Resource Management Technology and Application of Remote Network Education Based on Metadata

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Abstract. Based on the effective solution to the problem of poor supply and application of digital education resources. Aiming at the digital basic education resources involved in the field of basic education, this paper uses the methods of investigation and research, demand analysis, metadata model design, system design, practice verification, etc., based on the metadata system and web service of digital basic education resources. We have completed the business process analysis of the shared service system, the overall design of the sharing platform, the design of the three-tier metadata structure, the collation and aggregation of digital resources, the realization and verification of platform technology. From the compilation, supplement and description of resource metadata specification, to the clustering, integration and cataloging of digital resources, and then to the realization of retrieval and service interface, this paper focuses on the effective integration of high-quality digital basic education resources in the process of network sharing. Through the establishment of a relatively complete set of digital education resources integration, convergence engineering methodology, to provide the best solution for teachers in the application of resources, maximize support for teachers' work efficiency, and promote the improvement of curriculum teaching level.

Keywords: metadata, remote network, educational resources

1. Introduction

With the development of information technology, the information level of the school has been significantly improved, and a large number of digital education resource platforms have been built to provide support for school education and teaching activities. Due to the scattered construction of digital basic education resource platform, the heterogeneity of technical design, the diversity of data types, and the difference of data content, teachers and students are busy with frequent shuttling between various network environments and platforms, using multiple accounts and logging in multiple systems, so they can not get the most in the process of searching, obtaining and using resources good user experience[1]. It has brought burden to teachers' teaching and students' effective learning, resulting in low utilization rate and low benefit value of high-quality resources[2, 3].

With the rapid development of science and technology, information technology has penetrated into all aspects of economic development and social life, and also brought unprecedented opportunities and challenges to education. Information technology has injected new vitality and vitality into education. It not only provides innovative technical means and solutions, expands the coverage of high-quality
resources, but also injects new ideas and power into the sustainable development of education, promotes the reform of teaching and learning methods, and promotes the double promotion of the quality and efficiency of education. It should be said that education informatization is the inevitable choice to realize the leap forward development of education[4, 5]. To run education well, we should pay more attention to the actual acquisition of teachers and students, meet the real needs of students, respect and serve the healthy growth of students. The application of information technology in the field of education has more cross era significance. Exploring the supply methods and Strategies of digital education resources can maximize the benefits for teachers, students and families to provide quality education services. Under the background of Internet plus education, with the accelerating process of the deep integration of information technology and education, the enthusiasm of educational institutions at all levels to carry out digital resources construction and application has been unprecedentedly high, and a large number of digital resources have been absorbed through various forms, such as independent development, selection and selection, social purchase, and co construction. These resources are diversified in form, mostly unstructured data, involving documents, pictures, animation, programs, tools, videos, etc., which widely support teachers to carry out teaching design relying on teaching syllabus, and form personalized resources through processing and combination of various resources to meet the needs of daily education and teaching. In this context, the relevance and quality of resources themselves play a decisive role. This study is always guided by how teachers use appropriate digital resources in an efficient and convenient way to conduct analysis, design and practice.

2. Related Work
At present, more and more countries regard digital basic education resources as a forward-looking and strategic choice to promote the comprehensive reform of education, realize the modernization of education and improve the comprehensive competitiveness of the country. In order to accelerate the informatization construction of basic education, many countries have formulated a series of policy plans and action plans, such as netp2010 of the United States. The formulation and implementation of these plans have brought about significant improvement in information technology infrastructure, digital resources, information management, teaching mode reform, etc., and their positive effects are further showing[6]. However, as far as digital education resources are concerned, due to the differences in political system, economic level, cultural background and technical ability among countries, the work focus, development stage and development mode of different countries are different[7]. However, the development trend of digital basic education resources in various countries has great commonness, which is mainly manifested as: new technologies and new methods generally drive learning and teaching methods innovation. For example, with the popularization and promotion of cloud computing, more and more countries attach importance to the application of cloud computing in basic education informatization, and actively promote the construction of public service (resource) platform supported by cloud computing technology[8, 9]. At the same time, with the popularization and deepening of the concept of open education resource sharing, countries support education and teaching innovation based on open new resources, which provides an effective way to narrow the digital gap of basic education, promote the sharing of high-quality educational resources, and cultivate students' autonomous learning ability and lifelong learning ability. It can be said that the overall international trend is that new technologies and new methods lead the development of digital resources, which is basically consistent with China's development line.

3. Requirement Analysis
With the development of education informatization and the continuous improvement of teachers' application of resources, there are some problems, such as poor resource regeneration liquidity, imperfect sharing and co construction mechanism, repeated low-level construction and so on. It is necessary to build a diversified and integrated platform environment for resource sharing and exchange, and establish a standard system for resource integration, sharing and supply. Promote the balanced use of digital education resources and support the innovation of education and teaching methods. From the
perspective of business requirements, the main contents include the following two aspects: one is to design a relatively complete metadata specification system of digital education resources to promote the systematization and standardization of resources; the other is to complete a basic exchange platform to form a one-stop platform with rich and easy-to-use resource service interfaces, diverse means of resource exchange, and collaborative connection of users at all levels. We should organize, integrate and gather digital resources based on metadata, form resource metadata and index system from the perspective of education and teaching, support the systematic presentation of catalog and one-stop retrieval. Taking norms as the starting point, promoting integration with norms, leading the balanced utilization and healthy development of high-quality resources. In the research, it is not necessary to process, migrate or copy the entity resources in each platform, but to redesign and optimize the metadata bound by each resource to form an exchange and index system linked by it.

Metadata management function: it supports the storage of metadata of digital resources, and provides corresponding management configuration functions, including metadata version management, metadata structure maintenance, metadata import and export, etc. It can be flexibly supported and can be stored, maintained and extended.

Resource catalog function: Based on metadata, it presents the aggregated digital resources in different ways and dimensions. Through the construction of a multi-level directory system, in line with the perspective of education administrators, teachers and students. For example: the contents of teaching materials, syllabus, topics, subjects, etc. It makes the organization of resources more orderly, more suitable for application scenarios, and improves usability.

Unified retrieval function: realize the cross station (multi platform) retrieval function based on metadata aggregation, carry out fuzzy query according to various keywords, and automatically sort the retrieval results according to the similarity from high to low. At the same time, it supports multi conditional retrieval based on the resource type, release time, textbook version, discipline and other dimensions.

Sharing and exchange function: support resource entity logical centralization and physical centralization. Logical centralization is to realize resource sharing, query and acquisition between heterogeneous platforms based on metadata and resource directory on the premise of resource entity migration, without user's second login authentication. Physical centralization provides the storage and transportation function of resource entities.

Resource service function: it provides the encapsulation of data service interface, including metadata interface, retrieval interface, directory interface, authentication interface, etc., which can support the third-party application platform to access the resource service of the sharing platform, and effectively embed it into the application environment of the third-party platform. For example, the resources of the sharing and exchange platform are embedded into the resource platform of a school by calling the interface, and the user can retrieve the request at one time and query the resources of the two platforms at the same time.

Public portal function: it provides a visual portal interface, supports user login authentication, meets the systematic presentation of resources after gathering, carries out system display according to resource directory, or classifies according to different topics, and provides unified retrieval function, so as to facilitate users to obtain resources after direct access.

Through the investigation, sorting and analysis of distance education resources, the common outstanding problems are that the metadata system of resources has not been perfected, and the description information of some resources is incomplete or missing, which hinders the management, retrieval and application of data. As shown in Tables 1, 2 and 3. below, metadata information of different types of resources has commonness, but the differences are obvious. In the process of resource aggregation, priority should be given to the design of metadata structure to achieve unified description and presentation.
4. Design of Remote Network Education Resource Management System Based on Metadata

Due to the different sources and types of resources, the metadata standards of digital resources in different systems are not consistent. Therefore, in terms of resource organization structure, the open metadata model architecture will be adopted. The platform divides metadata into core metadata, extended metadata and supplementary metadata. For each type of resources, the platform allows to define the personalized extended metadata of such resources. All kinds of extended metadata will be stored in the column database of the system in a structured way to support structured retrieval. In addition, other unique attributes of various resources can be defined as supplementary metadata, which also supports structured storage and retrieval based on column storage. In order to ensure the quality of warehousing data, this study proposes the idea of "standard driven". Firstly, the standard of data type
and metadata is established, and the standardized management of metadata is realized by relying on digital resource management system. For the data with quality problems, the system is used for automatic cleaning and identification to ensure the quality of the data in storage. Compared with the traditional cleaning method, the data quality control rules are explicitly defined in the standard driven way, and the digital quality is checked before the data is put into storage. More importantly, the data standard is unified through the establishment of the model. At the same time, in order to ensure the unified management of multi-source heterogeneous data, the idea of regional management is proposed. According to the different characteristics of digital resources and metadata life cycle, the storage environment is divided into six storage domains: business domain, original file domain, resource backup domain, parallel storage domain, achievement domain and service domain. On this basis, the data management and call functions are provided for each region to realize the integrated management of data.

4.1 Digital Resource Metadata Architecture

The metadata architecture of digital education resources is based on a set of open metadata model architecture, which realizes the unified and standardized organization and management of multi-source heterogeneous resource metadata. The model architecture is shown in Figure 1.

Figure 1 Open metadata architecture map of digital educational resource

The so-called open metadata model architecture refers to the metadata organization requirements that can meet various types of resources. Specifically, the open metadata model architecture consists of core metadata, extended metadata and supplementary metadata. The core metadata is a set of common and common core metadata items formed by integrating all kinds of resource metadata. It is the most basic and core data content in the process of sharing and exchanging services. The extended metadata fully adapts to the characteristics of different resource types and provides personalized data items for each type of resources. The supplementary metadata provides other customized metadata items. At the same time, it is necessary to construct a set of "multi-level catalog metadata", which contains multi-dimensional and multi-level attribute information related to education and teaching, such as subjects, grades, teaching materials, bibliographic chapters, knowledge points, etc. Based on the multi-level directory metadata, it can realize the connection with resource data, assign different attribute "tags" to various resources, and provide support for carrying out resource thematic filtering and retrieval.
4.2 Database Design

The database architecture of the digital resource sharing service platform is shown in Figure 2 below. The platform data resources are supported by each node as the data source. The resource metadata for sharing services is extracted from the resource data layer of each platform and exchanged to the municipal platform according to the unified metadata exchange standard. The municipal platform carries out the basic management of multi-source metadata, and forms a classified extended metadata database according to each type of resources; on this basis, it carries out unified service publishing to form the metadata content for unified integrated services.

![Figure 2 Database architecture](image)

5. Conclusion

Based on the understanding and practice of metadata architecture, web service and other core technologies, I refer to the relevant design ideas and theoretical practice of a large number of literature at home and abroad. The digital resource sharing service system is completed and discussed systematically in this paper. This research provides a relatively complete digital education resource sharing service solution, which can further integrate high-quality resources and realize balanced supply. It has an important driving role in expanding the coverage of high-quality education resources in the city, promoting education equity, and improving the quality of school education and teaching, and has significant social benefits. At the same time, it reduces the phenomenon of repeated purchase of resources and low-level construction investment of educational units at all levels, and improves the overall economic benefits. Facing the future, the digital resource sharing service system should extend to the whole process ecological mode, pay more attention to the evaluation and feedback of resources, the accurate push of big data, and the intelligent combination of resources, so that teachers can obtain resources more easily and efficiently, and realize "one-stop total, zero distance application". We also clearly see that there are some obstacles and difficulties in the promotion of the model, such as the ownership of intellectual property rights, the subjective willingness of teachers to share, the degree of fit between resources and teaching, etc., which need to be explored and improved continuously in the process of research, so as to maximize the application benefits of the sharing service system.

References

[1] M. McClelland, “Metadata standards for educational resources,” Computer, vol. 36, no. 11, pp. 107-109, 2003.

[2] L. E. Anido, M. J. Fernández, M. Caeiro, J. M. Santos, J. S. Rodríguez, and M. n. Llamas, “Educational metadata and brokerage for learning resources,” Computers & Education, vol. 38, no. 4, pp. 351-374, 2002.
[3] M. Ivanović, D. Mitrović, Z. Budimac, and M. Vidaković, "Metadata harvesting learning resources-an agent-oriented approach." pp. 1-6.
[4] W. Halimi, C. Salzmann, D. Gillet, and H. Saliah-Hassane, "Standardization layers for remote laboratories as services and open educational resources," Online Engineering & Internet of Things, pp. 874-884: Springer, 2018.
[5] M. Mouriño-García, R. Pérez-Rodríguez, L. Anido-Rifón, M. J. Fernández-Iglesias, and V. M. Darriba-Bilbao, “Cross-repository aggregation of educational resources,” Computers & Education, vol. 117, pp. 31-49, 2018.
[6] D. A. Koutsomitropoulos, and G. D. Solomou, “A learning object ontology repository to support annotation and discovery of educational resources using semantic thesauri,” IFLA journal, vol. 44, no. 1, pp. 4-22, 2018.
[7] L. Favario, and E. Masala, “A new architecture for cross-repository creation and sharing of educational resources,” International Journal of Emerging Technologies in Learning (IET), vol. 12, no. 02, pp. 185-209, 2017.
[8] A. Finogeev, L. Gamidullaeva, A. Bershadsky, L. Fionova, M. Deev, and A. Finogeev, “Convergent approach to synthesis of the information learning environment for higher education,” Education and Information Technologies, vol. 25, no. 1, pp. 11-30, 2020.
[9] J. Ganapathi, “User-Generated Content's Impact on the Sustainability of Open Educational Resources,” Open Praxis, vol. 11, no. 2, pp. 211-225, 2019.