Application of Data Mining of Preschool Teachers' Information Literacy Based on Fuzzy Clustering

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Abstract. With the support of national policies and the active promotion of all sectors of society, China's information construction has also entered a new stage. While making progress in information construction, people need to correctly deal with the shortcomings in the development of information construction, actively learn advanced construction experience, and make the information construction of preschool education move forward stably. Multimedia courseware, modern information technology, computer, information technology education, information literacy and information construction have become the hot words in the information research of preschool education in China. In order to implement the planning requirements of the Ministry of education on strengthening the information literacy of preschool education teachers, using modern new media means to build a digital platform to improve the quality of children, promote the harmonious development of children's body and mind, and enhance the professional ethics and professional level of preschool educators, which is an important means to lay an important foundation for the steady and all-round development of preschool education in China. Preschool education is the most basic part of basic education. Improving Preschool Teachers' information literacy is particularly important to carry out early childhood information technology education and promote the development of preschool education. In view of the current situation of preschool teachers' information literacy in China, this paper puts forward to strengthen the construction of hardware and software, create an information technology application atmosphere, improve the management system and provide guarantee for information technology training.

Keyword: Fuzzy clustering algorithm · Preschool education · Information literacy

1 Introduction

With the rapid development of computer technology, network technology and communication technology, information technology has been widely used in various fields of Education [1]. The rapid development of information technology puts forward higher

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requirements for preschool education teachers [2]. The informatization of education has gradually become an important platform for educational modernization, and preschool education is the cornerstone of the whole education building. Its informatization plays a strong role in promoting the informatization of the whole education. Educational informatization is a systematic project. With a good software and hardware environment, teachers have high information literacy, which is of great significance for the promotion of educational informatization [3]. The popular understanding of information literacy is to search, process and process information, and then combine their own knowledge structure to internalize information and put forward their own views [4]. This kind of quality and ability is particularly important in the network era, and it is also an important quality for preschool teachers to develop professionally [5]. Kindergarten teachers' information literacy should be "know how to use computer and network technology to obtain relevant preschool education and teaching information, creatively develop and enrich kindergarten education resources, and reasonably and flexibly use a variety of information to solve practical problems in kindergarten education and teaching" [6]. The integration of Internet and education has become the development trend of the education industry. As an important participant in enlightenment education, preschool teachers must have basic information literacy to keep pace with the times and make the process of early childhood education more dynamic [7].

In recent years, the informatization level of early childhood education has been continuously improved, and the society has put forward higher requirements for the information literacy level of early childhood teachers [8]. Information literacy is an internalized cultivation. There are many indicators and factors involved in the evaluation. Its evaluation is often highly subjective. How to objectively and scientifically evaluate the information literacy level of preschool teachers is worthy of our careful study [9]. Data mining technology has been successfully applied in some fields, and its application in the field of high-level education management has been paid more and more attention. Not only normal universities and comprehensive universities, but also many large companies and enterprises have also participated in this business for the benefit of the future [10]. In the field of preschool education management, data mining is still a new topic. This paper will use data mining methods to analyze the information literacy of kindergarten teachers in the process of using information technology, including: ① personal information awareness and attitude, including teachers' professional ability, information environment construction, teachers' information awareness, and their initiative to solve work and life problems by means of information. ② Personal information knowledge and skill level, including teachers' use of multimedia software, multimedia courseware making ability, network skills, knowledge skills and courseware making ability. ③ Comprehensive factors and learning objectives of personal information literacy, including information teaching awareness, information ethics and security, information technology training requirements and information technology difficulties [11]. Through the research and analysis of the above three aspects, we hope to find out the subjective and objective factors affecting the improvement of teachers' information literacy, so as to guide the formulation of teachers' information technology training programs, and contribute to the formulation of pre service teaching plans for preschool education teachers and the adjustment of training objectives [12].

2 Information Literacy - The Professional Literacy that Preschool Teachers Should Possess

2.1 Connotation of Preschool Teachers' Information Literacy

In the field of preschool education, preschool teachers as the main body are a special young group. They generally have low educational background, limited research level and lower learning ability than primary and secondary school teachers, but they are a vibrant and positive group. Due to the special educational environment and teaching objects, they need more efficient teaching means and teaching modes to enrich the classroom, attract children's attention and improve the teaching effect, and information technology is the best tool. Therefore, how to strengthen preschool teachers' information technology ability and improve preschool teachers' information literacy is a very important task. The frame design of the preschool education public welfare evaluation index system is shown in Fig. 1.

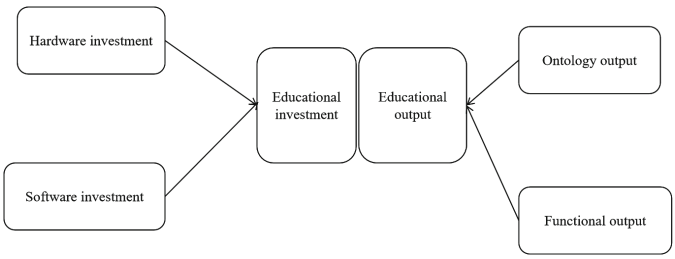

Fig. 1. Framework design of preschool education public welfare evaluation index system

Generally speaking, information literacy refers to the ability to master information-related theories, knowledge and methods, and effectively use information equipment and resources to obtain information, process information and create new information. Then, the information literacy that preschool teachers should possess in the information age includes: being aware of the important role of information in the information age, having a positive internal demand for information, being able to feel their own demand for information all the time, knowing what kind of information is easy for young children to accept and understand, promoting various activities and teaching, being able to integrate effective information into the teaching of the courses they teach, being good at quickly connecting information phenomena with children's life and environment, and being good at finding out the key to solving problems from information; Master the basic knowledge of information, information sources, transmission and acquisition; Can use network media, various multimedia and various softwares to develop and make preschool teaching courseware and preschool activity environment platform; Teachers, as transmitters of information, should filter out the mixed information before transmitting it to children to ensure their physical and mental health.

2.2 Information Literacy that Kindergarten Teachers Should Have

Because children's attention concentration time is short, they mainly focus on graphics and image thinking, and early childhood is the most active period of their creative thinking. Therefore, in early childhood activities, making full use of information technology can easily, quickly and accurately provide a large number of teaching materials and develop a suitable teaching environment, which requires preschool teachers to have certain information literacy. The information literacy required mainly includes: ① optimize teaching and make the form of education more flexible. In teaching, teachers are the provider of children's learning resources, the organizer of learning activities, and the most powerful helper in the process of children's learning and growth. For example, teachers with information literacy can understand children's interests and needs from children's life activities according to children's physical and mental characteristics, and take it as the basis for presupposing teaching themes; Then collect relevant pictures and small toys around the theme, use the network to consult relevant text materials and give guidance in all aspects; You can also use computers and projectors to play animation to help children learn language; Use computer drawing tools to help children learn painting; Through a variety of simple computer game software to help children learn numbers, and so on. Children experience and find problems in computer activities, and communicate with peers and teachers. In this way, learning and playing in the information-based teaching environment brings endless happiness to children's learning, so that their initiative, practical ability and creative imagination can be exercised and developed. At the same time, preschool teachers with information literacy can communicate with children's parents and peers in the form of network to explore educational experience, so as to enrich and flexible educational forms, so as to promote the all-round development of children. ② Cultivate children's information literacy and stimulate children's interest in learning. Like many toys and tools, computers and some simple game software can start from children's curiosity and interest, provide children with a variety of interesting opportunities, and timely seize useful educational opportunities to support children's learning and thinking. Only when preschool teachers have information literacy can they teach children to use computers and children's computer game software as in other activity classes, so that children can have more opportunities to practice problem-solving and make decisions.The overall structure of the integrated educational data system is shown in Fig. 2.

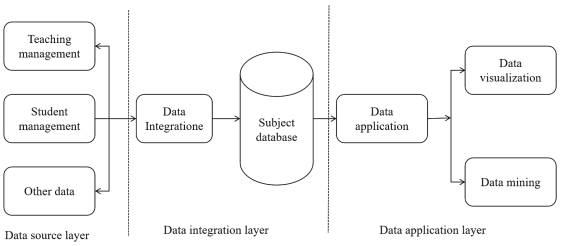

Fig. 2. The overall structure of the integrated educational data system

In the process of using information technology, preschool teachers should first put morality first, strictly abide by the corresponding moral standards in many links such as information acquisition and processing, and have certain ability to distinguish the authenticity of various information. In actual operation, we should fully respect factual property rights, respect personal privacy, abide by network laws and regulations, actively resist bad information, and refrain from spreading false and harmful information, so as to fully assume social responsibilities and obligations as a citizen. Teachers' specialization means that teachers' profession has its own unique professional requirements and conditions, which is also a developing concept and a deepening process. The improvement of teachers' professional level always needs to acquire new knowledge, update knowledge and apply knowledge. According to Vygotsky's "zone of proximal development" theory, we advocate preschool teachers to find the zone of proximal development for children, provide effective "support" for children's learning, and arouse children's enthusiasm for active exploration and active learning. As the main undertaker of preschool education, we also need to find the "nearest development zone" for preschool teachers to promote their professional growth. It is in this sense that the information literacy of preschool teachers is of great significance to improve the professional level of teachers.

3 Research on the Application of Data Mining in Preschool Education

3.1 Application Status of Data Mining Technology in Education

In the field of educational management, data mining technology is slowly being popularized, mainly applied in library management, educational administration management, teaching evaluation, data analysis and other affairs, but the research is not mature on the whole. At present, the major normal universities in China are also aware of the importance of data mining, and have set up "data mining" and other related courses in the curriculum of education. With the continuous development and improvement of association analysis, clustering, concept description, deviation detection and other technologies, data mining will play an increasingly important role in the field of education. At the same time, with people's increasing attention to this technology, it is believed that its application range in the field of education will be wider and wider, so as to quickly promote the reform and development of education. In the field of preschool education, due to the lack of managers in technology, the relevant applications of data mining are basically blank. More often, they use Excel charts or SPSS to summarize and analyze the survey results and draw conclusions. With the wide application of information technology, experts in preschool education also began to pay attention to the cultivation of information literacy and investigate and study the information literacy of kindergarten teachers. However, they failed to make more meaningful discovery and reasoning about the obtained data, the internal relationship and mutual restriction between problems.

Preschool teachers in the information society have better information awareness, and can correctly and quickly recognize information, use information, and create information. The teaching information is novel and the teaching vision is broad, which is conducive to cultivating children's divergent thinking and developing children's creativity. Most preschool teachers agree that information technology plays an important

role in life and teaching. Using information technology with computers and networks as the core to collect, process, generate and exchange information is a skill that teachers should have in the information age. For preschool teachers who do not major in computer science, the main purpose of learning computer, multimedia technology and network technology is to improve their work and improve teaching effects. At present, most kindergarten teachers have been able to use basic computer projection and other multimedia equipment, and are proficient in using basic application software such as word, Power Point, and windows drawing tools for lesson preparation and teaching, Collect and obtain required teaching information resources such as pictures, sounds, animations, etc. However, information technology should not only become a teaching tool for preschool teachers to demonstrate, but also a tool used to create teaching situations, organize children's thinking, and promote children's cognitive development. The essence of the Internet is sharing and communication, and many front-line teachers only search for information from the Internet, and do not publish their educational and teaching achievements on the Internet to share with everyone, and promote their own growth through mutual exchanges. Due to the influence of traditional concepts, information technology has entered the kindergarten poorly, and each kindergarten has little investment in hardware and software for modern educational technology, and only has a dozen computers for teaching, educational work management, and a small amount of multimedia, teaching software and other information resources. All these objectively restrict the cultivation and improvement of preschool teachers' information literacy.

3.2 Using Fuzzy Clustering Algorithm to Analyze the Application of Data Mining in Preschool Education

Clustering is the process of dividing physical or abstract objects or data according to the similarity between objects, and dividing similar objects or data into multiple classes or clusters. In short, it is the ancient idea of "birds of a feather flock together". Clustering is different from the classification in the field of machine learning. The learning process of clustering is unsupervised, and training samples and prior knowledge required by the classification process are not needed. Only according to the similarity between objects or data, the similarity between objects in each category is the largest, while the similarity between categories is very small, so as to discover the potential structure and potential effective information of data. Clustering analysis can be divided into hard partition and soft partition in terms of data partition. The dynamic clustering process is shown in Fig. 3.

Cluster analysis relies on the similarity between data as the basis for classifying each category, so how to measure the similarity between data is an important issue. At present, the commonly used similarity measurement methods mainly include distance-based measurement methods, similarity coefficient and correlation coefficient-based methods, information entropy-based methods, and other measurement methods for different types of data. Different from the previous quantum clustering-based community detection method, we introduce the concept of structural similarity in the data preprocessing stage. Next, we discuss the structural similarity matrix in detail.

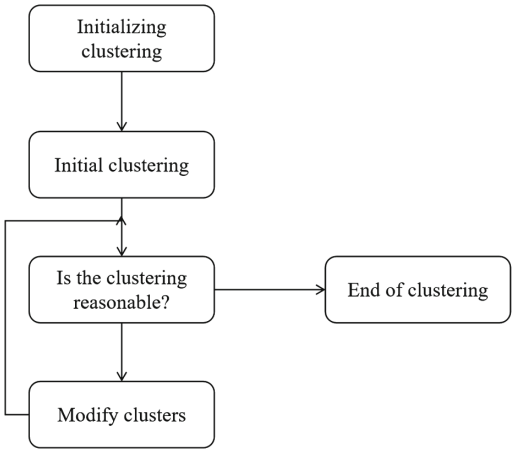

Fig. 3. Dynamic clustering process

We define a set i containing node i and points directly connected to node $\Gamma(i)$ through a common edge, then the tightness of node i and j can be expressed by the following formula:

$$M_{ij} = |\Gamma(i) \cap \Gamma(j)| = \sum_{u \in \Gamma(i) \cap \Gamma(j)} \omega_{iu} \cdot \omega_{ju} \tag{1}$$

However, the formula can't express whether two points in a set are connected with each other, so this index can be modified by a constraint, that is, when nodes i and j are not connected, let $M_{ij} = 0$. The matrix expression of post-M_{ij} constraint is as follows:

$$M = \left(A^2 + 2A + I\right) * (A + I) \tag{2}$$

In formula (1), A represents the adjacency matrix of the network, I is the identity matrix of the same order as the adjacency matrix, in which the operator $\cdot *$ represents the matrix multiplication, that is, the number multiplication at the corresponding position of the matrix of the same order. This modified matrix M is called the common adjacency matrix.

Next, the concept of structural similarity is introduced, and the formula of structural similarity is as follows:

$$S_{ij} = \frac{M_{ij}}{\sqrt{|\Gamma(i)| \cdot |\Gamma(j)|}} = \frac{M_{ij}}{\sqrt{\sum_{u \in \Gamma(i)} \omega_{iu}^2} \cdot \sqrt{\sum_{u \in \Gamma(j)} \omega_{ju}^2}} \tag{3}$$

The purpose of introducing this concept is to better define and measure the similarity between any two nodes. The return value of institutional similarity is between 0 and 1. The more common neighbors between a pair of nodes, the higher the structural similarity between the two nodes. If the two nodes are borderless, the similarity is zero. If the

structural similarity of two nodes is 1, it means that the two nodes are equivalent. The structural similarity matrix can be calculated by the following matrix.

Get:

$$S = D^{-1/2} M D^{-1/2} \tag{4}$$

D is a diagonal matrix of diagonal elements $D_{ii} = M_{ii}$. It can be seen that the S matrix is symmetric, and the diagonal elements are all 1 s.

In this algorithm, we first extract the feature information of the network to be detected, and use the obtained feature matrix Φ_l as the input data of the clustering algorithm. Each row of the feature matrix corresponds to a node in the network. As a result, the community detection problem is transformed into a clustering problem in the scale space. Finally, the obtained feature matrix is clustered by combining the quantum clustering algorithm that introduces the adjacency information, which achieves good results and reduces the time complexity. Spend.

4 Conclusions

The promotion of educational informatization makes preschool teachers' information literacy more and more valued. Teachers should actively establish information awareness and apply information technology to teaching practice through training and self-study, so as to promote their information literacy to be continuously improved. Information literacy education is a kind of information enlightenment and ability training, which can prepare children for learning and lifelong development. Therefore, we should vigorously cultivate preschool teachers' information literacy in many ways, improve the overall information knowledge level of preschool education teachers, further improve children's learning environment and jointly promote the development of early information education for children in China. With the progress of overall social cognition, people are more and more aware of the great value of preschool education. In order to promote the progress of preschool education in China, we need to pay attention to the cultivation of preschool teachers' professional quality. In addition to the traditional professional quality, it also includes modern information quality, which requires relevant colleges and universities, kindergartens and preschool teachers to pay more attention, gradually improve the information quality of preschool teachers from various aspects such as training mechanism, awareness concept and form innovation, and improve the level of preschool teachers' query, analysis, integration and application of teaching information.

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