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Construction and Design of All-Media Digital Textbook

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ABSTRACT
All-media digital textbook reconstructs traditional materials and online courses with the support of information technology in Internet plus era. It redefines the traditional teaching and learning, and also reforms the way of reading and the habit of learning. All-media digital textbook integrates three key elements: contents of course, learning platform and reading terminal. Not only has it changed the media presentation of teaching contents, but more importantly, it has changed the way of interaction among students, teachers and teaching materials. It has combined all education activities such as teaching, learning, testing, evaluating, managing, servicing and researching, etc. The construction and design of All-media digital textbook should pay more attention to the integration of systematization and individualization, interaction and big data, fragmentation and rich media.
Keywords: *All-Media Digital Textbook (hereinafter, AMDT), Fragmentation, Internet plus, Individualized Learning*

1. INTRODUCTION

1.1 Epoch Significance of AMDT

With the development of information technology by leaps and bounds, the form, content, distribution and use of teaching materials are constantly changing. Various conceptions arise as the times require, such as e-textbook, digital textbook, techbooks, electronic textbook, digital materials, electronic schoolbag, and so on. In recent years, the publishing industry has proposed an all-media transformation of user-first and depth data. The electronic schoolbag launched by compulsory education has made a good start for the network transformation of traditional teaching materials.

In 2012, National Open University launched the construction of AMDT, and proposed that all courses should adopt AMDT in future [1]. The publishing industry is facing a second "digital publishing technology revolution" proposed at 2016 China Cloud Computing Conference.

At present, the research of digital textbooks focuses on electronic textbooks, rather than all-media textbooks in the real sense, and the research results are relatively focused on electronic schoolbags.

1.2 Essential Characteristics of AMDT

In essence, AMDT is far from paperless reading. Through the Internet + information technology, it creates an open digital learning environment, subverts the traditional teaching mode, and advocates personalized learning and innovative learning. All-media textbooks reconstruct paper textbooks and online courses, which have the characteristics of media diversity and mobility, content richness and relevance, teaching interaction and openness. AMDT integrates teaching contents, learning platform and reading terminal [2], as shown in Figure 1.

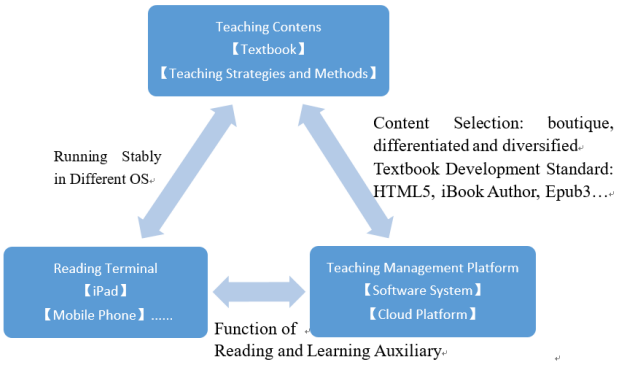

Figure 1 Three elements of construction and design of AMDT

"Teaching contents" provide all the resources needed for teaching through rich media, which still maintain the attributes and characteristics of teaching materials; "Teaching management platform" ensures that all-media teaching material runs stably in different operating systems, records the whole studying process including learning, testing and evaluation, realizes the function of interaction (such as bookmark notes, self-test exercises, forum answering questions, formative examination, behavior record and big data collection, etc.); "Reading terminal" should allow learners to choose their favorite terminal form to complete all aspects of learning in a flexible way and time. Therefore, these three core elements must be taken into account in the development of all-media teaching materials. All-media materials give full play to their flexibility, diversity and openness, so that people can better adapt to the drastic changes brought by the deep integration of information technology and education.

1.3 Digital Textbook VS Web Courses VS AMDT

E-Textbook is simply to show the content of traditional textbooks in digital media. Network course refers to the teaching content and teaching activities of a certain subject are all realized through the network. All-media teaching textbook is a complete subversion of the traditional teaching material, which integrates content, platform and terminal, and realizes all teaching activities such as teaching, learning, testing, evaluation, management, service and research etc. All-media teaching textbook strengthenes the education of reading content, the assistance of platform to teaching, the security and portability of terminal. On the basis of E-Textbook, it plays more emphasis on the richness of resources, the diversity of platforms and the interaction of processes. All-media teaching material is also a complete subversion of network courses. It integrates learning resources and learning process of courses, combines the product of digital publishing and the scene of digital education.It realizes the organic integration of digital resources and teaching activities, teaching materials and teaching auxiliary functions, learning and evaluation, on-class teaching and off-class work. It fully embodies the advantages of all-media, such as interactivity, intuition, jumping, convenience, expansion, measurability, flexibility, entertainment etc. [3]

2. TEACHING AND LEARNING IN AMDT

Constructivism holds that learning is a process of active construction of internal psychological representation in the process of interaction between learners and environment [3]. Learners acquire knowledge by means of meaning construction in a specific situation with the help of various learning materials and learning resources. The media richness and relevance of AMDT can help learners to understand the internal relationship between the current knowledge and other knowledge more easily, and can also understand the cognitive structure of knowledge more profoundly to draw inferences from one example to another. ADMT greatly changes the reading and learning methods in the digital era. It not only changes the media presentation of teaching content, but also changes the interaction mode between students, teachers and teaching content. Traditional teaching and learning are redefined. Teaching is integrated into learning, learning embodies teaching, individual extended learning, self-organized learning, interactive learning, fragmented learning, ubiquitous learning, project learning, mobile learning, integrated teaching, differentiated teaching, flipped classroom, micro-courses, and so on. All kinds of new learning and teaching modes are springing up.

2.1 The Roles Changes of Teachers and Students

In the era of Internet plus, students as "digital natives" and teachers as "digital immigrants", the traditional teaching mode is bound to be impacted. Therefore, Dole emphasizes, "postmodern curriculum recognizes students' ability of self-organization and reorganization, and takes the cultivation of this ability as the focus of curriculum" [3]. Self-organized learning promotes a change in the relationship between teachers (educators) and students (education receivers), who together become the main body of curriculum generation and construction. Its essence is student autonomy. Teachers need to maximize the potential of students and carry out differentiated teaching; Students need to learn to think cooperatively and learn collaboratively to actively construct knowledge through collaboration in addition to independent learning.

In the Internet plus environment, resources are inexhaustible. Information can be organized and managed to transform into learning resources. The traditional textbook are the divergent points of knowledge, which can infinitely related to various types of media resources. Therefore, teachers should be good at the organization and management of resources to build curriculum, and also good at training students' ability to distinguish, collect and organize resources. Teachers divide students into learning groups according to teaching objectives, make learning rules, advocate innovative learning, and participate in classroom sharing and evaluation.

2.2 Learning methods in AMDT

As students in the all-media era, they have the characteristics of autonomous learning, ubiquitous learning, extensive and free choice. The form of learning is not limited to traditional face-to-face learning, but more independent learning, cooperative learning and mobile learning. Therefore, self-organized learning and interactive learning have become the two most important learning methods in AMDT. Interactive learning includes three types: interaction between students and resources, interaction between students and teachers, and interaction between students and each other. The design of AMDT should focus on guiding the students to interact with resources. When mining and processing the teaching content, teachers must choose appropriate media presentation, because the effect of words, audio, video or animation can vary considerably. The interaction between students each other, teachers and students includes both in class and out of class. The openness and interactive performance of AMDT meet the needs of digital natives to learn anytime and anywhere. Through the tool of email, BBS, QQ and WeChat, they can communicate freely to solve the problems encountered in learning. Teachers can release preview before class and review after class through the platform, collect feedback information of students, discuss with students in real-time forum, and achieve more flexible interaction though communication software.

3. CONSTRUCTION AND DESIGN OF AMDT

At present, AMDT have formed a professional research direction across digital reading, publishing, learning, information technology, involving digital reading format, learning resource design, learning design, teaching mode design (under the environment of rich technology) and so on [4].

3.1 Reorganization of knowledge structure in AMDT

AMDT needs to redesign the teaching content and teaching process and pay attention to the interactive process of learning; “Learner centered” should be considered in the construction of courses and the design of resources, in order to maximize the autonomy and creativity of learners [3]. When building the whole framework, we should focus on the overall process of learning, including before, during, after and out of class four links. According to the system thinking methodology model, each link of design makes full use of "learning goal oriented technology", "autonomous learning technology", "team learning technology", "stimulating and strengthening learning power technology" and "learning evaluation and feedback regulation technology", to provide students with a support platform for autonomous, cooperative and inquiry learning, to help them change their learning mode from passive accepted learning to active personalized learning and gradually form the ability of "systematic thinking" [5], as shown in Figure 2.

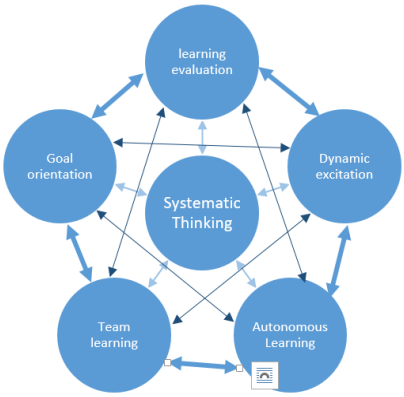

Figure 2 Five learning techniques of system thinking methodology model

Teaching contents should be fragmented, related and reorganized according to teaching objectives in AMDT. Fragmented learning, mobile learning and autonomous learning are complementary to each other. Content relevance refers to the use of the openness of the Internet to realize the relevance between different knowledge or the relevance of the same knowledge point among different subjects, so as to improve the depth and breadth of students' learning. Teachers must adjust and reconstruct the relevant knowledge points of ADMT with new knowledge view, curriculum view, learning view and education view.

3.2 Personalized learning design of AMDT

Under the new media environment, it is imperative to reform the traditional teaching materials by all-media to provide students with a new way of mobile learning experience and create a harmonious teaching environment. According to the research of Bethel National Training Laboratory in USA, there is a big gap in the learning effect brought by different learning methods, as shown in the "pyramid model" in Figure 3. It can be seen from Figure 3 that only 5% of the knowledge can be mastered through teaching, while the effect of acquiring knowledge through reading, audio-visual or demonstration is several times that of teaching, and the effect of mastering knowledge through discussion, practice, reverse teaching and immediate use is more solid. Therefore, how to use different learning methods for teaching design of

personalized learning is an essential step in the design of ADMT.

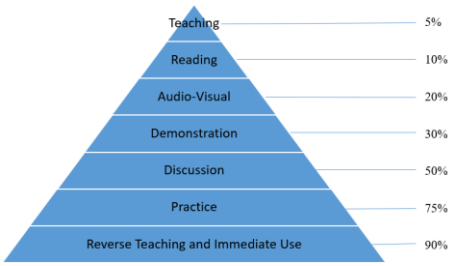

Figure 3 Effects Pyramid obtained by different learning methods

In ADMT, reconstruction of resources can strengthen the effect of reading and audio-visual. Traditional text resources can guide students to read by themselves, and deepen the absorption of knowledge points by combining multimedia resources such as video and audio. The highly operational, incomprehensible and important knowledge points are implanted with various forms of micro courses, emphasizing the combination of teaching and demonstration.

In the process of teaching design, teaching resources and teaching process, teaching in class and homework after class should be integrated organically. A learning mechanism should be established combining constraint and autonomy by task-driven learning closely linked to reality. With the purpose of self-discovery and self-realization, interactive learning and individual learning are carried out. Through discussion in study groups, students' ability of independent cooperation can be cultivated. Through problem- or task-driven learning, students' ability of solving and exploring problems can be cultivated. Through learning while testing and after class practice, internal motivation of learning can be mobilized.

The design of questions or tasks fully represents the level of teachers. How to stimulate students' desire for knowledge and exploration? How to embody the teaching goal and let the knowledge melt into a specific problem or task? How to build a learning community? How to share in class? How to carry out social investigation? These problems must be fully considered before teaching design, so that students can get a sense of learning pleasure and knowledge belonging in participation and sharing, and improve the effect of knowledge acquisition [6].

3.3 The Organic Integration of Fragmentation and Richmedia Resources

ADMT requires teachers to deeply excavate teaching contents and knowledge points, reorganize and process them through rich media such as pictures, texts, audio, images and video etc., present them from multiple angles and dimensions, implant rich teaching activities, virtual learning perception environment and clear learning process, so as to facilitate students to understand and master. At the same time, it integrates the process of learning, testing and evaluation to realize the function of online courses.

Mobile learning is anywhere and anytime to learn, and the corresponding fragmented learning is more and more accepted by learners. The organic integration of knowledge points and rich media can stimulate students' interest in learning and change them from passive learning to active learning. In order to meet this kind of fragmented learning method, we need to break and reconstruct the chapter system of traditional teaching materials, and fragment it. By defining the information model of ADMT, we can divide, aggregate and classify the resource elements from the perspective of educational semantics. The focus of fragmentation should be on wonderful, important and hard to understand knowledge points, and the teaching content and rich media form should be carefully designed to form wonderful micro-courses. According to the teaching objectives and cognitive rules, the knowledge structure is reorganized. When extracting knowledge points, pay attention to the universality, ubiquitous and small granularity of knowledge. When processing the teaching design, use the clear subjects and vivid cases, pay attention to follow the four links of knowledge introduction, innovation, transformation and evaluation, help learners realize the ability of new knowledge transfer, as shown in Figure 4 [3]. Through the relevance and openness of content, multi-dimensional and multi-directional interaction can be realized. When design the media, pay attention to the realization of knowledge across the media, pictures，animation, audio and video as the main, text as supplementary, through the media-rich immersion, stimulate students' learning interest [7]. When consider the interaction, games, experiments, simulations, online and offline tests should be closely focused on teaching objectives. The in-depth integration of fragmentation and rich media highlights the interest and expressiveness of information, improves the interaction of ADMT, and brings new application experience to teaching and learning, as shown in Figure 5.

Figure 4 Teaching design of fragmented knowledge points

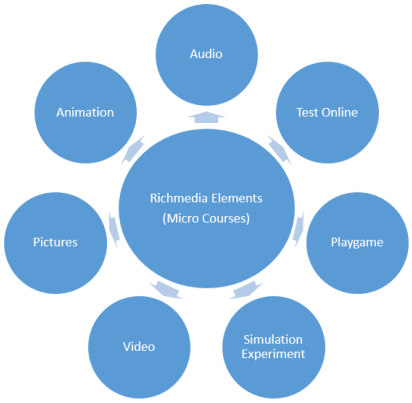

Figure 5 Integration of fragmentation and richmedia resources

3.4 Data fusion under the Internet + background

With the support of cloud computing and big data technology, the advantages of AMDT are mainly reflected in three aspects: (1) Because of infinite enrichment and continuous updating of resources, self-construction of new knowledge is realized through exploration and discovery of knowledge. (2) Through the statistics of students' learning behaviour and the monitoring of learning process, we can make evaluation plans, help them adjust their learning plans, improve their learning programs, create personalized learning models, and achieve effective and efficient learning. (3) In the same way, teachers can also track students' mastery of knowledge, learning progress and feedback on all aspects of teaching in real time according to the statistics and analysis reports given by ADMT, so as to optimize the teaching design. In addition, students can also mark teachers' teaching resources, teaching design and teaching behavior. When a certain score is too low, it can force teachers to reflect and make changes.

In short, through the data fusion in the Internet plus background, teachers and students continuously improve their teaching plans and the quality of resources in the open learning environment of ADMT.

4. CONCLUSION

ADMT spans digital reading, publishing, learning and information technology, involving the research of reform and innovation in many aspects such as digital reading format, resource design, teaching design, teaching mode, etc. It requires researchers to have a wide range of subject vision, cross domain knowledge structure, including digital publishing and reading, digital learning, information technology three areas of knowledge background and professional quality.

The design of ADMT should focus on the following aspects: Digitalization of teaching materials, not electronics of teaching contents. Interaction of learning, not teaching and acceptance of leaning. Networked of the environment, not flatted of the environment. Three-dimensionalization of resource forms, not Simplification. Learning terminal, learning cloud platform and learning content are indispensable.

The development of ADMT can also be organically integrated with online teaching platform, mobile learning platform, WeChat public number and so on, forming the "1+N" ecological learning system. It provides learners with complementary mobile learning function support, and lays a good foundation for improving the quality of distance learning.

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