Research on Online Learning Behavior Analysis from the Perspective of Learning Analysis

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Abstract. With the development of information technology, learning analysis has increasingly become the focus of research. Based on the concept and characteristics of learning analysis, this paper discussed the modeling mechanism of learners' online learning behavior, put forward the analysis model of online learning behavior from the perspective of learning analysis, and carried out empirical analysis, taking as example the learners' online learning behavior of Shanghai Open University.

Introduction

With the development of information technology, online learning is more and more common in various learning situation. Learners' learning behavior data is well documented because of web-based learning. And if we use the appropriate educational data analysis method to dig the data, we can use these fragmented, massive, heterogeneous data to improve the learners to learn important information. This can't help but make people doubt: what kind of technology can be used to achieve the effective use of online learning behavior data?

The advent of the era of large data, making learning analysis as an educational data analysis technology, is becoming a new wave of educational information. In the "Horizon Report 2011", the US New Media Alliance (NMC) said: Learning analysis is a process of assessing academic achievement, predicting future performance, finding potential problems, and interpreting large amounts of data that students generate and collect. The use of learning and analysis techniques can take care of the learning behavior of learners and examine them. Examine the factors that affect the behavior, motives and other factors, as well as the behavior with the purpose of personality, environment and other elements in a retrospective manner in order to optimize the learning process and the environment in which it occurs. Learning analysis provides a new perspective for online learning behavior analysis, and gradually becomes the focus of attention of educators.

Analysis of the Research Current Situation

At present, the concept of "online learning behavior" has not yet had a unified understanding. Similar concepts include "online learning behavior", "distance learning behavior", "online learning behavior", "digital learning behavior". The online learning behavior refers that under the network learning environment built by the information technology learners take the initiative to use the cognitive and metacognitive strategies to do the online learning activities in an autonomous and collaborative way in order to complete the course learning objectives and develop high-level thinking ability. Learning analysis provides a new perspective for online learning behavior analysis, and gradually becomes the focus of attention of educators.

Domestic and overseas online learning behavior analysis involves a number of research areas, such as behavioral science, data mining, network analysis, artificial intelligence. The research focuses on data indicators, model construction, technical means and so on.

Data-indicator latitude: Jiang zhuoxuan etc. (2014) tried to find the general significance of the learning behavior characteristics and laws, and to predict the final learning effect based on learning
behavior characteristics of learners through the analysis of mining more than 80,000 people involved in six MOOC courses of massive learning behavior data. Li shuang etc.(2016) researched on the framework and measurement index of online learning behavior input analysis and put forward the analysis framework of online learning behavior, including participation, interaction, persistence, focus, academic challenge and self-monitoring. Sun xiaowei (2017) analyzed online learning behavior and its influencing factors based on SPOC platform log data.

Model-built latitude: Hu yiling etc. (2014) proposed a three-level online learning analysis model based on data, mechanism and result, and classified and analyzed the learning data from the perspective of network mining. Zong yang etc.(2016) carried out the research on online learning behavior based on RFM model. Wang liuhui etc.(2016) proposed a network learning behavior collecting model supported by big data. Zhang Siliang (2017) proposed an xAPI-based network learning behavior analysis model.

Technical-means latitude: Barbara etc.(2014) analyzed learners' online learning behavior in adaptive learning system by using WEB analysis method and visualization tool. A Shimada etc.(2015) analyzed learners’ online learning behavior by tracking a large number of operational logs in the learning management system. Liu shaowei (2016) studied the behavior of learners' online learning behavior through the methods of forecasting, clustering and relational mining.

**Design of Online Learning Behavior Analysis Model**

Fati W etc.(2016) believed that the learning analysis has the following four characteristics: the completeness of the analysis process, the breadth and diversity of the data sources, the visualization of the analysis results, the prediction and intervention of the learning behavior.

The online learning behavior analysis should be top-down modeled on the basis of studying the definition and characteristics of learning analysis. And from the perspective of learning analysis it also should orient online learning behavior analysis needs, and optimize learner online learning as the goal. Main core elements are: online learning behavior data collection, online learning behavior analysis methods and techniques, online learning behavior analysis results, online learning behavior intervention.
Online Learning Behavior Data Collection

Learner data, which includes learner behavior data and associated intelligence data, is the basis of the online learning behavior model. The data of the learner's behavior mainly includes the behavior data of all aspects of the learning process, such as login behavior, test, job, resource browsing, online duration, time allocation, information exchange. The data associated with online learning behavior mainly includes three aspects: one is the learner's learning results, including test scores, job scores, etc.; the second is the learner characteristics, including psychological characteristics, personality traits, background information, etc.; third is the curriculum attributes, including the course content, curriculum resources, curriculum activities and other essential attributes of the course. The data is collected from various sources. That is, from different learning terminals data, and the third-party data platform data. In addition to the commonly used Web log, database and other virtual space data, you can use the eye movement instrument, brain wave detector, etc. to extract the learner signs data from the actual scene. Establish the behavior characteristic database on the basis of data feature extraction, classification, storage and index. Filter and classify the definition of the behavioral factors in the construction model. Establish feature subsets and adjust relevant parameters dynamically in order to achieve continuous optimization of performance.

Online Learning Behavior Methods and Mechanisms

Online learning analysis methods and techniques include the use of statistical methods, regression analysis, visualization, personalized recommendation, data mining and social network analysis, etc. The data collected by the data analysis method are filtered, reconstructed, transformed and extracted. The data are analyzed according to a certain online learning behavior analysis.
mechanism. In this way, the results are visualized. Learning diagnose mechanism is to enable learners to be able to understand the learning effect for the first time, and to provide timely diagnosis, stage learning diagnosis and summary study diagnosis. The immediate feedback mechanism includes timely feedback on learning resources, participation in learning activities, completion of test assignments, evaluation of learning outcomes, etc. The behavior prediction mechanism is based on the learner's existing behavior state to infer the next possible state, including the learner's learning preferences, learning tendency, learning path, etc. The planning mechanism is to understand the learner's learning style, to predict the learners may be suitable for the study plan, and to provide a certain booking program in order to provide customized, personalized learning support. The resource recommendation mechanism is based on the learner's learning resource analysis, combined with the learner's learning preference, predicting the learning needs of the learners, analyzing the learners' appropriate learning resources, and providing the learners with intelligent personalized recommendation.

**Online Learning Behavior Analysis Results Visualization**

Visualization is a method of presenting the data or analysis of data graphically. It is the most effective way to explore a large number of complex data. Combined with online learning behavior, common online learning data visualization can be divided into three categories: One is the visualization of knowledge, such as concept map, mind mapping, etc; The second is the visualization of learning process, including the discussion area posting posts, job completion, resource browsing, landing, etc.; The third is the visualization of learning results, such as job scores, test scores and so on. We can make trend analysis (such as a line chart, a bar chart), proportional analysis (such as pie chart, stack area chart), or relationship analysis (such as bubble chart, scatter plot, spider web map) of visualization of learning process and learning results.

**Online Learning Behavior Analysis Stakeholders**

The results of the online learning behavior analysis are ultimately presented to online learning behavior analysis stakeholders, including learners, teachers, managers and technical staff. Learners are the biggest beneficiaries of online learning behavior analysis. They can find out the advantages and shortcomings of their own learning by means of data analysis, and adjust their learning strategies in a timely manner so as to achieve better learning expectation. Teachers can timely grasp the learner's learning dynamics based on visualized data, understand the participation of learning activities, and develop relevant intervention mechanisms to intervene learners' learning behavior in order to achieve optimal learning outcomes. Managers can get the online learning situation of a course and even the entire school. And managers also can have some data support for management decision. Technical developers can modify learning platform based on the results of the analysis, optimize the learner's learning experience, improve the learning platform function, and provide a better learning environment.

**Online Learning Behavior Intervention**

Based on different roles, the focus of stakeholders' concerns of the visualization is not the same. Learners focus on online learning behavior individual data, including their own behavior, personalized and recommended learning resources, learning results, etc. Through the visualization of the learner's individual data, the learner can keep abreast of the connection between the current learning topic and the learning results that may arise in the future, so as to carry out self-intervention, correct learning attitude and correct learning behavior. Teachers are more concerned about the overall situation of teaching, including learner participation in activities, the quality of learning resources, the achievement of learning objectives, etc. Through the analysis of the overall behavior of learner behavior, teachers can clearly know the overall learning needs of learners, timely revise teaching plan and provide necessary learning support. Managers pay attention to the school's overall academic performance, curriculum usage, website visits and so on. And also they concern about the comparison of different classes, grade level, curriculum and other dimensions, through data analysis they can timely adjust the relevant decision and develop relevant
rules and regulations. Technology development staff concerned about the use of the platform, the convenience of resources, learning experience and so on, and through the data analysis results they can design online courses reasonably, perfect online learning platform functions, and improve learners learning experience.

**Online Learning Behavior Case Analysis**

This case analysis, based on online learning behavior of 136 learners of Shanghai Open University data mining and analysis, following the learning perspective of online learning behavior analysis model, relies on the Shanghai Open University online learning platform. Learners personal online learning behavior data, includes the number of course visits, course learning progress, learning time, interactive behavior, the number of learning tasks and academic performance. Learner-related behavioral data include online course data, total number of learner visits, browsing time, open learner characteristics, learner interest, resource visits, total learning activities, overall academic performance, etc.

**Learner Personal Analysis**

Analyzes the individual online learning situation of Shanghai Open University learners. The statistical data includes the number of courses, learning time, the number of learning completion, the academic performance, etc. And present the analysis in a visual form to the learner, so that learners and master their own learning situation. For example, the results of the statistical analysis of individual learners' learning are shown in Fig.2.

![Figure 2. Learners Personal Learning Situation Statistics.](image)

The maximum value of Learning Speed Average per Course is 88.9 page/10 minute, the lowest value is 1.5 page/10 minute. The maximum value of Course Completion Rate is 100%, the lowest value is 25%. Through the analysis of learning, learners have a great difference in the speed of learning, curriculum completion rate has obvious ups and downs, so the need for learners on the relevant courses for timely intervention.
Correlation-analysis of Curriculum and Learners

Statistical Analysis will be made on Shanghai Open University online course and the studying situation of all learners. It includes learning time, learning speed, academic performance, homework completion, likes, comments and other parameters. For example, the results of the statistical analysis of learner learning on a single course are shown in Fig.3.

![Figure 3. Statistical Report for Course Content Visits on a Single Course.](image)

The average duration of study for learners is 10 minutes, the homework completion rate is 70%, and the number of reviews is 5%. Through the statistical summary of the parameters of the analysis, teachers can be provided with the course learning data. Teachers can adjust teaching arrangements according to the circumstances and intervene in the learning progress of learners.

Course Hits Analysis

Course Hits analysis is carried out on part of Shanghai Open University courses. Analyze the 24-hour total hits in hours, 24-hour online user distribution and 24-hour traffic per course. Analyze the most active time and the most frequent-visit courses of learners. Set the teacher’s Q & A time, prepare curriculum assistant on demand and other interventions, and provide support for learners in time. Shanghai Open University curriculum traffic statistics analysis results are shown in Fig 4.

![Figure 4. Course Hits Survey of Shanghai Open University.](image)
The analysis found that the most active time period for learners to visit the course was 8 points to 10 points and 18 points to 20 points, so teachers needed to provide more learning support services during this time period.

Conclusion

Online behavior analysis is the inevitable product for the vigorous development of online education, and it also plays an irreplaceable role in online education optimization. How to make effective use of online behavior data to generate dynamic learning effect is of great significance to improve learners' learning quality. The analysis of online learning behavior is helpful to improve the learning performance of learners, improve the quality of curriculum construction and optimize the decision of managers. The author studies the online learning behavior analysis based on the learning perspective, constructs the analysis model, and carries on the certain practice analysis. In the future, we hope to fully establish the relationship between online learning behavior and knowledge construction model, to achieve the use of online learning behavior analysis, and to promote learners online learning performance by using online learning behavior analysis.

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