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Interactive Learning Behavior Analysis of Wisdom Classroom based on Big Data

Dian Wang [1, a], Xue Ding [2, *]

[1] Information College, Yunnan Normal University, Kunming 650500, China;

[2] Enrollment Office, Yunnan Normal University, Kunming 650500, China.

[a]549449411@qq.com

* Corresponding Author: Xue Ding

Abstract. At present, although the research on learning behavior has made some progress, it is still in infancy. There are still many practical problems need to be solved. For example, how to promote effective learning in class. In the context of big data, this paper proposed a framework to collect and process interaction behavior data in wisdom classroom. First step, collecting and processing the interactive learning behavior data in and after class. Second step, analyzing the interactive learning behavior data. Finally, judging the behavior based on the analysis results. A learning model to form a personalized learning library for students is built in this paper, which performs feedback and guidance for learners' learning activities. Using this framework can achieves individualized or adaptive student learning, and realizes the purpose of promoting effective learning.

Keywords: Big data; wisdom classroom; interactive learning behavior.

1. Introduction

With the continuous development of information technology and the arrival of the "Internet +" era, it has brought new opportunities for the innovation and development of education in China. "Internet + education" is also an inevitable requirement for the integration and development of education informatization during the "13th Five-Year Plan" period. The steady advancement of education informatization will inevitably set off a new round of changes in classroom teaching activities, effectively promote classroom teaching reform, and provide technical support for the arrival of the new classroom teaching era. The wisdom classroom is a hot spot in the current educational informatization research, and it is the product of the deep integration of new technology and education. Wisdom classroom is the inevitable result of school education informatization focusing on classroom teaching, teacher and student activities, and wisdom generation under the background of Internet + education. The wisdom classroom created by the new generation of information technology can track the whole process before, during and after class [1]. The quality education concept requires students to cultivate good information literacy, pay attention to the generation of ability and wisdom, and the emergence of the wisdom classroom also highlights the difficulties in teaching, making the original boring classroom become intuitive and easy to understand through the integration of technology and wisdom. The classroom interaction has been enhanced and students have increased their interest in classroom learning.

Big data technologies in education will play an important role in learning analysis, such as learning analysis technology, educational data mining, etc [2]. Different from the simplification and one-sidedness of traditional education data, in the context of big data, all the learning path data experienced by the intelligent classroom students' interactive learning is recorded. These rich learning data require relatively mature analytical tools and techniques. The development of learning analysis, data mining, and text mining has become increasingly mature. It provides a technical basis for analyzing data on knowledge, behavior, and emotions of online learning, and provides an opportunity for interactive learning behavior analysis.

In the mode of wisdom classroom, the relevant research and analysis of teacher-student interaction can explain the problems existing in teacher and student interaction in different classrooms, and propose corresponding solutions and suggestions for the problems, which can promote the reform and development of teaching, and help improve the students' ability to provide reference for

classroom teacher-student interaction in the new curriculum reform. Big data technology is integrated into the analysis of intelligent classroom, which makes teachers use technology to collect, count, process and analyze student learning data, improve students' learning behavior in class, which has become a development trend.

2. Interactive Behavior Data Acquisition Model

2.1 WeChat-based Classroom Response Analysis System

Design a WeChat-based classroom response analysis system to record and analyze the data of students' classroom answers such as response time, response correct rate, topic option distribution, response rate-time curve, response time-score distribution, and feedback on learning analysis report. Realize real-time recording and data analysis of classroom response [3].

The response process of the whole system is shown in Figure 1. Teachers and students follow the WeChat platform and bind their personal accounts before class, and then enter the classroom response system. There are teacher's operation menu and student's operation menu. After entering the classroom, the teacher first initiates a question and the student answers the question. After the student answers the question, the data is sent to the background of the system, and the system records the student's classroom response, such as response time, response rate, Response correct rate, etc. Then draw the classroom response curve, and then the analysis results will be sent to the teacher, the teacher determines whether to conduct the next teaching session or the knowledge by analyzing the response result. If the teaching expectation is not met, can be re-tested after the lecture. If the teaching expectation is reached, carry out the next stage of teaching, and the response process will end. A class can have multiple response processes.

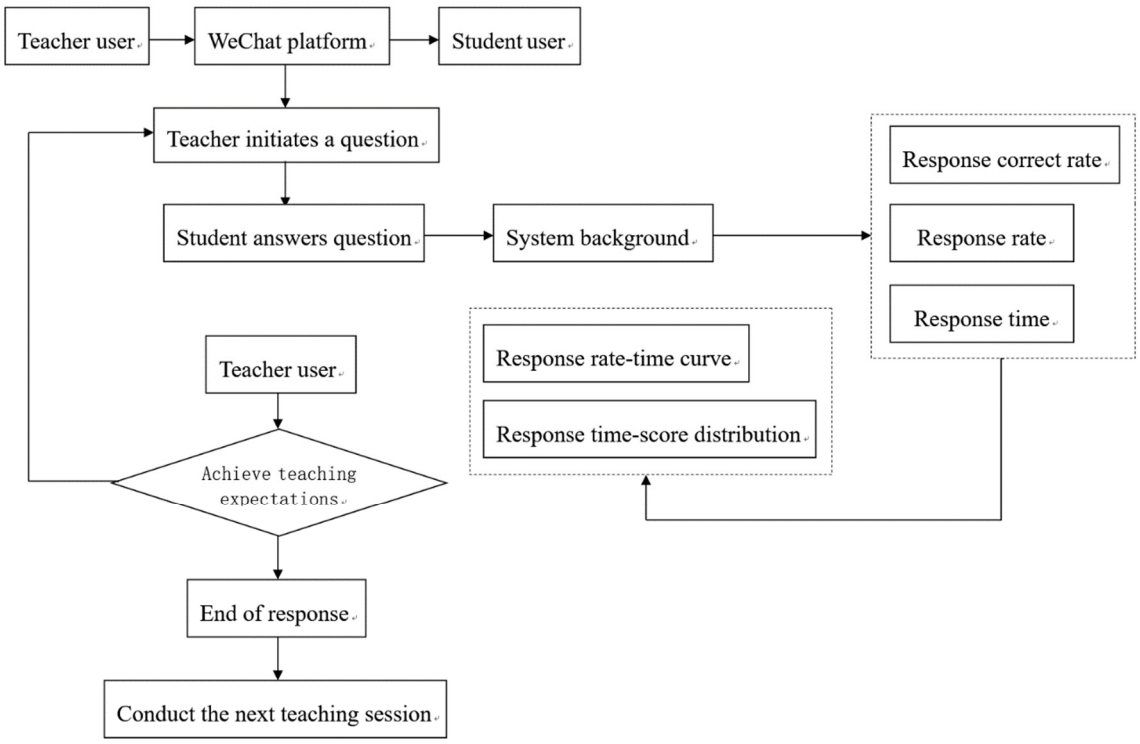

Fig. 1 Response flow

The response analysis system mainly comprises student response terminal, data collection terminal, data processing terminal, result presentation, teacher sending terminal and the like. The student response terminal is mainly used to enable the student to respond the question or test sent by the teacher; the data collection terminal uses the mobile phone to count the student's answer or test data, save and record the student's answer and test situations; the data processing terminal performs

statistical analysis and comparison on the student's response and test data, thereby obtaining the student's learning statistics; the result presentation refers to the display of the statistical analysis results or the response analysis data; the teacher sending terminal is the teacher's control of the response question, the response process, and the response time.

2.2 Interactive Behavior Data Collection Process

As shown in Figure 2, after the teacher initiates a question, through the answering process on the answering interface, the system records the response time of the students in the response process and the distribution of the answers to the questions. The collected data is the initial data. The positive answer rate, response time distribution, answer distribution and response time-score distribution of the response are counted in combination with the overall answer record of the whole class.

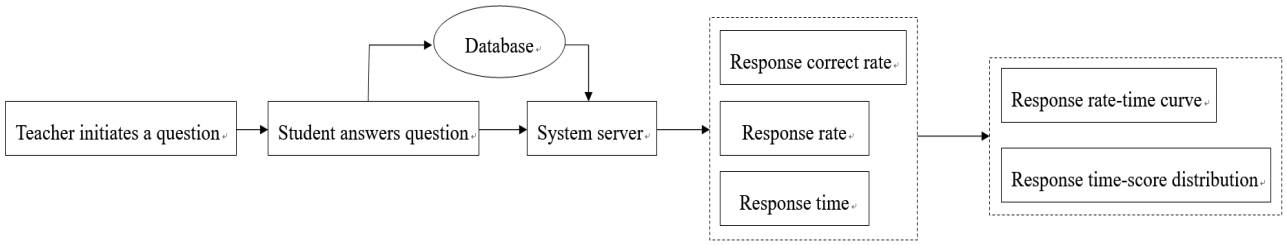

Fig. 2 Interactive behavior data collection process

3. Interactive Learning Behavior Analysis of Intelligent Classroom based on Big Data

3.1 Learning Analysis based on Big Data

The US "Promoting Teaching and Learning through Education Data Mining and Learning Analysis" believes that learning analysis is the theory and method of comprehensively applying information science, sociology, computer science, psychology and learning science, through the processing and analysis of general education big data, using known models and methods to explain the major problems affecting learners, assess learners' learning behaviors, and provide artificial adaptive feedback for learners. The report divides the application areas of educational data mining and learning analysis into: learner's knowledge, behavior and experience modeling; learner documentation; domain knowledge modeling; trend analysis [4].

3.2 Learning Analysis based on Big Data

J Mater, Chem reviewed the interaction between teachers and students in the wisdom classroom mode [5]. Weikai Xie, Yuanchun Shi, and Guanyou Xu discussed the characteristics of teache-student interaction in this mode through the exploration of the wisdom classroom teaching mode [6]; Julie B, Jeff C proposed that the key to construct effective teacher-student interaction in the wisdom classroom mode lies in teacher inspiration and student questioning [7]. Wang Xiaochen et al. combined the characteristics of wisdom classroom, designed and developed a class interactive observation tool for wisdom classrooms, which is divided into 5 factors, including basic data, classroom types, classroom related equipments, classroom interaction steps of the process conditions, and the help of wisdom classroom conditions to classroom interaction [8]. Based on constructing the theoretical framework of teacher-student interaction, Xu Enqin et al. proposed strategies such as student-centered learning environment, respect for individual differences, and transformation of network dependence [9].

3.3 Learning Analysis based on Big Data

Based on determining the goal of interactive learning behavior analysis, taking a course as an example, constructing an interactive learning behavior data model for in and after class, as shown in Figure 3, and collecting data, then from left to right, top to bottom, analyzing and modeling the

interactive learning behavior. Following the construction idea of the analysis model and the interactive learning process model, the horizontal flow of the analysis process is divided into two parts: the cluster analysis of interactive learning behavior, the correlation analysis between learning behavior and learning effect. According to the problem-solving process, the vertical process of the interactive learning behavior analysis model is divided into data processing, method selection and analysis process, result output, etc. Finally, the analysis results are visualized to guide the learning behavior, to achieve personalized or adaptive learning, and to build a learning model based on wisdom classrooms.

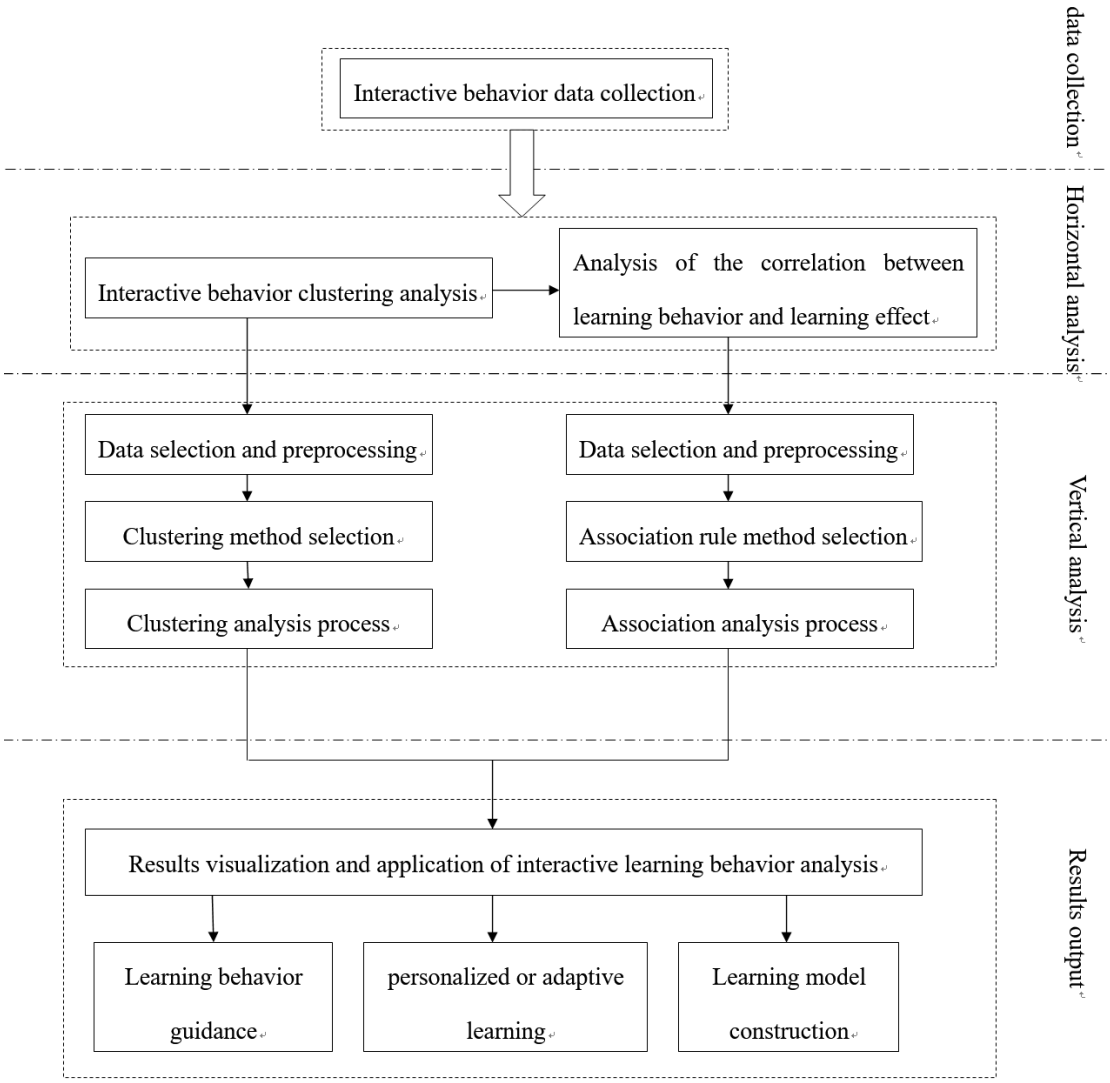

Fig. 3 Interactive learning behavior analysis model

3.4 Learning Analysis based on Big Data

As shown in Figure 4, the collected source data may be redundant, incomplete, and noisy. The data needs to be pre-processed before analysis. Interactive learning behavior data preprocessing generally includes data deduplication, denoising, conversion, missing processing, etc.

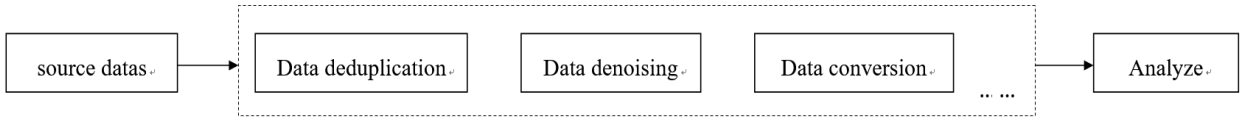

Fig. 4 Interactive learning behavior data preprocessing

3.5 Analysis Results Visualization and Application

Presenting the final behavioral analysis results to learners, teachers, and other outcome consumers is an important part of the interactive learning behavior analysis process. The representations of the results mainly include line graphs, histograms, pie charts, scatter plots, radar charts, etc. And the specific analysis results are presented to learners, teachers, etc. in an intuitive and easy-to-understand way, enabling them to quickly understand the results of the analysis.

By observing the results of behavioral analysis, it is possible to help learners to carry out self-awareness, self-reflection and the constructing of meaning, thereby guiding learning behavior design and achieving personalized or adaptive learning. The teacher can re-set the learning path for the learner based on the feedback of the analysis results. Through the interactive feedback, the learner's learning situation can be further grasped, and the learning model can be constructed according to the different learning levels of the learner.

4. Literature References Analysis-based Learning Model Design

As shown in Figure 5, applying the classroom response system designed before, collecting the personalized interactive information of students and doing data mining, forming a personalized learning library for students, including courseware library, answering library, task library, project library, teaching strategy library, etc. [10], and constantly updating and maintaining the resource library to realize the recommendation, mentoring, online homework correction, online test, study plan recommendation, evaluation exchange and other services for students' learning content.

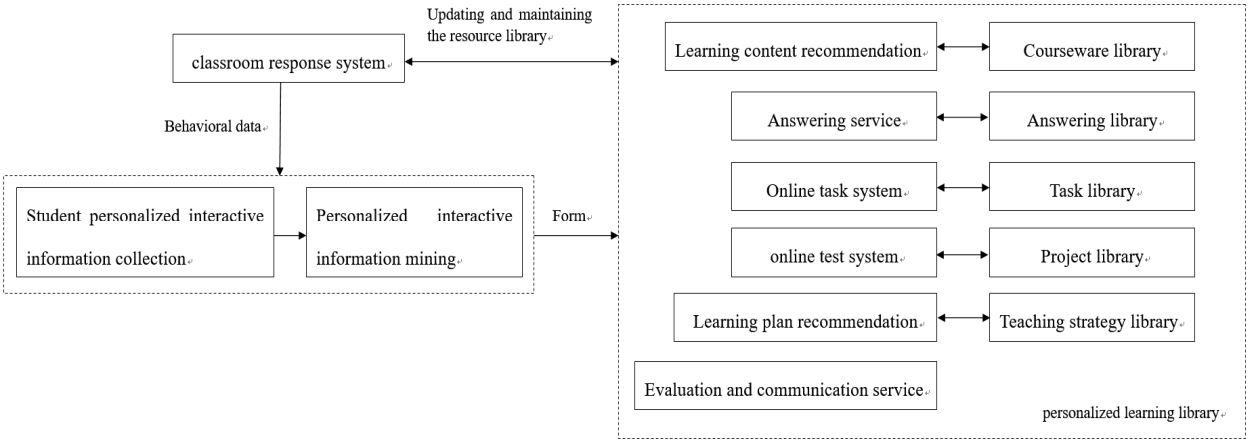

Fig. 5 Learning model

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