Study on Open Educational Resources Construction in Colleges and Universities in the Information Age

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Abstract. Nowadays, informatization has changed our work method and way of thinking as well as our educational mode. In future, education will break free from the constraints of time and space inevitably, and developed into the vast network world. Presently, the education informatization has basically completed its initial stage and application stage. Next it will adopt the development principle of "in-depth integration of information technology and education and teaching", guided by "application-driven" and "mechanism innovation", to enter the era of education information integration and innovation. Institutions of higher learning, as a concentration of high-level educational resources, whose popular and open digital education resources is a great guarantee for realizing new education in the intelligent era.

Keywords: Education resources · Open · Colleges and universities

1 Introduction

Digital learning is the product of the development of education informationization. Since the concept of digital learning was introduced for the first time in 2000, digital learning has been recognized globally as an important learning method with the rapid development of information technology. Digital education resources are the basis of digital learning, so its quality directly affects the effect of digital learning. The open and popular digital education resources (hereinafter referred to as "big resources") is the guarantee for digital learning to achieve that everyone have right to learn and can learn anywhere and anytime.

2 Social Background of Construction of Big Resources

Today, as digital learning grows, its resource construction has gradually become a core factor affecting digital learning. For this, countries' study on the construction of educational resources has continued to go deep with network information.

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The American Department of Education has always attached great importance to the construction and application of open educational resources. At the beginning of this century, about 90% of public colleges and universities in the United States provided distance education courses of electronic media. In 2012, MOOC began to grow rapidly in the American top universities and quickly spread around the world. Course suppliers, represented by Coursera, Udacity and edX, cooperate with famous universities around the world to provide high-quality online courses to learners from all over the world.

Since the late 1990s, UK has paid special attention to the construction of digital learning resources. And its "community learning network" established is the main method for the development of community education in the UK currently. In the *European 2020 Strategy*, curriculum resources reform is proposed. Education fields and business circles develop school-enterprise cooperation by creating "Knowledge Alliance', and jointly develop high-quality curriculum resources with high practicality to solve the practical problems of lack of innovative skills for learners.

Japan is a world leader in the construction of education informatization. The *i-Japan Strategy 2015* emphasizes that, to promote rapid changes in teaching methods and innovation in teaching models, more digital teaching resources should be developed and the utilization of teaching resources in public institutions should continue to be expanded. MOOC of Japan has made new progress in content form after experiencing a transition from university-led to multi-subject, promoting the effective use and diffusion of public education resources.

China's educational informationization started late. With the development of informatization education, *the Ministry of Education's Opinions on Strengthening the Application and Management of Online Open Courses in Colleges and Universities* is issued in 2015. It points out the direction for building an open online curriculum system with Chinese characteristics, and deeply promotes the construction and popularization of open curriculum resources. At the second summit of "Internet plus Education" in 2017, the education informatization of next stage was proposed, and efforts should be made to realize the transformation from the development, application and service of special education resources to that of big resources.

3 The Popularization Transformation of Special Education Resources in Universities

In order to better adapt to the changes in the new era, education informatization should shift from the development, application and service of educational resources to that of big resources; shift from improving the application ability of information technology to improving the information literacy of teachers and students; and shift from the development of integration to that of innovation [1]. Among them, the development, application and service of educational resources are the basis for the development of educational informationization. Big resources can not only support the new educational model based on information technology, provide rich educational resources for the open learning environment, and build an intelligent platform that can be learned everywhere and anytime; but also it can also develop an Internet-based information

education service model and integrate educational resources. In the era of "Internet plus" today, rich online resources has promoted the development of various online services, so every learner, whether or not he is at school, can find a learning service and learning resource suitable for himself on the Internet as long as he is willing to learn, to achieve the needs of learning for all and lifelong learning that everyone can learn and learn at any time.

Education resources are an important basis of carrying out educational activities. Its quality is related to whether education can be carried out normally and orderly, and its form affects the performance of educational form. In a long time, the printed-type educational resources represented by textbooks have formed people's deep-rooted educational form, That is, formal education represented by schools. In the information age, digital education resources have got rid of the constraints of printed-type educational resources like textbooks in quantity and space, and become an opportunity of the transformation of new-type education.

Traditional education resources have obvious special-purpose. The vast majority of education resources constructed is centered on teaching materials and oriented to specific students, and has strong relevance and dependence, especially for education resources in colleges and universities. Higher education is different from compulsory education. It's flexible training mode and professional characteristics make universities choose teaching materials more independently. Different universities have different focuses for the same course, so the materials they selected will also be different. This will result that the digital resources of a school building for a course cannot be used by other schools or even students of other majors.

A major feature of education informatization in the new era is to change special education resources to big resources, making the special resources of education become popular and open, and providing a guarantee for individualized learning and lifelong learning. With the continuous integration and innovation of disciplines, the knowledge in class is no longer attached to only one textbook. Interdisciplinary teaching resources have become an important carrier of teaching content. In addition, the development of emerging artificial intelligence, blockchain, virtual reality and other technologies has made digital education resources no longer just the form that everyone sees now. Dynamic educational resources with intelligent interaction will become the main form of educational resources in the information age.

4 The Planning of the Construction of Education Big Resources in Colleges and Universities

With the development of information technology, it will become the trend of education development to build an education system of networking, digitalizing, personality and lifelong and to build a learning-type society of "everyone learns and can learn everywhere and at any time" [2]. The realization of this kind of society cannot leave the support of a large number of high-quality digital education resources. The digital education resources built currently mainly include online courseware, cases, online courses, media materials, test databases, literatures, questions and answers, resource index and others, as shown in Fig. 1.

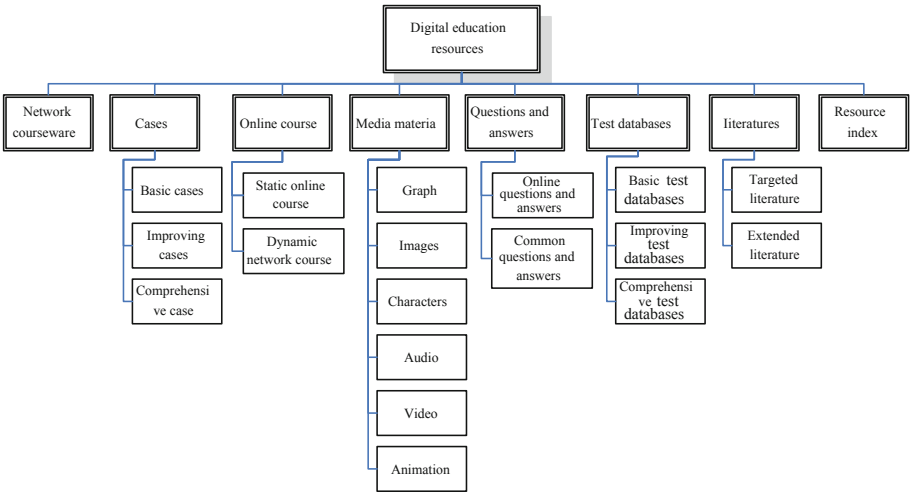

Fig. 1. Forms of digital education resource

Colleges and universities are the primary productive force of science and technology and the first resource to provide professionals, open majors covering all fields required in social production, and own the hardware and software conditions to build high-quality educational resources. With the transformation of higher education from elite education to popular education, the educational resources of application-type colleges and universities have already been equipped with the basis of transforming to popular educational resources. The open popular digital education resource needs to meet the needs of people in different levels and with different needs, and needs to coordinate all parties to avoid causing chaos that each acts (in) his own way. The big resources in the era of education informationization can be divided into two parts: basic resources and specialized professional resources.

Basic knowledge is the basis for people to recognize things and learn professional knowledge, such as Marxist political economics, advanced mathematics, university foreign languages, university physics, etc. Basic resources, characterized by less knowledgeability and changibility, can organize authoritative organizations to conduct unified development and construction, and use them as the basic resources of professional learning, to avoid low-level and repetitive construction of departments and universities at all levels.

The specialized professional resource, based on the basic resources and the professional development and the needs of social development, is cutting-edge resources, and also is the focus of popularity of the special education resources in colleges and universities. Colleges and universities should fully play their advantages in professional, science and research, resources, equipment and others, prioritize to construct scarce education resources, so that the digital education resources constructed should

be free from the influence of restrictive factors such as teaching materials to solve practical problems in a targeted manner, meanwhile they should also have relative independence as much as possible, so as to provide resource support for online open courses, flipping classrooms and other new-type education methods.

In the information age, the construction of education resources should not only consider whether it conforms to the student-centered learning theory, but also examines the depth and breadth of the constructors' professional knowledge to check whether they own rich teaching experience and other qualifications, and whether they have related hardware equipment and so on. In addition, it also needs to ensure the richness of educational resources, and provides a variety of supporting materials such as media materials, literature, cases, etc., to help learners learn and understand better. However, if all these tasks are undertaken independently by the colleges and universities, their pressures are obviously increased, so multiple construction modes flexibly can be adopted to attract multiple forces, gather the power and the wisdom of the people, and build more high-quality education resources, to benefit more learners.

5 Construct Educational Resources and Build Ecological Environment

The construction of high-quality education resource requires a good ecological environment. The ecosystem of constructing education big resources in colleges and universities includes the educators, developers, users, supervisors, and operators of colleges and universities, as well as factors that affect their construction of open education resources, such as metadata standards, supervision mechanisms, operation mechanisms, safeguard mechanisms and so on. Only these factors are interconnected, interdependent and interacting can the ecosystem constructed be more powerful, more valuable and more meaningful.

5.1 Metadata Standard

In the information age, the metadata standard for the education big resources of colleges and universities is the basis for effectively describing big resources and realizing resource sharing and exchange. The attribute of the resource is labeled according to the metadata standard, which can make it be reused in different learning systems, and make it easier for learners to quickly retrieve, and serve as a basis for learners to screen resources. At present, the relatively complete educational metadata standard is IEEE LOM, and many countries have established localized educational metadata standards based on it. LOM divides learning objects into nine categories, with each containing several elements, in which element sets of educational category and technical category [3] are shown in Tables 1 and 2.

Table 1. Learning object metadata element set of education category

Category	Elements
Educational	Interactive level
	Semantic density
	Intended end user role
	Context
	Typical age range
	Difficulty
	Typical learning time
	Description
	Language
	Interactive type
	Learning resource type

Table 2. Learning object metadata element set of technical category

Category	Elements	Child element
Technical	Format	
	Size	
	Location	
	Requirement	Type
		Name
		Minimum version
		Maximum version
	Installation remarks	
	Other platform requirements	
	Duration	

5.2 Supervision Mechanism

The supervision mechanism is a mechanism to ensure that the education big resource construction of colleges and universities can be carried out orderly and normatively. It is a strategy and method implemented to ensure the construction of high-quality education resources. The educational resources will ultimately serve the popular education situation and learning situation in the era of education informationization. If there is no a good supervision mechanism, it will lead to the redundant construction of resources, and will appear the excessive construction of low-level education resources and the relative lack of high-level education resources. If we neglect the educational needs under the new situation to build resources blindly, it will inevitably make the content and form of the resources constructed unable to meet the requirements of the learners, and eventually lead the resources constructed to be abandoned. At the same time, if the evaluation and opinions of the resources in the process of resources use are not feedback to the resource builders, the excellent resources will not be promoted and spread, and the old resources will not be improved and updated in time.

The education information age is a new era that advocates diversification, individualization and lifelong learning. It requires resource builders to build new-type resources that are rich, diverse, safe, highly utilized, and adapt to the information-based teaching model according to the development of era. Resource users and third-party managers can participate in the construction of resources, which is undoubtedly a strong support for the innovative application of educational resources.

5.3 Operation Mechanism

At present, the development of digital educational resources is mainly based on the independent construction of college teachers, and a small part of the resources are constructed by inter-university or enterprise outsourcing. Since resources construction task is heavy, and it also is influenced by professional content, information technology and hardware conditions, the resources constructed can only be applied and practiced in a small scope. To build high-quality digital education resources that can develop for a long time, we must first integrate the latest developments of the industry with the latest technologies while adopting multiple operation mechanisms.

In the university, policy encouragement and economic encouragement are adopted to encourage teachers of colleges and universities to continuously accumulate, refine and update education resources around the field of their own professional characteristics, and continue to develop digital education resource construction. In the inter-university, the mode of co-construction and co-sharing is adopted to realize the inter-university collaborative construction, to form the complementary advantages of different university disciplines. Outside the university, the university-enterprise cooperation and service outsourcing are used to attract online learning service enterprises and resource development enterprises to participate in the construction of education big resources of colleges and universities.

In this way, in addition that some front-end featured disciplines need professional teachers to grasp the form and content of resource construction in person, for teaching resources which are used widely and frequently, such as public courses and professional foundations, school-enterprise cooperation and service outsourcing can be adopted to make enterprises become the main body of resources construction and in charge of development and cooperation. Experts in colleges and universities participate in the construction of curriculum resources as a course consultant.

5.4 Protection Mechanism

A large number of high-quality digital education resources support the new networking and digitalizing learning method, while they also bring great challenges for resource builders in the aspect of intellectual property right. The openness and sharing of the Internet makes it easy for people to access resources on the network. We should promptly adopt protection technology of digital intellectual property right, formulate relevant laws and regulations, and appeal people to strengthen the protection awareness of intellectual property right, to ensure that resource on the network is respected and protected. We should strengthen the supervision of resource construction and

application market, crack down on illegal misappropriation of digital resources, and purify the environment for the construction and application of high-quality resources.

In education information age, high-quality education resources are indispensable, especially those of colleges and universities. Colleges and universities, as the origin of the dissemination of high-level education content, whose education big resources structed can greatly improve the quality of online learning. Every educator and educational resource builder in colleges and universities should participate in the practice of educational informatization to accelerate the construction of open educational resources in universities.

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