



Monitoring Method of students' Learning Behavior in Online Education Platform Based on Data Mining

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Abstract. Education platform learning is a kind of autonomous learning, which is manifested as learners' autonomous control of learning behavior on their own education platform. In order to better improve the practical application effect of education platform, this paper proposes a monitoring method of students' learning behavior based on data mining technology, and uses data mining technology to collect and analyze students' learning behavior. The process and results of the monitoring function to evaluate students' learning behavior. Based on the clear definition of learning behavior of educational platform, this paper studies the monitoring mechanism of learning behavior of educational platform from the visual angle, so as to improve the learning effect and quality of educational platform.

Keywords: Data mining · Online education · Online education · Teaching monitoring

1 Introduction

With the gradual popularization of the Internet in China and the arrival of learning society, the focus of online education platform has shifted from the initial provision of teaching resources to the organization of teaching activities. When organizing teaching activities, most schools tend to focus only on the organization of knowledge content, the design of online courses and the provision of learning resources, while ignoring the learning supervision of registered students, which is an important reason for the low learning quality of the current education platform [1]. The research status of learning behavior on education platform and learning behavior monitoring on education platform was investigated. The traditional method elaborated the connotation and significance of learning behavior monitoring on education platform, and proposed the data collection method of learning behavior monitoring on education platform. Through the research of data mining technology, the method of learning behavior characteristic log mining to realize intelligent feedback of learning behavior was proposed, Intelligent monitoring of learning behavior and application effect analysis are realized.

On the basis of the above research, some new ideas and methods are proposed to solve the problem of learning behavior monitoring on the education platform. Therefore, a monitoring method of students' learning behavior on the online education platform based on data mining is proposed. Using background database server log combined with online learning platform technology, collection of learning behavior data mining, using data mining technology to feedback of learning behavior, to achieve a certain comprehensive intelligent education platform learning behavior monitoring method, education platform for students learning behavior, rtvu teaching platform operation monitoring and data collection, Support data mining, get similar groups, related questions and other intelligent feedback, effectively realize the effective supervision of students' learning behavior. This study will effectively promote the management of the teaching process of the online education platform and provide a strong guarantee for the improvement of the teaching quality of the online education platform.

2 Online Education Platform Students' Learning Behavior Monitoring Method

2.1 Optimization of Feature Mining Method of Display Education Data

The operation of online education platform is usually based on a database management mode, which provides a safe, reliable and efficient running environment for data management, recording the time and times of students entering the mode, as well as all interactive behaviors. Online learning model collects various data in various ways to reflect students' learning behavior. How to analyze these large amounts of data, so as to provide guidance for students' learning evaluation and give scientific evaluation has become the focus of current research. Therefore, it is necessary to establish a large amount of knowledge behavior data model, and conduct learning behavior characteristics based on the above requirements combined with data mining. After data preprocessing, the learning behavior information matrix of education platform is formed. Then, the algorithm of statistical analysis, path analysis, association rule mining and sequential pattern discovery are used to extract students' behavior orientation, so as to deeply mine students' learning state.

Data mining refers to the extraction of effective models hidden in a large number of, incomplete, noisy and random massive network data, and obtains the user's use characteristics according to this model. The object of data mining is massive, heterogeneous and distributed data mining documents. Data mining server log uses data mining as middleware to mine database and the data mining of log and user information on data mining server is no longer the category of traditional data mining [2]. Secondly, data mining is logically a graph composed of documents and hyperlinks. Therefore, data mining documents are semi-structured or unstructured, and lack of machine-readable implication. However, the objects of data mining are limited to structured data in database and use storage structures such as relational tables to mine knowledge. Therefore, some data mining technologies are not suitable for data mining. Mining, preprocessing data mining documents to get the feature representation of documents, has become the research focus of data mining.

In online teaching platform, there are a lot of heterogeneous forms of massive resources, and each isomer only corresponds to a single attribute interface. In order to better realize the unified monitoring requirements of massive information, assembly language must be used as a tool to analyze different resource isomers abstractly, and select the rules that meet the most interface attribute requirements at the same time as the standard conditions of all interfaces. This process is the unification of heterogeneous interface specifications of massive resources. The specific content specification of monitoring learning feature mining is shown in Table 1.

Table 1. Content optimization of monitoring learning feature mining

Monitoring interface	Replacement method	Replacement function
Set up the interface	Monitoring data set	Get data sources and collect data source information
Set data	Set interface collection	
data mining	My clipboard data	Collect data destination information and decide whether to cancel the operation according to the anti monitoring rules
Get monitoring data	Real time monitoring information collection	
Settings view	–	Make sure that the monitor observation window is always at the top of the chain and that the site is first

Data mining is a process of extracting information or knowledge from data mining resources. It applies the traditional ideas and methods of data mining to data mining, and extracts interesting, potential, useful patterns and hidden information from data mining documents and data mining activities [3]. Log mining in the process of data mining is the direct source of data. Therefore, in the process of data mining, it is necessary to standardize the access logs: server logs, error logs, cookie logs to record the information about user access and interaction. In the process of data mining, there are two formats of server log: one is common, the other is extended. Therefore, the data mining common logs collected on the server can be used as the research object, and its format is shown in Table 2.

The learning behavior data acquisition module of online education platform is mainly responsible for collecting and quantifying the data of students' online learning behavior, and storing it in the behavior database to prepare for analyzing the characteristics of students and resources. Data collection module must ensure the comprehensiveness and accuracy of data collection. In order to dynamically track, collect, analyze, evaluate and feedback the learning behavior of students on the education platform, a data acquisition model of learning behavior based on the learning platform of education platform is further designed. The structure is shown in Fig. 1.

The main functions of the learning behavior data collection model are: first, tracking the learning process of students in the learning platform of education platform, collecting the data related to learning behavior in this process, and establishing the learning

Table 2. Data log mode of learning behavior monitoring

Name	Content	Parameter
Client IP	IP or/DNS entry of remote host	10.445.65
Date	The date the page was requested	19.02.4
Time	Request page time	10:00–12:00
Port	Server interface	80.22.401
Service name	The name of the service requested by the user	–
Page	User requested	5–12
Protocol version	Protocol version for transmission	–
State	Server status	Normal
Byte	Bytes transmitted (sent or received)	10.47.52

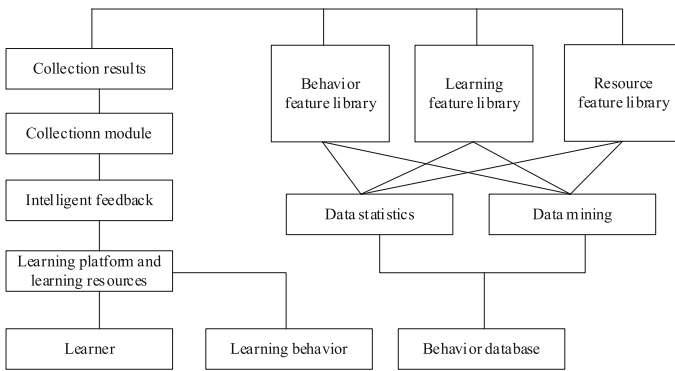


Fig. 1. Data acquisition model of learning behavior

behavior database to prepare for analyzing the characteristics of students and resources [4]. Behavioral data collection must ensure the comprehensiveness and accuracy of data collection. And the data in the learning behavior database are extracted, processed and analyzed, and the graphical operation interface is provided to realize the real-time statistical analysis of the learning behavior of students' education platform [5]. According to the collected learning behavior data, the relevant algorithms are used for data mining to find out the learning behavior patterns under the learning environment of the education platform, and the discovered learning behavior patterns are used to provide students with personalized learning contents and learning arrangements, so as to realize personalized learning support services.

2.2 Online Education Platform Student Learning Behavior Monitoring Model

From the teaching mode of online education platform, it can be seen that the implementation of online education platform teaching in the operation process largely depends on

the online education platform environment constructed and whether the online education platform model adopted can meet the needs of students' personalized chemistry learning to the maximum extent. Online education platform mainly refers to the network teaching platform, which provides a series of specific education related services for students.

After several stages of development, online teaching platform has risen from the common resource database model to the comprehensive teaching support service and teaching management platform [6]. Its functions include students' online learning, teachers' online teaching, teaching administration management, online teaching analysis model, etc. In order to realize the real-time monitoring of the learning behavior of the education platform, one of the basic premises is that effective measures can be taken to automatically collect all kinds of information in the process of learners' online learning for real-time processing of behavior monitoring model [7]. How to accurately, efficiently and real-time collect the learning behavior information of education platform, the key is to define the data model of learning behavior of education platform accurately and appropriately. The learning behavior of educational platform refers to the long-distance autonomous learning behavior of learners in the learning environment created by modern information technology, with new communication mechanism and rich resources.

In order to realize the real-time monitoring of learning behavior of education platform, the basic premise is to take effective measures to collect all kinds of information in the process of learners' online learning for real-time processing of behavior analysis model [8]. Based on the accurate definition of learning behavior information of education platform, the monitoring model of learning behavior of education platform is constructed. The specific structure is shown in Fig. 2.

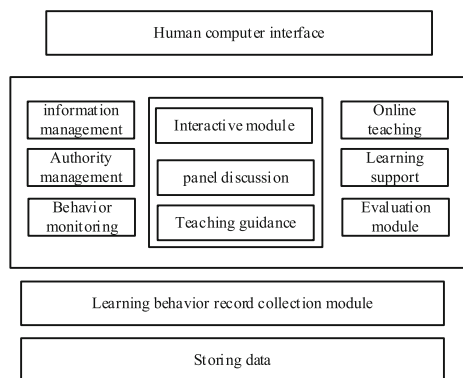


Fig. 2. Online education platform learning behavior monitoring model

As shown in the figure, the learning platform of education platform includes user management, class management, permission management, resource management, interactive world, online Q & A, learning support and evaluation model [9]. In the design of monitoring model, the behaviors that need to be recorded are counted and analyzed, and each learning behavior is refined to be as accurate as possible [10]. The learning

behavior information of students' education platform is processed by learning behavior collection module, and the storage module records learning behavior into database management model in the form of database record for statistical analysis.

Aiming at the definition of learning behavior of educational platform, this paper constructs a multi-dimensional learning behavior model of educational platform, which divides learning behavior of educational platform into information retrieval learning behavior, information processing learning behavior, information publishing learning behavior, interpersonal communication and communication behavior and learning behavior based on problem solving. From the micro point of view, learning behavior should be considered in depth. According to the degree of contribution to learning effect, learning behavior can be divided into low-level, intermediate level and high-level levels, which is also helpful for targeted evaluation of students' learning behavior.

Low level learning behavior refers to simple operation behavior, including login model, browsing content, browsing resources, clicking columns, viewing personal space, etc.

Intermediate level learning behavior refers to the network interaction behavior, mainly including: answering questions, homework, forum, testing and other interactive behaviors.

Advanced learning behavior refers to the behavior that students use the learning platform of education platform to carry out cooperation and solve practical problems. With the development of information technology and mobile Internet technology. High level learning behavior usually goes beyond the single education platform learning model.

Based on this, the function of behavior detection model is further optimized, including:

Q & a test: when students encounter problems in the learning process of the education platform, they can use the "online Q & a" function to ask questions, seek real-time help from teachers or classmates, and answer questions raised by others;

Homework management: teachers set different types of homework topics according to the teaching content, and teachers evaluate the learning effect of students through the assignments submitted by students.

Forum: students post, follow, discuss and communicate on a certain topic or case to construct knowledge;

Test monitoring: it is divided into level examination and summary test, which can test the learning effect of a module or a course for students.

Resource Management: students comment on the value of curriculum resources when they study curriculum resources,

Voting Management: teachers create questionnaires or voting questions in the course construction, and students participate in the questionnaire survey or voting, so as to facilitate teachers to obtain valuable reference data;

Class speech: the learning model of education platform can create class learning space, in which students can publish their own learning and experience and share collective wisdom;

Evaluation management: it mainly refers to the real-time evaluation of teachers' and students' behaviors, such as when students' homework is rated as excellent homework,

when students' questions are listed in the FAQ database by teachers, and when students' answers are rated as excellent answers, students' learning behaviors will receive additional rewards;

Negative operation behavior: when students delete questions, comments, homework and other operations, it can be considered that students have carried out negative operation, and this behavior will be punished additionally.

In addition to recording all kinds of teaching resources and interaction with teachers, the model also records the time when students log in and log off each course. According to the needs of students' formative assessment, the statistical monitoring module makes statistics on the collected learning behaviors and forms data reports, which provides data support for teachers to improve teaching and school teaching management departments to make decisions. The automatic monitoring module of learning behavior includes virtual machine, physical machine and other physical monitoring running equipment, which can realize the acquisition of monitoring indicators of learning behavior in task layer and function layer. Physical machine is an important component of cloud computing monitoring platform. It can generate occupancy index related to resource monitoring situation, and judge whether the current resource node is under monitoring according to the specific physical difference between the value and resource occupancy threshold value. When the database is not enough to support the running status of this model, the virtual machine can release the abnormal connection state, which is also the main reason that the data in the new model can quickly reach the upper limit of monitoring occupancy. The specific monitoring module structure is shown in Fig. 3.

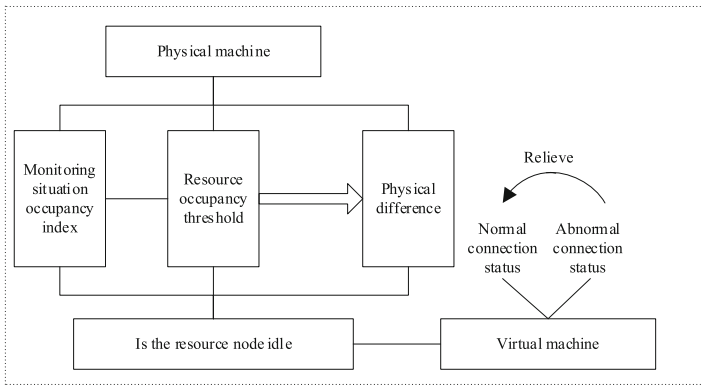


Fig. 3. Structure optimization of learning behavior automatic monitoring equipment

Based on the above structure, monitoring students' learning behavior on the education platform, and presenting the behavior trend in the form of graphics and images, we need to take a method to quantify and transform students' learning behavior.

2.3 The First Step of Online Education Platform Learning Behavior Automatic Monitoring

The automatic monitoring of learning behavior of online education platform not only requires the stable operation of the network, but also requires that the network can support the reliable transmission of multimedia data. However, the environment of network operation is very complex. Hacker attacks, computer viruses, equipment failures and software design defects may cause network anomalies and even network communication interruption. Therefore, it is necessary to install network protocol analysis equipment in the core of computer network and network outlet, comprehensively monitor the real-time flow and network application of the network, prevent or timely handle network anomalies, and ensure the normal development of online teaching activities.

Because the external environment of online education platform is mainly the learning environment of education platform, there will be network exploration, cooperation, communication and other processes in the learning process. This part focuses on the analysis of the self-monitoring process in Online Autonomous Learning, focusing on the self-regulation activities of students as learning subjects, and takes human-computer interaction and human-computer interaction in the learning environment of education platform as the cognitive means, rather than as independent process elements. In order to better conduct behavior detection, it is necessary to optimize the monitoring method of students' learning behavior on the education platform. The specific monitoring principle is shown in the Fig. 3 (Fig. 4):

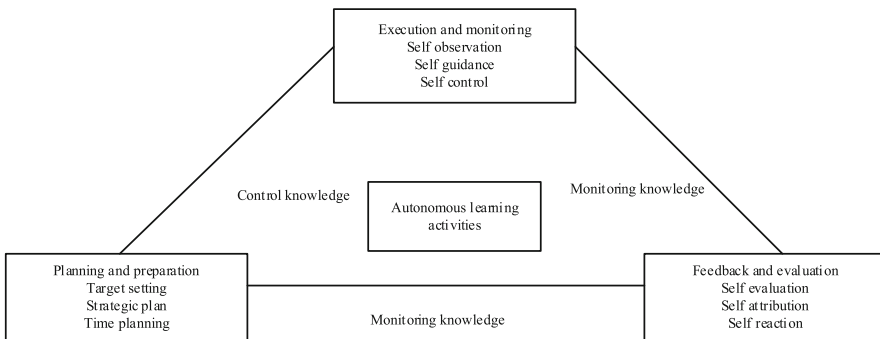


Fig. 4. Monitoring principle of students' learning behavior in education platform

Based on the above analysis, the self-monitoring process in the learning process of the education platform is constructed as shown in the figure. The whole monitoring process takes the learning environment of the education platform as the external environment, and takes the three links of students' self-monitoring as the core, regulating the whole process of autonomous learning. Due to the lack of self-monitoring of students, the learning behavior of education platform generally occurs under the supervision and encouragement of teachers. As an important function, learning monitoring of education platform is integrated into the network teaching model. Through learning monitoring, teachers can master the learning status and effect of students, and feedback the monitoring

results to students, so as to implement effective learning. Learning from Professor Li Kedong's definition of learning monitoring, the author interprets learning monitoring of educational platform as a series of processes of planning, checking, evaluating, feedback, controlling and adjusting the learning activities of students' educational platform in order to ensure the success of learning on the educational platform, improve the learning effect and quality, and achieve the learning objectives. The design of monitoring process is shown in Fig. 5.

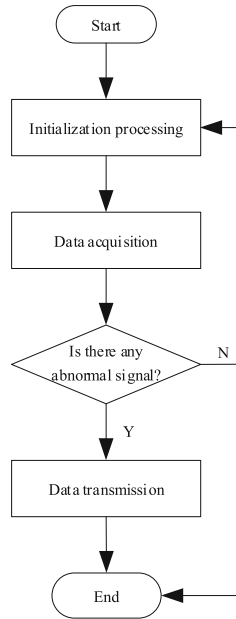


Fig. 5. Optimization design of monitoring process

It can be seen from Fig. 5 that the information is initialized, and the data is collected, and the real-time evaluation and monitoring of all education platform learning behaviors are further processed. There are four specific aspects.

The monitoring of learning time mainly monitors the total number of times that students log in to the learning model of the education platform, the total number of times to visit the model resources and columns and the average daily visits, and the total stay time of browsing resources, so as to understand the attitude and investment of students in learning on the education platform.

Monitoring the learning content and progress, students need to complete the learning tasks according to the teaching plan formulated by the teacher. The network teaching model should monitor the completion of students' content in real time, record the learning progress, and facilitate students to make early warning intervention. The process of students' task implementation includes choosing learning tasks, online learning, self-directed collaboration, submitting results, evaluating and evaluating.

The monitoring of learning interaction includes the interaction between students and network teaching model, between students and between teachers and students. When students encounter problems in the learning process, they can get help through the interactive tools provided by the network teaching model, and can also provide help for others. The interactive behavior sets the conversion rules in the form of points, and then presents the monitoring results of learning interaction in the form of learning behavior scores of education platform, mainly including class speech, comment speech, participation in voting, online questioning, forum post (reply), submission of homework and examination, etc.

According to the teaching arrangement, the course assignment and level test are submitted, the formative evaluation is carried out, and the students' theoretical learning and skill mastery are assessed. Through the monitoring of the above contents, four functions can be achieved: first, real-time positioning of students' personalized learning state, and making early warning intervention to guide students to complete the learning tasks according to the learning plan; second, evaluating whether students have reached the learning objectives, which is helpful for memory and understanding; third, the monitoring results are timely fed back to students, which will help students adjust their personal learning plans; and 4, to provide decision-making basis for teachers, and timely control the learning intervention of education platform.

3 Analysis of Experimental Results

In order to verify the practical application effect of the online education platform students' learning behavior monitoring method based on data mining proposed in this paper, the experimental equipment is carried out under Windows 2000 server operation model and Microsoft. Net framework, and visual studio is used Net tool development, using SQL Server 2000 as the background database, mainly storing learner model information and rule information. The operation model of monitoring equipment is 9windows 2000 server+ Microsoft.Net Framework v2.0 database model: Microsoft SQL Server 2000.

The data source of data mining is the learner registration information and the learner learning process information of the network teaching model, which are collected and stored in the learner model database through the information collection model. The whole model includes two sub-models: information monitoring model and data analysis model. Enter the correct user name and password to enter. The data analysis model mainly realizes data mining analysis and intelligent feedback. The information monitoring model mainly realizes the collection and simple analysis of the basic information of the teaching platform, the information of the student group, the information of the individual student and the behavior of the teacher.

Through the real-time monitoring of the number of people online at the same time on the learning platform of the education platform, it can provide a positive reference for the teachers and technical managers of the learning platform of the education platform. According to the change of the number of online students, teachers can analyze the main time period of learners' daily online learning, and participate in the interaction between students in this period, and master the time point of releasing teaching resources and answering students' questions. Furthermore, the learning behavior monitoring effect

under the traditional monitoring method and this question method is compared and recorded, as shown in Table 3.

Table 3. Comparison of platform monitoring effect

Experimental time/(min)	This method is used to monitor the timeliness/(%)	Traditional methods to monitor timeliness/(%)
50	73.15	47.02
100	80.27	47.16
150	77.98	47.23
200	82.72	47.30
250	83.60	47.41
300	83.60	47.54
350	83.60	47.59
400	83.60	47.62
450	82.87	47.78
500	82.41	47.81
550	82.06	47.94
600	81.93	47.99
Average value	79.82	47.53

Based on the analysis of the test results in Table 3, it is found that, compared with the traditional methods, the average monitoring effect of the online education platform student learning behavior monitoring method based on data mining is 81.35%, while the average monitoring effect of the traditional method is only 47.53%, which is obviously better than the traditional method in the actual application process, and fully meets the research requirements.

4 Conclusion

The development of online education platform in China is still in its infancy. Online learners in the network environment still lack the independence, autonomy and self-control learning ability required by autonomous learning. Therefore, it is necessary to introduce and strengthen the monitoring mechanism. Through strengthening the monitoring of learners' external learning behavior, we can improve learners' self-control, and give learners timely learning feedback in the process of learning on the education platform, so as to stimulate and maintain learners' learning motivation, so as to ensure the effectiveness of online education platform teaching and improve the teaching quality. The innovation of this paper is to optimize the education data feature mining method. The online learning model collects various data through a variety of ways to reflect students' learning behavior and analyze these large amounts of data, so as to provide

guidance for students' learning evaluation. Establish a large number of knowledge behavior data model, based on the above requirements, combined with data mining to collect and mine the characteristics of learning behavior, record the login time, IP address, interactive behavior of student number, and store them in the corresponding database. After data preprocessing, form the learning behavior information matrix of the education platform, and then use statistical analysis, path analysis, path analysis, data mining Association rules mining and sequential pattern discovery algorithms extract students' behavior orientation, so as to deeply mine students' learning state.

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