



Online Teaching Method of Biochemistry Course of Nursing Specialty Based on Association Rules

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Abstract. The content of biochemistry course of nursing specialty is relatively abstract, which is difficult for students to understand and has low learning enthusiasm. In order to improve students' learning enthusiasm and improve the overall teaching effect, an online teaching method of biochemistry course of nursing specialty based on association rules was studied. The problems existing in online teaching are summarized and analyzed. Based on the existing problems and on the basis of in-depth understanding of data mining theory, association rules algorithm is applied to online learning behavior analysis, online examination score analysis, teaching resource recommendation and teaching quality evaluation to mine the hidden and useful knowledge in teaching data and realize the effective combination of teaching and learning in online teaching. The test results show that under the application of this method, the accuracy of course recommendation is maintained at about 80%, which improves the overall teaching effect.

Keywords: Association rules · Nursing specialty · Biochemistry course · Online teaching method

1 Introduction

With the rapid development of mobile Internet, Internet of things and other new generation information technologies, data has become an important information resource in modern society. The processing of big data is inseparable from the application of data mining technology. Therefore, data mining technology plays a very important role in all walks of life. In the education industry, the mobile Internet has created a cross time and space learning method, the way students acquire knowledge has changed fundamentally, and the traditional teaching mode is gradually changing into an online based teaching mode. In the face of a large number of data resources generated in the process of online teaching, how to make full use of these teaching data and provide useful decision-making basis for online teaching is a problem worthy of discussion.

Biochemistry is an important public basic course for nursing majors in medical colleges. It is a necessary basis for further study of physiology, pharmacology and clinical

medicine. Biochemistry course has many contents, which is highly abstract and logical, and requires students to have a certain physical and chemical foundation to be easy to understand. However, in recent years, nursing majors in many medical colleges have implemented the enrollment model of both arts and Sciences. For liberal arts students, due to their weak physical and chemical foundation, they are subjectively afraid and resistant to the learning of Biochemistry, forming the bad habit of passive learning, and the learning effect is poor.

2 Related Work Introduction

Reference [1] aimed at the problems existing in the current network teaching, put forward methods to improve the effect of network teaching of biochemistry courses of nursing specialty, including careful preparation of lessons in the early stage, interactive discussion type live teaching, enhancing the sense of learning community, etc., taking multiple measures to improve the teaching effect of network teaching and ensure the teaching quality. Reference [2] takes the course Ideological and political education as the starting point to share the experience of online teaching practice and teaching experience of the basic course “biochemistry” of undergraduate nursing major in the Medical College of Guizhou University. The main contents include: the basic situation and teaching requirements of the course, the special scheme designed for online teaching, how to teach professional knowledge and integrate ideological and political elements in online teaching implementation cases, as well as the evaluation of the implementation effect of online teaching, In order to provide reference for online teaching of related courses in other colleges and universities.

The above existing research methods do not recommend courses according to the association rules of courses, resulting in low accuracy of course recommendation. In order to improve the accuracy of course recommendation, this paper proposes an online teaching method of biochemistry course of nursing specialty based on association rules. Firstly, it summarizes and analyzes the problems existing in online teaching. Then, based on the existing problems and on the basis of in-depth understanding of data mining theory, this paper focuses on the application of association rules in online learning behavior analysis, online examination score analysis, teaching resource recommendation and teaching quality review, and discusses how to find hidden and useful knowledge from a large number of teaching data to help students learn effectively, Guide teachers to teach effectively, so as to realize the effective combination of teaching and learning in online teaching, and also provide a certain reference value for the application and development of data mining technology in the field of education.

3 Problems in Online Teaching

Compared with traditional teaching, online teaching shows some characteristics of the information age, but some problems have also been found in the process of implementing online teaching, mainly focusing on the insufficient use of teaching resources, the lack of online application skills of teachers, the imperfect statistical function of network teaching platform, and the lack of effective data mining methods. The specific analysis is as follows:

- (1) Due to the lack of understanding of the value of online teaching, some teachers carry out online teaching under the pressure of applying for a project or meeting the teaching evaluation. Once the project is completed and the evaluation is completed, the developed online courses and digital teaching resources will be idle, not fully utilized and continue the later construction.
- (2) Due to the lack of online application skills, some teachers' teaching contents have remained unchanged for several years after the construction of online courses; Some teachers even put too much emphasis on students' autonomous learning ability, throwing a pile of learning materials online for students to digest and absorb by themselves, ignoring the timely adjustment of online teaching and support services according to students' conditions, and ignoring the analysis of online teaching effect.
- (3) Due to the incomplete statistical functions of online teaching platforms and the lack of sound online learning tracking and monitoring, teachers can not know the detailed learning effects of students' knowledge points in time, and can not grasp the learning dynamics of students in time, so that teaching contents and organizational activities can not be adjusted accordingly with the dynamic changes of students' learning status, Not to mention giving targeted guidance to students, so it is easy to separate teaching from learning, and online teaching can not achieve the expected effect.
- (4) Due to the lack of mining methods and means, people often ignore a large number of teaching data generated in the process of online teaching, and can not find valuable knowledge and laws in the data, resulting in a great waste of data resources and limiting the improvement and development of online teaching.

At the same time, it also puts forward new requirements and convenience for teachers and students. Online teaching not only requires teachers to have the ability of online application and information processing, the presentation of teaching content should be multi-level and diverse, and the teaching resources should be rich and novel; More importantly, teachers should mine useful teaching feedback from a large number of teaching data information, and make corresponding adjustments to teaching mode, teaching strategy and teaching content in time, so as to better guide students' learning and teach students according to their aptitude, so as to achieve the best online teaching effect. Therefore, data mining technology has important application value in online teaching. In addition to online application knowledge and skills, students also need to have a certain cognitive style, cognitive ability and autonomous learning ability, improve their self-control ability in the learning process and cultivate good online learning behavior.

4 Integration of Teaching Data

Aiming at the problem that online courses and digital teaching resources can not be fully utilized, teaching data integration is carried out. In the traditional sense, data warehouse refers to the previous data stored in a single place, which is called data center. These data resources are processed in some basic ways, including transaction processing and batch processing. Data warehouse is produced to mine the relationship between data and get

the final decision. There are a large number of databases before it is produced. It has certain integration and stability.

At the same time, it can reflect the changes of history and is also organized for a certain theme [3]. Data warehouse is like a process, a process of integrating, processing and analyzing the data of courses, grades and so on.

The data warehouse integrates the information of different data sources in multiple databases and reorganizes them according to the set subject content. Then, the reorganized historical data will be stored in the data warehouse. Generally, all the data stored will not be modified. The data warehouse structure model is shown in Fig. 1.

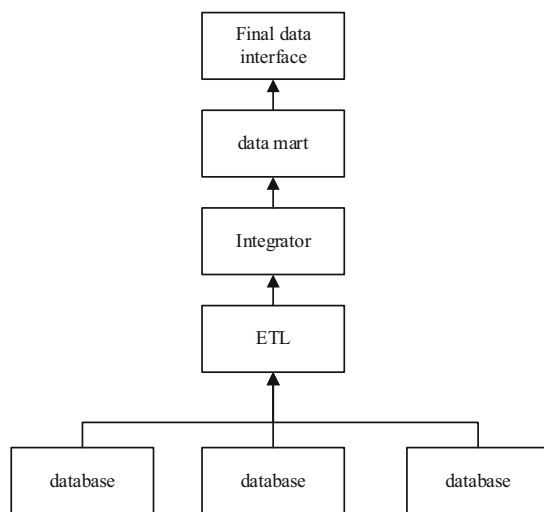


Fig. 1. Data warehouse structure

The main function of data warehouse is to extract metadata from the original decentralized database and integrate it together.

There is a big difference between operational data and DSS analytical data. The data source of the first database is different from that of the original database, and all the data sources of the first database are different from those of the original database; Second, the comprehensive data in the data warehouse cannot be obtained directly from the original database system [4]. Therefore, before entering the data warehouse, the data must be unified and integrated. This step is the most critical and complex step in the construction of data warehouse. The work to be completed includes:

- (1) All contradictions in the source data should be unified, such as the same name and different meaning of the field, synonymy of different names, inconsistent units, inconsistent word length, and so on.
- (2) Data synthesis and calculation. The data synthesis work in the data warehouse can be generated when extracting data from the original database, but many are generated inside the data warehouse, that is, after entering the data warehouse.

5 Preprocessing of Teaching Data

In order to solve the problem of teachers' lack of online application skills, simplified data is needed, so the teaching data is preprocessed. Analysis of the teaching data preprocessing in this chapter is for data cleaning, data type conversion and data statistics. Where, data cleaning includes missing value processing and removing outliers. The obtained data is corrected and supplemented by teaching data preprocessing to obtain as much clear and effective information as possible, and to lay the data foundation for the later association rule mining.

(1) Data cleaning

A. Missing value processing: there are many reasons for the lack of data information. Some information comes from different databases. For example, in the process of getting teachers' personal information, in addition to teaching information in the educational administration system, we need to transfer personal information from the personnel system, and transfer scientific research information from the scientific research system. Some information can be deleted in the process of transfer. Some are the lack of original data, such as students' scores. The absence or delay of students will cause the lack of original score information. For these cases, we need to use the most common value to make up for them.

B. Delete outliers: that is, delete the abnormal information in the data set, which may affect the quality of the model. If we want to build a model based on students' performance information (original performance, make-up performance, deferred performance, graduation make-up performance, etc.), some students may fail in the effective performance. After the make-up test, two results will appear. The best way is to delete them directly. For the analysis of students' performance, we will keep the students' original performance [5, 6].

(2) Data type conversion: data conversion refers to the conversion of data extracted from relevant business systems according to the data structure of the data warehouse of the auxiliary decision-making system. These conversion operations include the conversion of data format, data content and structure, and data statistics. It includes the following aspects:

The data for data type conversion comes from the existing business systems of the school. There are many kinds of business system databases, including Oracle, SQL server, mysql, DB2 and text data. The data formats of different databases are different. Therefore, in the process of data integration, it is necessary to convert the data types of different data files into the data types of the target database.

Data content conversion: in the process of data integration, it is necessary to convert the content of the extracted data according to the corresponding rules, including string operation, arithmetic operation of numerical value, date and time, etc. for example, the identity of students in the existing educational administration system includes junior college students, undergraduates, postgraduates and doctoral students, which are represented by strings, In the data integration of data warehouse, it needs to be converted into corresponding numerical types [7].

(3) Data statistics

In data integration, statistics and classification results of business data are sometimes required. Therefore, the data transformation process requires statistics and classification of relevant data of business system.

6 Association Rule Mining

In view of the imperfect statistical function of the network teaching platform and the lack of effective data mining methods, it is necessary to improve the data statistical function through association rule mining. The data mining process can be divided into four parts: data integration, data preprocessing, datamining, evaluation & interpretation. The process is shown in Fig. 2.

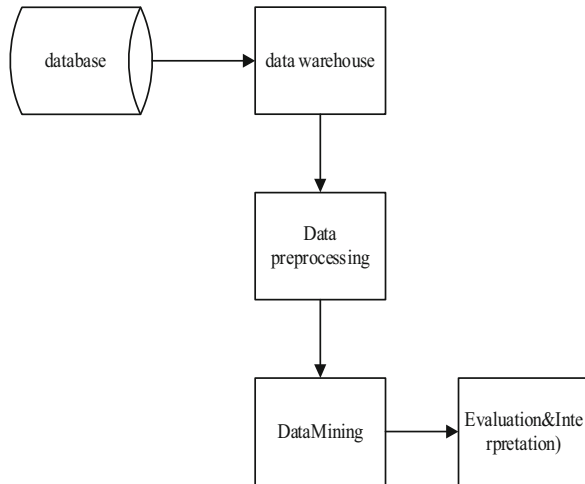


Fig. 2. Data mining process

Knowledge discovery in database, also known as knowledge discovery and data mining, appeared in the late 1980s. It is a new research field with strong vitality based on database technology and combined with artificial intelligence, machine learning, statistics, neural network and other disciplines and technologies; Since the 1990s, it has

developed by leaps and bounds, and has become a very active research field involving artificial intelligence, database theory and technology, e-commerce and other disciplines; It shows good application prospects in business management, production control, market analysis, engineering design and scientific exploration, and will become one of the key technologies that will have a far-reaching impact on the society in the next few years.

Among them, the research of association rule mining is an important content of knowledge discovery research. Its purpose is to find interesting association relationships or patterns between itemsets in large-scale data sets [8].

Association rule mining is an important part of data mining. Through association rule mining, we can find interesting associations or related relationships in the itemsets of a large number of data. Shopping basket effect is a typical case of association rule mining. This association relationship is considered according to conventional thinking, and there is often no law to speak of. Through the mining technology of association rules, this law becomes discoverable knowledge.

The process of association rule mining generally includes two stages. In the first stage, all high-frequency project groups must be found first, and in the second stage, association rules are generated from these high-frequency project groups [9].

The first stage is to find all high-frequency project groups in all the original database data, that is, to find out the item set that all projects meet the minimum support or not less than the minimum support. Find all frequent itemsets to form association rules.

The second stage is to generate association rules. That is, using the high-frequency item group in the previous step to generate rules, under the condition of minimum confidence, if the trust of a rule can meet the minimum trust, association rules are formed. For example, the reliability of the rule XY generated by the high-frequency itemset g-project group $\{x, y\}$ is obtained by using the association rule formula. If the reliability is not less than the minimum reliability, XY is called the association rule.

The problem of association rule mining was first proposed by R. Agrawal in 1993. Since then, many researchers have conducted extensive research on this problem, mainly focusing on improving the association rule mining algorithm to improve the efficiency of mining and popularizing the application of association rule mining.

So far, one of the classical association rule mining algorithms is still the Apriori algorithm proposed by R. Agrawal and others. The main idea of this algorithm is to first find the frequent itemsets in a given large data set, and then generate strong association rules through the frequent itemsets; The core idea of finding frequent itemsets is to use the results of the previous scan of the database to generate the candidate itemsets of this scan, so as to improve the efficiency of the search. The concepts of frequent itemsets and strong association rules are determined by two indicators: support and reliability; The itemsets that meet the requirements of support are called frequent itemsets, and the rules that meet the requirements of reliability are called strong association rules [10, 11].

The basic process of mining association rules with Apriori algorithm is shown in Fig. 3.

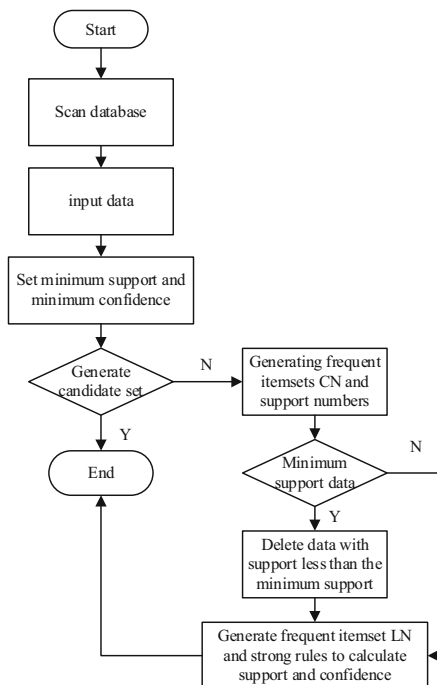


Fig. 3. Basic flow of the Apriori algorithm

Where, the confidence and support formulas are calculated as follows:

Confidence:

$$Y = \frac{\bar{X} - \mu}{\sqrt{1/5}} \tag{1}$$

In the formula (1), Y represents confidence; \bar{X} represents average value of the teaching data; μ represents standard deviation of the teaching data.

Support:

$$F = Y \cdot \frac{P(A \cap B)}{n} \tag{2}$$

In the formula (2), F represents support degree; $P(A \cap B)$ represents the probability of both transaction A and transaction B ; n represents the number of things in the transaction set.

7 Design the Online Teaching Method of Biochemistry Course of Nursing Specialty Based on Association Rules

The association rules mined above can help reasonably arrange teaching plans, timely reform teaching methods and guide students' learning methods. Examinations are not only an investigation of students' learning, but sometimes more a test of teachers' teaching level. Therefore, when candidates prepare for the examination, teachers can give targeted guidance according to the actual situation of candidates, Then make reasonable arrangements for students to pass the exam smoothly.

Designing teaching method based on Association Rules refers to clarifying the relationship between various factors and online teaching through the above mined association rules, and designing online teaching method according to the obtained relationship, so as to make online teaching more reasonable. The process is shown in Fig. 4.

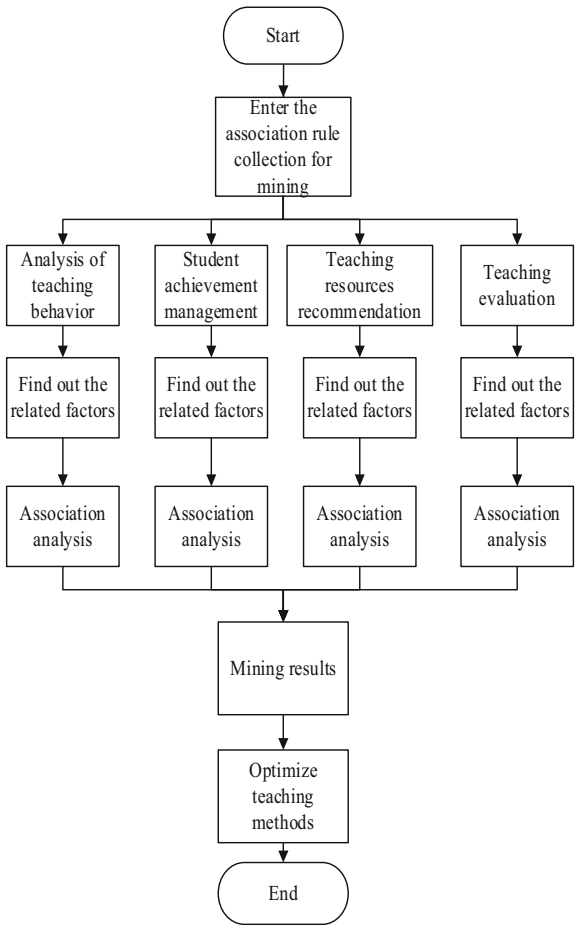


Fig. 4. Design the process of teaching methods based on the association rules

(1) Analysis of teaching behavior

Among many teaching behaviors, which are related to the effect of online teaching? What is the learning behavior of most students? By mining the relationship between students' online learning behavior and learning effect, and looking at the relationship between their academic performance and which factors, we can predict what kind of learning behavior in the online environment can make personnel work twice with half effort and achieve better academic performance.

(2) Student achievement management

Effective student achievement management can not only improve students' learning ability, guide teachers to reasonably arrange teaching plans and improve the overall competitiveness of colleges and universities, but also better serve students, teachers and teaching.

The goal of applying association rule mining technology in student achievement management is to transform a large number of student achievement data into valuable information and knowledge. Data mining technology can not only help managers mine interested knowledge and information from the massive data in the database, but also help teaching managers study them to varying degrees, so that they can use and analyze these data more effectively. In recent years, the research perspective of student achievement management has gradually developed from the traditional management mode to a management mode based on mining the effective information of achievement data, supplemented by the traditional management mode.

(3) Teaching resources recommendation

When users visit the teaching system, the corresponding "access traces" are generated and actively recorded and stored by the system. Through association rule mining, the hidden knowledge and patterns in these access behaviors can be found. These knowledge and patterns can describe the general behavior law of users, which is the key to constructing user interest model. The fusion of association rule mining and information recommendation is also the key.

(4) Teaching evaluation

In teaching evaluation, the evaluation standard, as a part of it, affects the practical significance of teaching quality evaluation. A reasonable teaching evaluation standard can play a role of supervision and feedback on teaching. Teaching evaluation is an overall evaluation of teachers' teaching process, content and teaching effect. It is an important way to detect and measure teachers' teaching quality. Teachers can recognize the shortcomings in the teaching process through the feedback information of teaching evaluation, so as to continuously improve teaching methods. Teaching managers can also put forward targeted suggestions and opinions to teachers through the evaluation information fed back by students and the previous mutual evaluation information of teachers, and encourage and suggest teachers to continuously improve teaching methods

and means in the future teaching process, so as to further improve the teaching quality. At the same time, It can also provide decision-making basis for college teaching managers to carry out teaching reform.

8 Example Analysis

Take the application of association rule in teaching resource recommendation as an example.

8.1 Analysis Tools

This study selects the data mining software Weka (Waikato environment for knowledge analysis) as the learning analysis tool. The tool is an open source intelligent analysis project supported by the New Zealand government. It is widely used in many fields such as finance, medical treatment and transportation. It can directly connect to the system database and realize the seamless integration of heterogeneous data sources.

Weka contains a large number of data mining algorithms, mainly including association rules, clustering, attribute selection, classification, visualization, preprocessing and so on. In addition, with the help of Weka interface, we can develop new data mining algorithms on Weka architecture, or realize our own visualization tools by learning from Weka methods. The data format of Weka tool is ARFF (attribute relationship file format). The expression of ARFF format is similar to excel table. Each row in the table represents an instance in the database, and each column represents an attribute, that is, a field in the database.

8.2 Research Object

The experimental data sample of this paper comes from the database of the network teaching system, and the learning data of the top 10 professional students in the system are selected. During the construction of the online teaching system, the website group technology is used, that is, each online course is essentially an independent website, which can be called a sub station relative to the whole course platform. Online courses have independent domain names and can be distributed on different servers. Users can log in to online courses through the main portal or directly to a course sub station, You can jump freely between courses, and single sign on technology solves the problem of repeated login. If a user logs in to an online course, a “trace” will be left on the server where the online course is stored, that is, a server log file will be generated. If web mining is used, the work of the data collection stage is to collect all the server log files that store the course website. In the next data preprocessing stage, these log files will be cleaned and identified, and then enter the mining stage for rule mining to finally get the desired course Association.

The format of “log” information is greatly different from ordinary log files. It only stores and records some attribute information related to course recommendation, including user name, grade, major, access course and access time, as shown in Table 1.

Table 1. Top 10 course login logs

Serial number	User name	Course	Login time
1	XX	Fundamentals of nursing A1	2020/5/3/10:25:36
2	XX	First aid nursing technology A2	2020/5/4/12:20:11
3	XX	Internal medicine nursing A3	2020/5/3/8:20:43
4	XX	Surgical nursing A4	2020/5/5/14:4:50
5	XX	Obstetrics and gynecology nursing A5	2020/6/1/17:48:35
6	XX	Pediatric nursing A6	2020/5/7/15:20:11
7	XX	Community nursing A7	2020/5/3/25:24:45
8	XX	Internal medicine nursing	2020/5/18/12:10:25
9	XX	Community nursing	2020/5/3/14:15:30
10	XX	First aid nursing technology	2020/5/3/9:11:20

When the “log” information is written into the database one by one, it is recorded in the special course login log table. The next data mining work is carried out for the corresponding database files.

8.3 Parameter Setting

With the help of the data mining tool Weka platform, the association rules are mined, and the complete Apriori algorithm written in advance is imported into Weka tool. Open the data file, select Apriori algorithm and set the parameters: the lower bound of minimum support is 0.5, the upper bound is 0.5, and the minimum confidence is 0.3.

8.4 Basic Processes Based on Association Rules

The recommendation process of teaching resources based on association rules is as follows:

Step 1: first, find out all the association rules G ‘supported by the user in the rule set G , that is, all the courses preceding the rule G ’ have been accessed by the user.

Step 2: find out all courses h predicted by association rule G ‘but not accessed by users.

Step 3: directly recommend all courses h to users, or sort according to the weighted value of courses in H , and select the first m to recommend (the value of M can be adjusted at any time according to the situation).

The mining association rules are shown in Table 2.

Table 2. Association rules

Rule	Confidence degree	Support degree
A1A2	100%	60%
A1A3	50%	50%
A1A4	52%	40%
A1A5	66%	60%
A1A6	70%	40%
A1A7	72%	45%
A2A1	65%	50%
A2A3	100%	65%
A2A4	58%	60%
A2A5	70%	50%

Taking A1A2 rule as an example, it can be determined that the confidence of the two rules reaches 100%, indicating that the rules are effective, which can be recommended to student users, that is, students who visit the basis of nursing are more likely to visit the emergency nursing technology course, so they can be recommended to the emergency nursing technology course; vice versa. You can also recommend relevant online course information to teachers according to the rule table. For example, the information provided in Table 2 indicates that there is a strong correlation between the two courses of basic nursing and emergency nursing technology. Teachers can arrange the links between courses and adjust the teaching contents of courses accordingly.

8.5 Evaluation Method

For association rule analysis, this paper uses accuracy (Precision@k) And average the number of association rule entries to evaluate the algorithm results. At the same time, because the algorithm has been actually used in the system, it is also necessary to evaluate and explain the running time of the algorithm on the server. Since some algorithms have not been implemented in the system, the classic standard data set on association rule testing, groceries data set and system data are selected for comparison and explanation. The calculation formula of accuracy is shown in formula (3).

$$P = |S(k) \cap D| / |S(k)| \tag{3}$$

In the formula (3), $S(k)$ represents the first k rules of association rules in the result of association rule algorithm operation, D represents all association rules obtained from the test set.

8.6 Course Recommendation Results

Reference [1] and reference [2] methods compare the course recommendation accuracy of the three methods, and the results are shown in Fig. 5.

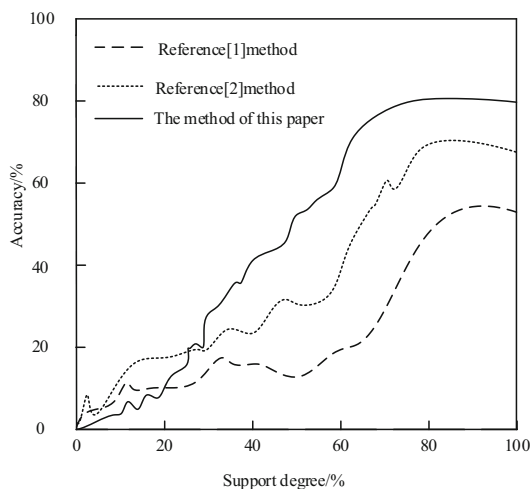


Fig. 5. Accuracy results

It can be found from Fig. 5 that the accuracy of the method and course recommended in this paper increases with the increasing support. This is due to the high support for removing a large number of items with fewer appearances, so the results increase with higher support, and the final course recommendation accuracy remains at around 80%, significantly higher than the other methods.

9 Conclusion

Biochemistry is one of the compulsory basic courses stipulated in the teaching plan of nursing specialty in higher vocational colleges in China. It is also one of the important professional basic courses of nursing specialty in higher vocational colleges. It is a marginal discipline developed from organic chemistry and physiology. The knowledge theory of biochemistry has penetrated into other professional courses of the specialty and various fields of clinical nursing. It is the basis for nursing students in higher vocational colleges to learn professional courses such as basic nursing, emergency nursing technology, internal medicine nursing, surgical nursing, obstetrics and gynecology nursing, pediatric nursing and community nursing. This discipline plays an important basic role in the follow-up professional course teaching, and integrates with other disciplines and appears in the test questions of nurse qualification examination. The biochemistry of nursing major in higher vocational colleges has the characteristics of strong theoretical content, which involves complex material molecular structure formula, chemical reaction formula, material metabolism pathway and regulation mode, transmission of genetic information and the latest progress of molecular biology. It is one of the difficult courses for nursing majors in higher vocational colleges. With the rapid development of information technology and the thrust of various needs, online education came into being. The participation of colleges and universities in the field of online education increases students' educational opportunities. At the same time, they also use "online

education” to enrich teaching methods and attract more learners. Promoting the modernization of education is an important means to meet the growing needs of lifelong learning in society.

Based on the above background, an online teaching method of nursing professional biochemistry courses is proposed based on the association rules. The correlation rules algorithm was applied to online learning behavior analysis, online test score analysis, teaching resource recommendation and teaching quality evaluation, and a large number of hidden teaching data was excavated, combined with online teaching teaching and learning, recommended course knowledge popular with students. The example analysis results demonstrate the effectiveness of the studied method.

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