Research on English Distance Education Web Resource Management System Based on Data Mining Technology

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Abstract—In recent years, with the wide application and popularity of education informatization, the importance of EDERs as a content carrier for learning and teaching has become increasingly prominent, and the contradiction between users' demand and supply of high-quality EDERs has become more and more prominent. How to optimize the allocation of EDERs? How to provide users with quality resource services? It has become an important problem that needs to be solved in current education informatization. The main purpose of this paper is to investigate the English DE network resource management system based on DM technology. The purpose of this paper is to examine and explore the CS of EDER allocation and service, reveal the existing problems, and propose optimized countermeasures for EDER allocation and service from the perspective of users' needs and taking English DE platform as the research object. Due to the lack of online teaching resources, students cannot receive high-quality services anytime and anywhere and a great waste effect is produced. Therefore, online tutoring is a major direction for the current development of English education. In this paper, we investigate in the aspects that mining potential variables in online resources and enriching data processing capabilities can improve utilization efficiency and teaching quality. Data mining (DM) techniques are used to analyze and study online resources so that they can provide an effective reference basis for teaching and research.

Keywords- Data Mining Techniques, English Distance Education, Web Resources, Resource Management

1 INTRODUCTION

The rise of the "Internet+" industry has triggered deepening changes in various fields. Under the background of the "Internet+Education" era, education informatization has been continuously promoted, and the deep integration of education and technology has prompted the development of EDERs to receive more and more attention. The English DE platform, which takes EDERs as its main product, always pays attention to market changes and user characteristics, and therefore plays a leading role in the construction, application, sharing and service of resources, and its development plays a crucial role in the promotion of education informatization in China. In the

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context of service-oriented society, the market rules are constantly changing, and the concept change from product demand to user demand urgently requires the platform to change from focusing on the product itself to attaching importance to and tapping user demand. In the face of the complex market and the increasingly diverse needs of users, English DE platforms must meet user needs by optimizing the allocation of EDERs and improving the service quality of EDERs in order to gain advantages in the market competition [1-2].

In a related study, Mahdi et al. studied the educational demographics of the banking sector in the context of developing economies with respect to employment allocation [3]. Due to the interaction between chain components, policies and decisions are studied through a system dynamics (SD) approach to ensure appropriate and balanced growth of banks. Various policies were simulated and the consequences of applying them were assessed. The results show that even in the long run, the optimal settings for each education level (i.e., the number of jobs defined for each level) cannot be achieved and, in the most efficient case, a deviation of 27% from the desired level of work can be achieved. This is due to the presence of multiple time delays in the system. Mohamed et al. aimed to investigate students' attitudes towards DE during the Moroccan New Coronary Pneumonia [4]. A mixed methods design was used to triangulate data from a five-point Likert scale questionnaire and focus groups. The results showed that students generally preferred face-to-face education to DE. However, part-time students had a positive attitude towards DE. It is recommended that DE and face-to-face education should be planned by faculty, coordinators, and administrators.

To address the management of web resources, this paper uses DM techniques to analyze and study web resources so that they can provide an effective reference base for teaching and research. English education as a new form is one of the important pillars of a country. With the continuous development of Internet technology, English education has also seen new developments. However, due to the lack of online teaching resources, there is a great waste effect because students cannot receive high-quality services anytime and anywhere. Therefore, online tutoring is a major direction for the development of English education at present. With the economic development of major cities and the improvement of people's living standards, people's demand for English education is also increasing and online teaching resources are a huge choice. Therefore, this study is conducted in terms of mining potential variables in online resources and enriching data processing ability can improve the utilization efficiency and teaching quality.

2 DESIGN RESEARCH

2.1 Classification of English DE Platforms

English DE platforms are classified into four types according to the resource operation method: online school type, B2B2C platform type, B2C service type, and tutorial tool type [5-6]. The online school type is a platform that provides teachers with video learning and tutorial communication; the B2B2C platform type is an English DE platform that supports online education for resource content providers such as institutions and individuals, and resource users such as teachers and students; the B2C service type platform is dedicated to developing high-quality EDERs independently and providing high-quality resource content and services; the

tutorial tool type platform is based on characteristic and rich functional services and provides users with efficient and convenient learning tools and services. The tutoring tool-based platform is mainly focused on providing users with efficient and convenient learning tools and tutoring resources [7-8]. According to the educational fields involved in English DE platforms, they can be divided into preschool education platforms, K12 education platforms, vocational education platforms, interest education platforms, vocational education platforms, language education platforms, etc.

In this study, English DE platforms are divided into four major categories according to the different service targets and service areas of EDERs [9-10], as shown in Table 1.

Table 1. Classification of English distance learning platforms

Platform Type	Description
Resource Based	Resource aggregation platform
Tools	A resource-based learning aid
Coaching	Based on one-to-one tutorials and other online learning methods
Online School	Online format for schools

2.2 Application of DM in Education

The application of DM in education is not very different from its application in other fields (e.g., business, medicine, biology) because it follows a generic process of knowledge discovery in databases [11-12]. Specifically, these include.

(1) Problem study: to obtain a priori knowledge relevant to the application domain and to understand the processing objectives of knowledge discovery in the database.

(2) Create target data: select data of interest from the dataset.

(3) Data cleaning: cleaning data by removing noisy, redundant and irrelevant data.

(4) Data reduction and transformation: reducing data by selecting dimensions of interest and converting them into a data format that can be mined.

(5) Application of DM methods: Based on the goal of knowledge discovery process in the database, intelligent mining methods such as summarization, clustering, classification, regression, etc. can be applied to the process. The application results in the generation of data patterns.

(6) Model assessment: assessment of the acquired model.

(7) Knowledge representation: interpretation and presentation of interesting patterns as visual knowledge models [13-14].

2.3 Information gain

(1) S represents the sample (number), Ci is type 1, 1=1, 2, ... ,m,

$$I(s1, s2, ..., sm) = -\Sigma pi \log 2(pi) \quad (1)$$

(2) Si is the number of samples of type i, Pi = Si/S, and og2 is the binary logarithm;

(3) Attribute A has v different values;

(4) Entropy:

$$E(A) = \Sigma\{(S1j + S2j + ... + Smj)/S\} * I(s1j, ..., smj) \quad (2)$$

(5) where Sij is a subset j of the attributes A of class i.

$$I(S1j, S2j, ..., Smj) = -\Sigma pij \log 2(pij) \quad (3)$$

$$Gain(A) = I(s1, s2, ..., sm) - E(A) \quad (4)$$

(6) Then the average gain in the test is selected as the gain rate, and

$$P(A) = \sum_{i}^{t} \frac{Si}{S} \log(\frac{Si}{S}) \quad (5)$$

(7) Gain rate of attribute A.

$$GainRatio(A) = Gain(A)/E(A) \quad (6)$$

3 EXPERIMENTAL RESEARCH

3.1 EDER Allocation and Service Model Construction

A model of EDER allocation and service is constructed as shown in Figure 1.

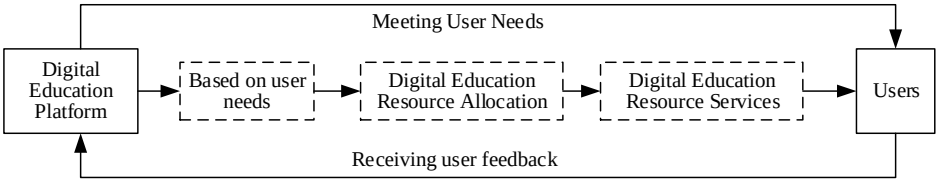

Figure 1. A model of digital education resource allocation and services from the perspective of user needs

The model is divided into three parts, one is the main body that is English DE platform and users, the second is the process that includes EDER allocation and EDER service, and the third is the relationship that is English DE platform meets users' needs and accepts users' feedback content. The three parts have different connotations in the model.

Subjects - English DE platform and users. English DE platform and users are the main subjects in the model, where English DE platform is the bridge of value transfer between EDERs and users, and users are the main reference source for English DE platform to improve EDERs.

Process - EDER configuration and service. This part is the main content of the model. The English DE platform configures EDERs based on users' needs, and the configuration process consists of three elements: configuration object, configuration content and configuration means, which are interlocked and aim to deliver appropriate EDERs to users. Then, it provides follow-up support for users through EDER services. The service process consists of five elements: support service, push service, optimization service, evaluation service and incentive service, and the service contents correspond to the service purposes of providing support, recommending resources, improving efficiency, learning evaluation and arousing interest, so as to create an efficient, personalized and intelligent learning environment for users.

Relationship - Meeting user needs and receiving user feedback. From the perspective of the value transfer process of EDERs, the relationship between English DE platform and users is a two-way cycle. The English DE platform can obtain user needs through market research, data analysis and other means and then meet user needs, while users pass on information such as usage experience reports and suggestions through the feedback channels provided by the English DE platform in the process of applying EDERs. Through the two-way process of satisfying user needs and receiving user feedback, the English DE platform can reach a balanced state with the users and thus achieve a win-win situation.

3.2 Educational DM Process

When using DM techniques to solve educational problems, it is important to choose different data processing methods for specific tasks.

Define the DM objectives, i.e., the expected mining results. Currently, educational DM objectives focus on five main areas.

(1) Building learner models: Learner models are usually built to provide personalized solutions related to learning, with the aim of building models that contain the cognitive, skills and declarative knowledge of the user/student. Educational DM has been used to automatically construct student models considering student characteristics (motivation, satisfaction, learning style, affective state, etc.) and learning behaviors.

(2) Student achievement prediction: The purpose is to estimate the unknown values of the variables that describe the student. In education, the variables predicted are usually student behavior, knowledge, scores or levels. For students, prediction systems within can help them choose the most appropriate and specialized and different difficulty courses; for teachers, prediction systems can alert which students' learning is at risk and provide academic guidance to students in advance.

(3) Provide feedback to support services: The goal is to provide feedback to course producers/teachers/administrators to make decisions (about how to improve student learning and organize teaching resources more effectively).

(4) Data analysis and visualization: The goal is to highlight useful information and support decision-making. For example, it can help educators and course administrators to analyze student course activities as well as use the information to gain a general view of student learning.

(5) Recommendations for students: The purpose is to solve the problem of disorientation and cognitive load caused by information overload. The main function is to be able to recommend personalized activities, links to visit, next tasks or problems to be done, etc. for students, and also to be able to adapt to the characteristics of each student to recommend learning content, feedback and learning sequences, etc.

4 EXPERIMENTAL ANALYSIS

4.1 Analysis of the CS of English Distance Education (DE) Resource (EDER) Allocation

The research on the current situation (CS) of EDER configuration of English DE platform is divided into three aspects: configuration object, configuration content and configuration means. Among them, the basic attributes of configuration objects are education fields, subjects and school sections, configuration contents can be classified according to learning styles and resource types, and configuration means are mainly realized by providing various resource navigation and recommendation information for users who have active purchase intention.

(1) Configuration object

Different English DE platforms actually serve different populations based on market positioning, marketing strategies, and other specifics, so the basic allocation of EDERs needs to be made by grasping the basic attributes of the configured objects. In the survey, it was found that five of the selected platforms (31.3%) are oriented to a wide range of people, and their service groups include preschool education, K12 education, vocational education and all-age users of university and above, as shown in Table 2 and Figure 2.

Table 2. Statistics on the distribution of educational areas of the configuration objects

	Number	Percentage
K12 Education	14	87.5%
Language Education	3	18.8%
Vocational Education	2	12.5%
Hobby Education	1	6.3%
Quality Education	1	6.3%
Exam Education	3	18.8%

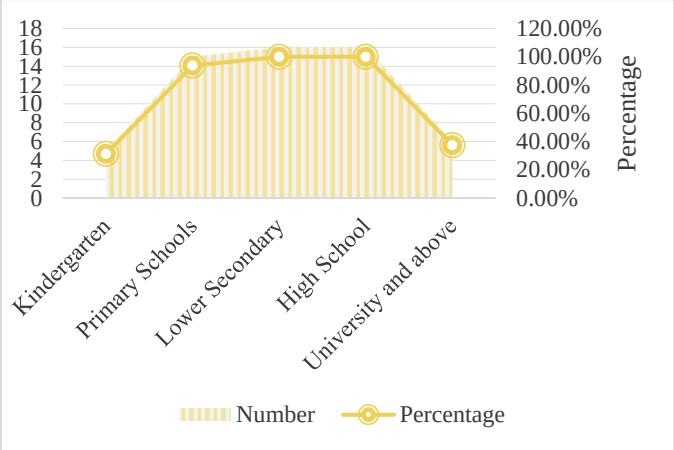

Figure 2. Statistical chart of the distribution of school segments of the configuration objects

Such platforms occupy a large share of the market, have a wide variety of resources, rich resource content and a good brand image, but also because of their large market has led to lax supervision of EDERs and uneven quality.

At the same time, English distance learning platforms in the basic education field basically choose the subject resources required for current exam-based education when allocating subject resources, and usually develop and allocate resources according to K12 subjects. There are also platforms that mainly allocate resources for a single discipline. These platforms have a targeted audience in the market because they focus on one type of EDERs, and according to the current research results, these platforms have a good reputation and high popularity, and are widely praised among users. At the same time, such platforms tend to increase their resource allocation after achieving better development and gradually expand their market areas. According to China's education reform documents in recent years, the country has gradually attached importance to quality education for primary and secondary school students, and has begun to pay attention to students' STEM literacy, innovative thinking and other international talent quality cultivation in line with international standards. However, the current mainstream English DE platform in China is still dominated by knowledge transfer and test-taking education tutorial content, and lacks an English DE platform that can truly cultivate students' literacy.

(2) Configuration content

During the research, it is found that most English DE platforms have established appropriate resource content modules in the development process, but the platform resource system has not yet been formed, and the content of various resources is independent of each other and presented in an isolated tree-like structure, which cannot help learners form a net-like knowledge connection. However, the development of EDERs is dynamic in nature, and the resource planning made in the early stage of platform development is no longer adapted to the current market and user needs.

In terms of the learning style dimension, as shown in Table 3, the

Table 3. Statistics on the content of resources configured to match different learning styles

	Number	Percentage
Individual Task Type	13	81.3%
Mini-lesson	8	50%
Process Experiential	1	6.3%
Group work	0	0%
Proximity Experience	1	6.3%

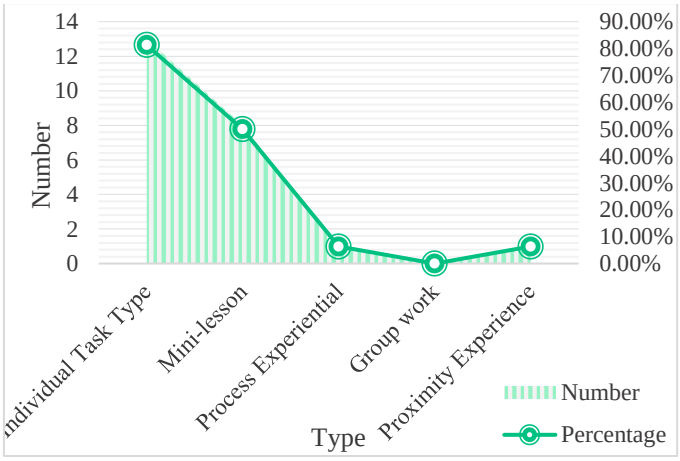

Figure 3. Statistical chart of the content of resources configured to match different learning styles

Figure 3 shows that individual task-based resources (81.3%) provide users with a series of learning activities from issuing learning tasks, providing learning resources, organizing learning evaluation to providing learning support, etc., which is the main configuration of most English DE platforms and overlaps with the learning paths of pre-study-lesson-practice-test-evaluation in school education, and is a more accustomed and easily accepted learning mode for primary and secondary school users. It is the learning mode that primary and secondary school users are more accustomed to and easily accepted. Half of the platforms configure mini-lesson resources (50%) based on knowledge units such as knowledge points, materials and words, providing users with a fragmented, anytime, anywhere ubiquitous learning approach, mainly applicable to mobile English DE platforms such as English Fluency, Homework Help, Onion Math, etc. Mini-lesson resources have the advantages of being short and compact, easy to store and small in capacity; the new curriculum theory emphasizes the cultivation of The new curriculum theory emphasizes the cultivation of students' abilities of collaboration, inquiry and innovation, but the content of process experience-based (6.3%), group cooperation-based (0%) and neighborhood experience-based (6.3%) EDERs in the education market is very scarce, reflecting that the current resource allocation content of English DE platforms is still limited to the knowledge-based resource collection of exam-oriented education, and lacks the resource allocation content for cultivating social innovation talents. The content of English DE platform is still limited to the knowledge-based resources of exam-oriented education, but lacks the resources for cultivating innovative talents in society.

4.2 Personalized Services to Help Learners

Knowledge mapping-based educational resource services can be personalized according to the real situation of learners, and these services will help learners clarify their personal learning situation, facilitate subsequent learning and review, and thus enhance the learning effect. Its findings are shown in Table 4.

Table 4. Personalized services to help learners

	Clarity of learning	Easy to study and review	Enhanced learning outcomes
Strongly Agree	0.6	0.5	0.45
Agree	0.3	0.4	0.35
Generally	0.1	0.07	0.15
Disagree	0	0.02	0.01
Strongly disagree	0	0	0.02

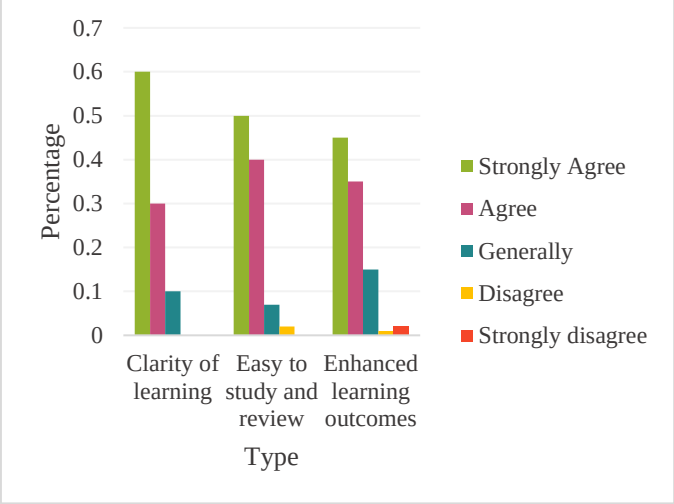

Figure 4. Analysis of the help of personalized services for learners

From the clear learning situation in Figure 4, about 90% of learners think that learner portraits can help them clarify their learning situation to help learners check the gaps and review effectively; 90% of learners think that this personalized learning service method can facilitate their own independent learning and review what they have learned; 80% of learners think that through this method, they can improve their learning effect and make themselves less 80% of the learners think that this way can improve their learning effect and make them less confused and more confident. In summary, whether comparing various data analysis methods at the algorithmic level or qualitatively analyzing the advantages and disadvantages of various personalized service models for educational resources, personalized learning based on learner portraits still has advantages. From the analysis of quantitative questionnaire data, the personalized learning model based on learner profile has a positive impact on learners' academic performance, and learners who learn with this personalized learning model have significantly better group academic

performance than the control class. The user satisfaction survey shows that the learners have a very positive opinion of the personalized intelligent learning system based on this model, and believe that this intelligent learning can help them learn meaningfully and enhance their learning effect.

5 CONCLUSIONS

In this paper, we found during the training of teachers that teachers often cannot make full use of online resources, so they cannot accurately grasp the distribution of students' online resources. Therefore, this study establishes a DM-based web resource management system for English DE. By fusing learning data and text data together to form a data set. When applied to teaching, the teaching resources in the network can be used rationally according to the teaching situation. This system can effectively detect students' learning and pre-study effect in pre-course pre-study. Pre-learning is more effective in improving students' mastery of the material and in interacting with the teacher. Students are able to adapt to the new learning style more quickly and make better use of class time. Classroom materials are useful for improving students' learning efficiency, but they seem to be very weak for students who do not have a basic knowledge of English. Therefore, this study designs an intelligent assistant that can help students learn English, which can greatly help students improve their English skills.

REFERENCES

[1] Mohammad Arfaee, Arman Bahari, Mohammad Khalilzadeh: A novel prediction model for educational planning of human resources with DM approach: a national tax administration case study. Educ. Inf. Technol. 27(2): 2209-2239 (2022).

[2] Kerry Walton: Role of Campus Community in Open Educational Resources: The Benefits of Building a Collaborative Relationship with Campus IT and DE Departments. libr. Trends 69(2): 395-418 (2020).

[3] Mahdi Bastan, Hamed Shakouri Ganjavi, Reza Tavakkoli-Moghaddam: Educational demographics: a system dynamics model for human resource management. Int. J. Syst. Assur. Eng. Manag. 11(3): 662-676 (2020).

[4] Mohamed Benhima: Moroccan English Department Student Attitudes Towards the Use of DE During COVID-19: Moulay Ismail University as a Case Study. Case Study. Int. J. Inf. Commun. Technol. Educ. 17(3): 105-122 (2021).

[5] Odiel Estrada-Molina, Dieter Reynaldo Fuentes-Cancell, Anaibis Alvarez Morales: The assessment of the usability of digital educational resources: An interdisciplinary analysis from two systematic reviews. Educ. Inf. Technol. 27(3): 4037-4063 (2022).

[6] Maimoona H. Al Abri, Brenda Bannan, Nada Dabbagh: The design and development of an open educational resources intervention in a college course that manifests in open educational practices: a design-based research study. j. Comput. high. educ. 34(1): 154-188 (2022).

[7] Murilo Gazzola, Sidney Evaldo Leal, Breno Pedroni, Fabio Theoto Rocha, Sabine Pompéia, Sandra M. Aluísio: Text complexity of open educational resources in Portuguese: mixing written and spoken registers in a multi-task approach. Lang. Resour. Evaluation 56(2): 621-650 (2022).

[8] Charlotte Warkentin: Open Educational Resources-Praxis an Hochschulen. Inf. Wiss. Prax. 73(5-6): 277-283 (2022).
[9] Ishewakatipa Muzvondiwa, Ngoako Solomon Marutha: Framework for improving usage of library services and resources in the private higher education in South Africa. South Africa. Digit. Libr. Perspect. 38(1): 104-130 (2022).
[10] William Simão de Deus, Ellen Francine Barbosa: A Systematic Mapping of the Classification of Open Educational Resources for Computer Science Education. IEEE Trans. Educ. 65(3): 450-460 (2022).
[11] Guilherme Medeiros Machado, Vinícius Maran, Gabriel Machado Lunardi, Leandro Krug Wives, José Palazzo Moreira de Oliveira: AwARE: a framework for adaptive recommendation of educational resources. computing 103(4): 675-705 (2021).
[12] Thanuja Chandani Sandanayake, Shironica Priyanthi Karunanayaka, Ajith P. Madurapperuma: A framework to design open educational resources- integrated online courses for undergraduate learning: A design-based research approach. Educ. Inf. Technol. 26(3): 3135-3154 (2021).
[13] Jonela Carmada Marisa Wilson, Patrick Kandege, Akadje Jean Roland Edjoukou, Mussie Tesfay Teklu: Unpacking smart education's soft smartness variables: leadership and human resources capacities as key participatory actors. Educ. Inf. Technol. 26(5): 6267-6298 (2021).
[14] Nadim Akhtar Khan, S. M. Shafi: Open Educational Resources Repositories: Current Status and Emerging Trends. Int. J. Digit. Lit. Digit. Competence 12(1 Competence 12(1): 30-44 (2021).