

# RESEARCH ON THE E-TEXTBOOK AND E-SCHOOLBAG IN CHINA: CONSTRUCTING AN ECOSYSTEM OF E-TEXTBOOK AND E-SCHOOLBAG

Yonghe Wu<sup>1</sup>, Lin Lin<sup>2</sup>, Xiaoling Ma<sup>1</sup> and Zhiting Zhu<sup>1</sup>

<sup>1</sup>*East China Normal University, Shanghai, P. R. China*

<sup>2</sup>*University of North Texas, Denton, Texas, USA*

## ABSTRACT

The e-Textbook and e-Schoolbag initiatives have received wide attention and have been seen as the trend towards future education. This paper describes the framework of e-Textbook and e-Schoolbag including its conceptual model and system model. It further discusses the five interconnected categories that form the main parts of this Ecosystem construct. The five categories include the overall standards, e-textbook standards, learning terminal standards, learning tools standards, and learning services standards.

## KEYWORDS

E-Textbook; e-Schoolbag; ecosystem; framework; profiles of standards; educational application

## 1. INTRODUCTION

Digital learning tools have been improved with the development of information technology. E-Schoolbag and e-Textbook as digital learning tools have been implemented in education at a fast speed (Wu, Yang, & Ma, 2013). Two recent issues of the Horizon Report (The New Media Consortium, 2010; 2011) pointed out that e-Book technology would mature in the next two to three years, and that it would have significant impact on the development of learning science technology in the next five years. According to the survey report from CLIFF Market Consultancy Ltd, over 50 countries plan to promote e-Textbooks & e-Schoolbags. As a result, great attention has been paid to the foundation of this technology, the development of standards of e-Textbooks and e-Schoolbags. Open E-Books Forum organization developed OEBPS Open E-Books Publishing structure standards (Open eBook Forum, 2011). International Digital Publishing organization developed ePub standard and launched ePub3.0 standard on Oct. 2011 (IPDF, 2011). In China, Founder developed CEBX standards. International Standardization Organization ISO/IEC JTC1 SC36, in partnership with British JISC and China National Information Technology Standardization Committee have begun to research on standards for e-Textbooks, and research on e-Textbooks contents, framework and affordances.

On the 22ed to 25th ISO/IEC JTC1 SC36 plenary and working group meetings, Chinese representatives led the development of international standards of e-Textbook (Wu, Guo, & Zhu, 2011). Ministry of industry and information Technology of China (MIITC) and General Administration of Press and Publication of China have conducted research on e-Textbook standards, as well as established relevant research institutions to work on the subject. An electronic reading industry consortium was founded in Taiwan and an e-Book industry consortium was founded in Shanghai. Shanghai Municipal Commission of Economy and Information launched special research on e-Book industry. In Nov 2010, China e-Textbook and e-Schoolbag Standards Working Group (CETESBSWG) was jointly founded by the China National Information Technology Standardization Technical Committee of SAC (Standardization Administration of the People's Republic of China) and China e-Learning Technology Standardization Committee (CELTSC) of MOE (Ministry of Education) to work on e-Textbook & e-Schoolbag Standards (ETESBS). Now, there are many e-Textbook and e-Schoolbag initiatives and pilots under way covering nine provinces in China.

In Europe, CEN Workshop on Learning Technologies launched the eTernity project to develop a common vision, frameworks and specifications for e-Textbooks for educational purposes to bring European stakeholders in education together (CEN WS-LT, 2013). E-textbooks and e-Schoolbags have also been adopted by many schools in the US, South Korea, Japan, and Singapore. Standards research, industry development and educational application of e-Textbook & e-Schoolbag have also been launched.

## **2. FOUNDATIONAL WORKS FOR THE CONSTRUCT OF AN ECOSYSTEM OF THE E-TEXTBOOK AND E-SCHOOLBAG**

Chesser (2011) traced the evolution of the e-Textbook and identified several emerging best practices in the technical and business aspects of the new class of products. An e-Textbook and iPad were used on a Pilot Program (Roberta & Sloan, 2013). Wu, Yang and Xiong (2013) wrote about the characteristics and functionalities of e-Textbooks, and Xu, Su, Wu and Wang (2013) conducted some initial research on the behavior patterns of classroom teaching with e-Schoolbags. However, there has been limited research on the standards, industry development, and educational applications of e-Textbooks and e-Schoolbags.

It is clear that standards of e-Textbook and e-Schoolbag must be developed before the industry development and educational applications of the e-Textbooks and e-Schoolbags. Currently, the IMS learning resources standards, SCORM of ADL, CEBX of Founder, and ePub of IDPF form a profile of reference standards. In 2010, Chinese industry standard for the format of digital publication CEBX was developed by Founder. In terms of the system of standards, technology standards of China ICT in education have CELTS system structure (CELTSC, 2013). Framework of the CELTS and Reference Model suggest the framework structure specification of online education (Zhu, Zhang, & Wu, 2009). Wu (2011) summarized the overall standards for e-Textbook and e-Schoolbag in China. Afterwards, the framework of standards for ITLET of SC36 was put forward (Wu, Guo, & Zhu, 2011). Wu, Yang & Ma (2013) then further elaborated three aspects of e-Textbook including the standards research, industry development and educational applications of the e-Textbook. Several steps were taken before the Ecosystem of e-Textbook and e-Schoolbags was constructed. First, the demand for the applications of e-Textbook and e-Schoolbag in China were investigated. Workshops were organized in order to understand the needs of relevant industries of e-Textbook and e-Schoolbag. Needs assessments were conducted among a wide range of e-Textbook and e-Schoolbag stakeholders, including users, governments, domestic and foreign companies, international organizations, and research institutions. Application cases and field research were conducted to better understand the users' needs for terminal equipment. These needs assessments helped produce project proposals, application case reports, and technology reports to construct the Ecosystem of e-Textbooks and e-Schoolbags.

## **3. THE CONSTRUCT OF THE ECOSYSTEM OF THE E-TEXTBOOK AND E-SCHOOLBAG IN CHINA**

The construct of the Ecosystem of the e-Textbook and e-Schoolbag includes two parts, that is, the conceptual framework of the e-Textbook and the model of the e-Textbook and e-Schoolbag system.

### **3.1 The Conceptual Framework of E-Textbook**

E-Textbook refers to the digital instructional materials (e.g. textbooks, teaching reference books) for teaching and learning (Wu, Zhu & He, 2011). It provides tools to help users to read, teach and learn. E-Schoolbag refers to the personalized learning environment with e-Textbook readers, virtual learning tools and ubiquitous learning services (Zhu & Yu, 2011; Wu, Zhu, & He, 2011). The standards for e-Textbook and e-Schoolbag are used to solve the interoperability among learning contents, learning platforms, learning tools, and learning terminal (e.g., Human-Computer Interaction). Figure 1 shows the conceptual framework of e-Textbook and e-Schoolbag from the perspectives of interoperability.

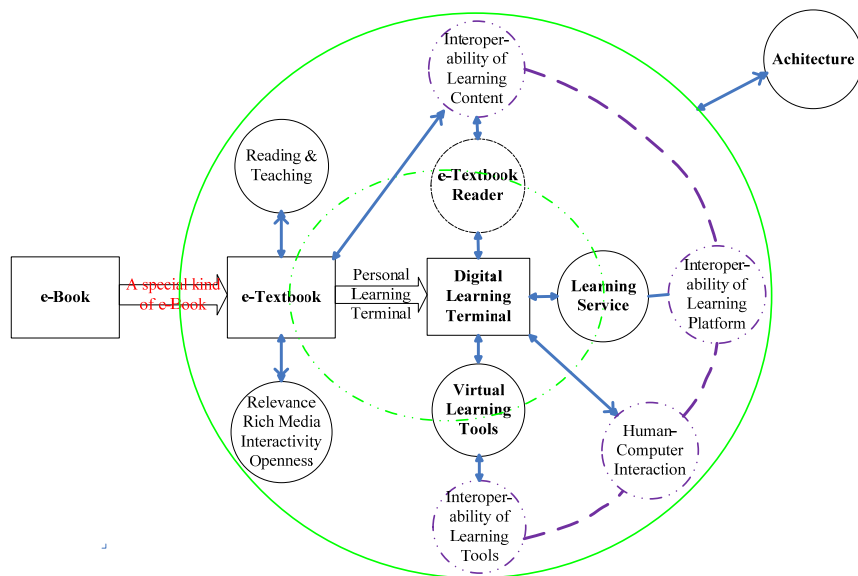


Figure 1. The Figure of Conceptual Model for e-Textbook and e-Schoolbag

As shown in Figure 1, the interoperability of learning contents connects between learners and contents as well as between contents and contents. The interoperability of learning terminal refers to interoperability of hardware equipment, such as the specification of hardware and software interface, compatible specification and environment adaptable specification, especially human-computer interface. The interoperability of learning tools refers to the interoperability of virtual learning tools, for example, interaction and collaboration based on different virtual learning tools. The interoperability of learning platforms refers to interoperability of learning services, for example, how to share learning resources in different platforms. The standards are developed from five scopes, including e-Textbook, learning terminals, virtual learning tools, learning services and the general framework.

### 3.2 The Model of E-Textbook and E-Schoolbag System

E-Schoolbag system covers four parts: learning contents, learning terminals, learning tools and learning services, as shown in Figure 2. Among them, learning contents, including e-Textbooks, e-Books and other extensive information, are learning objects when learners use e-Schoolbags. E-Textbooks are the core contents. Learning terminals, supplying hardware equipment to support learning activities, are the main media when using e-Schoolbag to study. They carry learning tools and online learning services. Learning tools are provided with virtual learning tools. Learning platforms supply all kinds of remote services to e-Schoolbag system, such as resources push, activity managements and so on. Therefore, the framework model of e-Textbook and e-Schoolbag system can be divided into e-Textbooks, learning terminals, virtual learning tools and learning services.

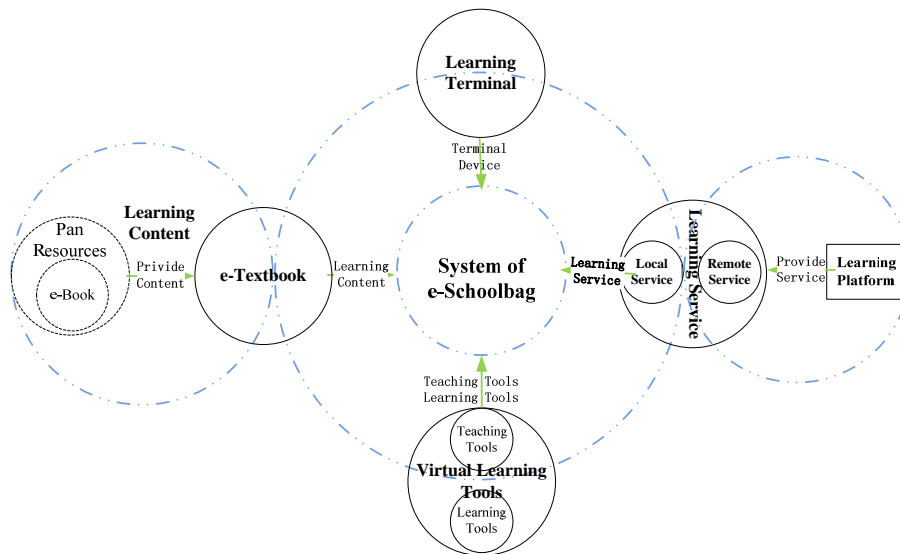


Figure 2. The Framework Model of e-Textbook and e-Schoolbag System

**E-Textbooks.** Learning contents mainly contain all kinds of e-Books for study, extensive information (pan resources) and e-Textbooks. E-Textbooks are the most important learning contents in e-Textbook and e-Schoolbag system. They are different from ordinary digital publications. They have features of readability and teaching and properties with relevance, rich media, interactivity and openness (Wu, Yang & Xiong, 2013). To research e-Textbooks, we need to not only adopt merits of present formation of e-publications to settle down operational issues of e-Textbook contents, but also to introduce teaching traits to the aspects of definition, inner structural characterization and media presentation of e-Textbook metadata.

**Learning Terminals.** Learning terminal of e-Schoolbag is the general term of e-educational equipment, which plays an auxiliary role in learning. With development of technology, this new kind of educational equipment enhances the function of e-Textbook, and supports different forms of learning and various subjects. Learning terminals are provided with a strong learning function. Some of them are equipped with open operating system, which supports the functions of capacity expansion and player. At present, there is a wide variety of learning terminal equipment, such as Pad, Table PC, Mobile Phone, PDA. The research on the digital learning terminals will avail to rule and guide the design, development and application of learning terminal.

**Virtual Learning Tools.** The name “Virtual Learning Tools” came from learning tools used in the traditional education process. Virtual learning tools are educational software and platform for learning activities. They develop into two directions. One is to present traditional physical learning tools in digital and virtual formations, such as electronic dictionary and virtual ruler. The other is to optimize new tools to support learning activities, which are designed by combining the research results of cognitive science and learning theories, such as conceptual tools and groupware tools. In the aspect of teaching and learning, virtual learning tools can be divided to teaching tools and learning tools.

**Learning Services.** The research on learning services of e-Textbook and e-Schoolbag system is mainly to solve the following issues:

- (1) To improve the interoperation between e-Textbook and e-Schoolbag system and other related support systems as well as to improve the flexibility, sharing and reusability of the system.
- (2) To solve interoperating problems between e-Textbooks and services related to e-Schoolbags, data exchange among different systems and technical obstacles between service suppliers and consumers of e-Textbooks and e-Schoolbags.
- (3) To improve flexibility of integration of system and to mingle the present learning technical system (ITLET system) through exchanging data with other systems.

#### 4. E-TEXTBOOKS AND E-SCHOOLBAG STANDARDS AND PROFILE

E-Textbooks and e-Schoolbag standard system consists of five categories of technical standards as the first phase of research and development of technology standards. They are E-Textbook and E-Schoolbag Overall Standards Cluster, E-Textbook Standards Cluster, Learning Terminal Standards Cluster, Virtual Learning Tool Standards Cluster, Learning Service Standards Cluster.

**E-Textbook and E-Schoolbag Overall Standards Cluster** is about the total framework, the basic standards and specifications of e-Textbooks and e-Schoolbag. It includes the Definition of e-Textbooks and e-Schoolbag, System Framework Model, the General Terminology, as well as a description of the reference relationship between standards. It provides a comprehensive guidance for the application of the standard system of e-Textbook and e-Schoolbag.

**E-Textbook Standards Cluster** includes e-Textbook Information Model, Content Package, Content Aggregate, XML Binding, Metadata as well as Practice Guidelines. It has an extremely important role in the application and popularization of e-Textbook and e-Schoolbag.

**Learning Terminal Standards Cluster** describes requirements of the electronic learning terminal part from the hardware, operating systems and software provisions. It consists of three main criteria, which are Electronic Learning Terminal Hardware Specification, e-Schoolbag Operating System Specification and e-Schoolbag Normal Software Specification.

**Virtual Learning Tools Standards Cluster** specifies the requirements with virtual learning tools in system framework model of e-Textbooks and e-Schoolbag. It includes five main criteria, which are Classification Norms, Descriptive Specification, Assembly Specification, Aggregate Specification and Assessment Regulate of Virtual Learning Tools.

**Learning Service Standards Cluster** specifies the concept, information model, interface and binding norms of learning service in the framework of the model. It mainly includes four standards, General Specifications, Information Model, XML Binding and Demonstration Guide.

Currently, two initial specifications, Architecture of e-Textbook & e-Schoolbag and Information Model of e-Textbook, were approved as China national standards on the May, 2013. And Terminology of e-Textbook & e-Schoolbag, Profile of e-Textbook & e-Schoolbag related standards, e-Textbook Metadata, Specification of e-Schoolbag Terminal Hardware, Classification of Virtual Tools, Description of Virtual Tools and Overview Learning Service of e-Textbook & e-Schoolbag have their drafts.

#### 5. INTERFACE DEVELOPMENT, CURRENT APPLICATIONS AND RESEARCH OF THE E-TEXTBOOK & E-SCHOOLBAG ECOSYSTEM IN CHINA

By far, CETESBSWG has had more than 50 institutional members taking part in the research on the standards for e-Textbook & e-Schoolbag. The members have developed products based on the standards related to e-Textbook, learning terminals, learning tools and learning services. Examples of some interface design are presented below. Figure 3 and figure 4 are demos of the Interface of Chinese Language and Chinese History as e-Textbooks.



Figure 3. Interface of Chinese Language.

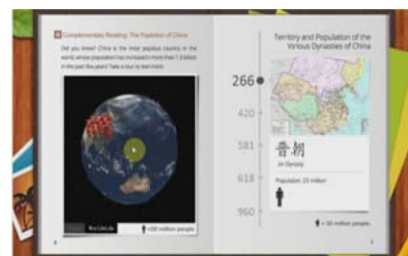


Figure 4. Interface of Chinese History

Figure 5 below presents another good example of e-Textbooks named iEnglish, which was co-developed by the Foreign Language Teaching and Research Press, ECNU, and Intel for K12 English classrooms. As can be seen the Figure 5, a variety of tools including (1) notes, erasers, dictionaries, (2) the mark pen, (3) the label, and (4) the toolset have been incorporated to support students' learning activities.



Figure 5. Toolsets for e-Textbook of iEnglish

In addition, ECNU Press and HSJC have co-developed virtual learning tools, which have protractors, compasses and other tools belonging to mathematics. Figure 6 shows the interface of virtual learning tools in math.

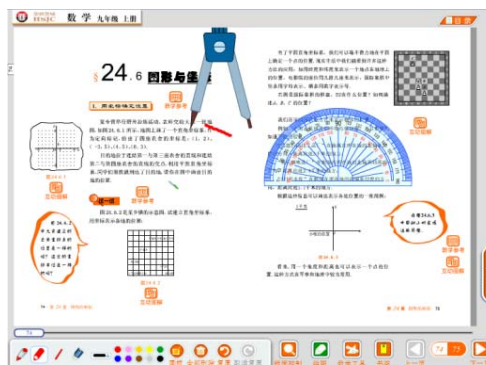


Figure 6. Learning Tools from ECNU and HSJC

As for learning terminals, CETESBSWG has the terminal technical specification draft for the technical requirements of e-Schoolbag Learning Terminals. And Intel, Dell, BenQ, Hanwang, Yifang and E-Ren E-Ben, which take part in the research on the standard, have their products of different PAD and Table PC as learning terminals of e-Schoolbag. These products obey the terminal technical specification draft, and OS has Androids, iOS and Windows.

Last but not the least, e-Schoolbag software for classroom teaching has developed according to the actual needs of classroom teaching. The software consists of PC servers by teachers and teacher and students Pad terminal components. The main interface of teacher PC server-side, main interface of teacher's and student's terminal are shown as figure 7, figure 8 and figure 9. The main functions of teacher the PC side are monitor, teaching on classroom, quiz management, test analysis, the screen lock and screen broadcasting; the main features of teacher's terminal includes lectures play, quiz management, quizzes, status monitoring, screen lock, etc.; the main functions of student's terminal are handouts play, problem management, file upload, screen sharing, quizzes and so on. Some functions of student's and teacher's terminal come from learning service in the server of e-Schoolbag system.



Figure 7. Interface of PC Server



Figure 8. Interface of Teacher's Pad



Figure 9. Interface of Student's Pad

CETESBSWG with its partnerships has launched multiple projects related to the e-Textbook and e-Schoolbag Ecosystem project. Field research, structured questionnaires and individual interviews have been used to collect data to assess the effectiveness of e-Textbooks development and application process. Some initial findings indicated that teachers need to change their ideas of teaching, need to learn to use morphological characteristics of e-Textbook, and focus on the humanized design of e-Textbook (Wu, Lei, & Ma, 2013).

## 6. CONCLUSION AND FUTURE

This paper provides an overview of the Ecosystem of the e-Textbook and e-Schoolbag project in China, including its conceptual framework and system model, standards requirements, samples of interface designs, and applications. The construction of the standards of e-Textbook and e-Schoolbag will guide the development of e-Textbook and e-Schoolbag, and thus promote their applications in education. And standards research, industry development and educational application of e-Textbook & e-Schoolbag have gradually become an ecosystem of e-Textbook & e-Schoolbag in China. In order to effectively promote them, the International Open Forum on the Development of e-Textbook and e-Schoolbag Standards and Applications will open on Shanghai, China on 28th Nov. to 29th Nov.2013.(Website is <http://www.etesbs.org/>). With the help of CETESBSWG, more standards of e-Textbook and e-Schoolbag will be developed, more products produced, and more projects for application carried out for the students and teachers in schools in the future.

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