rich: rich media presentation, very attractive, closer to the students' usual contact with the game, entertainment media. 2. interactivity: with diversified interactive experience modules, students learn knowledge in active exploration. 3. timeliness: synchronized updating of teaching materials with the times. 4. portability: with the convenience of remote transmission through the network and the portability of reading based on mobile terminal storage. 5. cost-effective: the on-demand reproduction and sharing of digital content is extremely cost-effective for digital textbook publishers and textbook users.

In terms of media characteristics, although numerous researchers call each developmental form differently, the overall presentation.

By analyzing 742 pieces of related literature, Zhong Cencen (2016) concluded that domestic research on digital teaching materials is diverse but slightly insufficient in depth, and the overall presentation is characterized by practice first and theory later.

The publishing form of digital textbooks adopts electronic and digital publishing, which is easier to realize on-demand publishing and on-demand reading. Its editing and publishing process can be divided into three stages, namely, the teaching material content writing stage, the digital teaching material editing stage and the teaching material distribution stage. Its related elements include: textbook content, talent team, digital editing tools, textbook pricing, textbook distribution channels, and R&D and promotion funds. (Li Yazheng Zhou Rongting He Tongliang, 2016). Yu Tao (2017) conducted a study on the publication and application of rich media teaching materials, which showed that rich media teaching materials have the characteristics of rich media nature, interactivity, timeliness, personalization and so on. Media-richness is the external manifestation, and interactivity is the key feature. The publication mode of media-rich teaching materials is mainly divided into three types: media-rich traditional publications, media-rich electronic publications, and teaching materials of media-rich resources. Schools and education administration departments are the main driving force of rich media teaching material publishing, traditional publishers are the active participants of rich media teaching material publishing, and technology companies are the technical promoters of rich media teaching material publishing. Western countries such as Europe and America started the research of media-rich teaching materials earlier, for example, France started the development of e-teaching materials and teaching experiments in 2000, and in China, the more economically developed regions have also implemented the use of digital teaching materials earlier. However, there are problems of copyright protection and profit model.

2.3. Applied Research for Teaching and Learning

Zhao WeiQiong (2014) proposed that the design of electronic teaching materials should follow the following principles: (1) the user's reading experience of the interface structure and process should be consistent with the experience of reading traditional books: (2) the interface color matching is reasonable, coordinated and beautiful, and the interaction processing should be easy to identify and easy to trigger; (3) the format of multimedia materials should be in line with the

requirements of the relevant software format. The research on the design and application effect of teaching materials can be carried out through the corresponding theoretical foundations: the theory of multiple intelligences, the theory of personalized learning, the flipped classroom teaching model and the relevant design principles. He also explains that the design and use of interactive electronic teaching materials play a better role in helping students break through the difficult points, stimulate the enthusiasm for learning, improve the efficiency of learning and improve the ability of self-study.

Multiple Intelligences Theory is put forward by Howard Gardner, a contemporary American psychologist, who believes that human intelligence is composed of nine intelligences: linguistic intelligence, logical/mathematical intelligence, visual/spatial-relational intelligence, musical/rhythmic intelligence, bodily/illusory intelligence, interpersonal intelligence, self-reflective intelligence, natural observer intelligence, and existential intelligence (Huo Liyan, 2000). Multiple Intelligences Theory seeks to incorporate a variety of materials in an effort to develop multiple intelligences in each module and to enhance students' multiple intelligences.

The Department for Education and Skills (DFES) of the United Kingdom put forward the concept of "personalized learning" in 2004, identifying personalized learning as consisting of five basic elements: assessment for learning, effective learning, curriculum choice, school management, and out-of-classroom development and support. (Fei Long, Ma Yuanli, 2010) Personalized learning refers to a learning paradigm that is based on students' individual differences and aims to promote students' individual development (Liu Xuezhi, Fan Lishuang, 2013). The theory of personalized learning promotes educational equity and quality education to a certain extent.

Flipped classroom comes from the English word "Flipped Class", also known as reverse classroom, which has changed the previous teaching mode, giving the classroom time originally used for the teacher to unilaterally impart knowledge to the students, and focusing on the interaction between the teacher and the students to answer questions, with the basic knowledge and knowledge of the students as the main focus.

It changes the previous teaching mode by giving students the classroom time originally used for the teacher to impart knowledge unilaterally, and focuses on the interaction between the teacher and the students to answer questions, while the basic knowledge is completed by the students' independent study outside the classroom. The main features of the flipped classroom model are: First, the form of student learning is in the form of teaching videos, which has a strong focus; Second, the teaching information is clear and unambiguous, and will not distract the attention of students; Third, it reconfigures the learning process of students, which helps students to better understand and digest the knowledge Zhao Wei-Qiong (2014). Flipped classroom teaching mode increases the interaction in learning, which is conducive to better mastery of knowledge by students.

Micro-course is a foreign word, also known as Mini course, abbreviated as micro-course. This concept was first proposed in 1960 by AIU Affiliated Schools in the U.S. Micro-courses were formally known after David Penrose first proposed the "one-minute micro-video" "micro-course" in 2008 (Chen Li, 2013). The micro-course learning model and related design principles help learners to pre-study before class and review

after class by means of short videos of knowledge points, which improves the efficiency of teaching and facilitates the realization of the flipped classroom. Yu Tao (2017) also pointed out that the application scenarios of media-rich teaching materials are specifically reflected in the development of inquiry teaching, reshaping the flipped classroom: flipping the teaching mode from "teach first and then learn" to "learn first and then teach" and enriching the second classroom: media-rich teaching materials have changed the way "teachers guide students' learning". "Teachers' guidance and support for students' learning is seriously insufficient, and students have insufficient learning resources and nowhere to turn to for help when they encounter learning difficulties. It breaks through the limitations of traditional teaching resources and brings a new interactive teaching experience and a new way of learning, which has a broad development prospect. Previous studies have also attempted to design and practice interactive e-textbooks. For example, Pearl Li (2013) designed a set of interactive code for children's electronic teaching materials by analyzing the characteristics of children's groups, under the guidance of theories of cognitive psychology, child psychology, instructional design, and interaction design; at the same time, it was pointed out that appropriate interspersed interactive behaviors or interactive behaviors that can trigger the teaching objectives are the purpose of adding interactive design in electronic teaching materials, and that instructional design must be more important than interaction design in the whole design of electronic teaching materials. In the whole e-textbook design, teaching design must be more important than interaction design.

Previous studies have also given suggestions on the process of classroom teaching, for example, Gong Chaohua (2013) divided the process of e-textbook into four stages: preparation, design, implementation and reflection, iPad-based e-textbook can be used as the main learning resources to support classroom activities and an important cognitive tool for classroom teaching activities, and the e-textbook can be used to carry out resource-based learning and problem-based learning. Chen Junsheng et al. (2014) designed a model for the application of digital teaching materials before, during, and after class based on the concept of teaching model in the environment of "Guangdong Teaching Cloud".

Zhuang Shaoyong et al. (2013) found through an empirical study of English classroom teaching in Hong Kong elementary school using classroom observation and questionnaires that e-textbooks played a significant role in facilitating the design of e-textbooks, students' interest and motivation in learning, students' acquisition of knowledge and skills, students' approach to deep learning, and classroom participation.

Zhang Ruijing et al. (2017) argued that the impetus for the renewal of digital textbooks comes not only from the innovation of science and technology, but also from the continuous deepening and expansion of China's teaching reform. The construction of new-form teaching materials, which is currently being vigorously promoted, is to implement student-centered teaching activities in combination with the changes in the learning environment and conditions of the mobile Internet. Wei Zhenshui (2016) conducted a comparative analysis of the core elements of teaching, pointing out that the new form of teaching materials emphasizes the concept of "student-centered, teacher-student common development".

3. Conclusion

3.1. Education

At a time of rapid development of information technology, it is of great significance for China's educational development to actively research and develop interactive digital teaching materials and promote their application in educational activities. According to Gong Chaohua (2013), the problems that need to be paid attention to in the future classroom teaching practice of electronic teaching materials include: resource design and development, classroom application mode, teaching environment construction, teaching concept change, classroom organization and management.

Among them, the problem of resource design and development has been analyzed and explored in detail in classroom application and classroom organization, because digital textbooks are not popularized on a large scale at present, and only in a few developed regions can achieve the conditions of using digital textbooks for teaching, so the research stays at the level of a few pilot studies as well as theoretical researches.

3.2. Publishing and Information Technology

Li Yazheng et al. (2016) pointed out that in the era of digital publishing wave and traditional paper textbook impact, interactive digital textbook will become the future development trend of textbook digitization, and the study of editing and publishing characteristics of interactive digital textbook is of great significance to the application and promotion of interactive digital textbook. However, domestic research and development experience and practice are far behind the level of foreign developed countries, so more scholars, digital publishing organizations and textbook publishers need to work together to fill the gap of the application practice of interactive digital textbooks in China. Under the background of scientific and technological innovation and educational reform, the form of digital teaching materials is constantly changing, and it is believed that with the rapid change of information technology, more cutting-edge technologies will be introduced into the field of education and applied to digital teaching materials, which will innovate and change the traditional teaching methods. In the near future, digital teaching materials can even realize the "direct dialogue" with the user, and at this time, the textbook is not a textbook in the pure sense, but an intelligent digital textbook (Cui Lei, 2017). Bi et al. (2012) proposed that the development path of digital teaching materials should follow the route of "traditional teaching materials - electronic textbooks limited to electronic content - digital teaching materials providing online learning tools and online teaching services for electronic textbooks - embedded digital teaching materials providing in-depth excavation and processing of teaching materials and value-added services with high value-addedness". The route to break through the innovation step by step. Zhang Ruijing et al. (2017) proposed that mobile interactive digital teaching materials show three major development trends: the full application of VR/AR technology, a shift from teaching materials to learning materials in terms of functionality, and a shift from development to design in terms of research and development.

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