

A Conception of Individualized Online Education Scheme at Middle Schools based on Big Data Technology

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Abstract

As a new development trend of information technology, big data has penetrated into various industries and become an important factor of reform. In the era of big data where reform of teaching is driven by data analysis, big data has become a science power that pushes educational innovation and development. Compared with traditional education data, the collected education big data demonstrates better timeliness, connectivity, comprehensiveness and naturalness. Therefore, its analysis and processing are more complicated and diversified and the application is also more diversified and profound. In this paper, an individualized online education scheme at middle schools based on big data technology is conceived mainly to provide solutions a series of problems with traditional teaching at middle schools such as inadequate cognition of learners, inadequate learning resources to satisfy the demand of most students, lack of pre-warning mechanism in learning situation analysis and unitary learning evaluation, thus forming intelligent classrooms.

Keywords

Big data technology; middle schools; individualization; online education.

1. Introduction

In the *Improvement of Teaching and Learning through Education Data Mining*, the United States Department of Education pointed out that, the application of big data in education mainly included two major orientations: education data mining and learning analysis technology. Data mining helps with integration of learners' knowledge, meta-cognition, motive and attitude, etc. quantitative analysis and modeling study of learners' learning behaviors and process, modeling and improvement in the field which covers optimal teaching sequence and teaching content and the prediction of learners' learning trend, thus promoting high-efficient learning. To be specific, the learning analysis technology is application of data measurement, collection and analysis, etc. in analysis of learning environment to understand and optimize learning process. Based on analysis of education big data, the learners' behavioral characteristics are constructed, whereby individualized resources are provided to satisfy the demand of different learners. Facts prove that big data technology has broken the limitation in traditional teaching where teachers analyze students academic performance based on their teaching experience at middle schools. In various teaching scenarios, data mining and learning analysis technology enables identification, summarization and storage of the data of learners' entire learning process and learning behaviors under multiple modes, the in-depth understanding and accurate diagnosis of learning behaviors, whereby teachers may provide more scientific and reasonable learning support and help develop precision education.

2. The Important Significance of Individualized Education at Middle Schools

As an advanced teaching concept, individualized teaching suits the demand for talents cultivation in society and is of great significance to cultivation of innovation capacity and creative thinking. More than 500BC, Socrates proposed the “art of midwifery” which is considered as the bud of individualized education.

No two leaves are perfectly identical in the world and so are the characteristics of students which influence their learning method. In traditional education, it's quite difficult to identify these characteristics for suiting teaching to their ability. In routine teaching, teachers spend too much time on checking students' homework and at the same time, they cannot accurately master the students' learning since data collection is not available with traditional homework; furthermore, there is lack of interaction between students and teachers and teachers lacks time and energy to care for every student, as a result of which there is no individualized learning scheme for students. China has undergone the stage of popularization of basic education. In the future, furthermore endeavors should be made to satisfy different demand for education of students. The national development and rejuvenation requires a great deal of innovative talents with spirit, awareness and capacity of innovation. Therefore, individualized education at middle school stage is particularly important.

3. Basic Characteristics of the Structure of Individualized Teaching System

In the era of 5G intelligent communication, the boundary of traditional education mode is gradually broken by precision education with development of big data technology, evolving into a new technology-enhanced education mode. The main characteristics of big data-driven precision education are accurate customization of education content, accurate design of education activities and accurate assessment of academic performance based on accurate analysis of learning conditions through the means of big data, whereby quantization, monitoring and coordination of education process and result are achieved. There are four basic rules to be followed in big data-based target teaching: (1) observability of behavior data; (2) multi-dimension of measurement indexes; (3) attachment of importance to use of learning situation analysis tools; (4) learners' behavior data as the importance basis for decision-making. Under the background of big data based target education, the multi-mode data, including the data of the behavioristics, psychology and physiology, records and displays the behaviors and learning process in a traceable manner. With application data technology, precision education no longer focuses on “directly observable behaviors” but permeates into hidden areas which are not easily discovered or measured, providing more scientific basis for formative assessment and predicative analysis and individualized guidance for individuals and organizations.

4. Conception of Individualized Online Education Scheme at Middle Schools based on Big Data Technology

“Precision teaching” was proposed by U.S. Doctor Lindsley in the 1960s. Its idea is as follows: the observable learning behaviors of learners such as behavior frequency and response speed are recorded for drawing a standardized chart and teaching strategy is adjusted based on the law of change of frequency data in the chart. Precision teaching is able to judge whether teaching objectives are met and whether students satisfy the requirements on knowledge on skills by detecting students' learning behaviors and process. Precision teaching reflects the detection result through smoothness index. The smoothness index includes “accuracy” and

“speed” which refer to the accuracy of students’ mastering of knowledge and skills and the speed of application respectively. Precision teaching requires students to spend time on practice and measurement every day, while the teachers will record the measured frequency data into a standard variable speed table to judge students’ mastering of knowledge and skills and whether intervention is needed.

The big data based precision education is a micro measurement and diagnosis tool focusing on learners’ core performance and discipline ability, which will diagnose learners’ mastering of core knowledge. Furthermore, the platform will provide intuitive visualized data after data analysis. The teachers will, based on the visualization result, select appropriate teaching strategy, accurately design education objectives, adopt appropriate lecturing method, build high-efficient classroom mode, create reasonable learning atmosphere, set education activities based on learners’ knowledge and design accurate performance assessment, etc. According to the big data analysis result, the self-adaptive engine may make individualized recommendation of learning resources targeting at learners’ recognition characteristics, proving learners’ independent learning. By placing assessment and diagnosis links into classroom interaction between teachers and learners, learners’ changing knowledge system and potential problems may be diagnosed accurately, whereby teachers may timely improve teaching strategy and execute accurate education intervention measures. The key links of this micro measurement and diagnosis tool include micro measurement and diagnosis, intuitive visualized display, selection of self-adaptive learning strategy and recommendation of individualized learning resources.

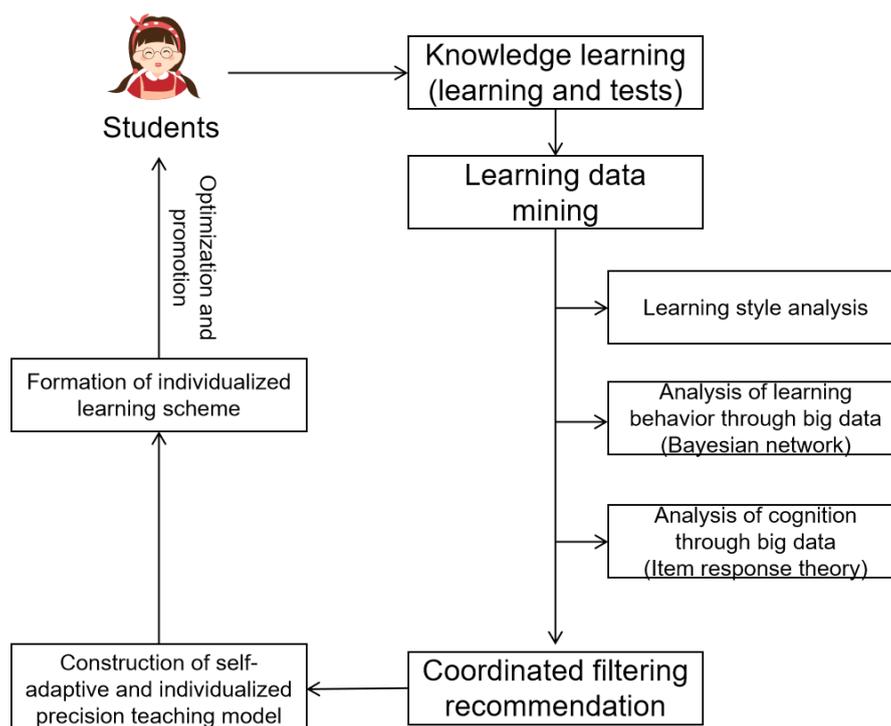


Figure 1: Structural scheme of individualized teaching system based on big data and cloud computation

4.1. Intelligent Diagnosis and Predication

Intelligent diagnosis and prediction tools have become necessary in analyzing learners’ academic conditions and in carrying out precision education. A pre-condition for applying micro measurement and diagnosis tools in diagnosis of academic conditions lies in teachers’ accurate understanding of education and the mastering of education demand. Before classroom education, teachers may use such tools to diagnose students’ academic situations. The diagnosis result will help them prepare education objectives and design targeted and individualized

education content. In the classroom, teachers may also use micro measurement and diagnosis tools to diagnose teaching process, thus timely adjusting teaching pace and content. After completion of all courses or unit teaching, teachers may use micro measurement and diagnosis tool to test students' mastering of knowledge and verify the effectiveness of teaching. There are certain similarities in use of micro measurement and diagnosis tools before, during and after teaching: they accurately assess learners' current academic performance and the expected academic performance after learning in a scientific manner, enables learners to carry out self-diagnosis and provide objective basis to teachers.

4.2. Visualized Analysis Report

Diagnosis tools and various built-in algorithm may intuitively illustrate learners' cognition capacity and provide teachers with objective basis for accurate teaching. The report mainly consists of learners' comprehensive quality, discipline recognition chart, core concepts of discipline and relevant assessment indexes, etc. The learners' understanding and cognition structure in the individual and group concept is demonstrated from discipline cognition chart and their comprehensive quality. For instance, a learner's relevant capacity in a discipline may be proved through modeling and calculation. The learners' capacity indexes are expressed core concepts of the discipline and assessment of core capacity indexes. Therefore, this series of indexes are of great significance to teachers' education design and classroom teaching. Furthermore, they enable learners to understand their own learning situations and carry out independent learning. At the same time, the development from singular assessment to diversified assessment will help learners discover and identify their problems in recognition through analyzing learning conditions.

4.3. Guidance on Individualized Learning

First, teaching analysis is conducted on teaching content, learning situations and the latest development field based on diagnosis result. Then, the teaching schemes, education activities and self-adaptive learning are designed upon education analysis. Third, during implementation of teaching scheme, teaching adjustment is made based on the diagnosis result to adapt to changes of learners' cognition during teaching. Finally, upon post-class learning diagnosis, the validity of teaching design is diagnosed, so that the improved teaching design may provide reference for subsequent teaching and teachers may provide targeted guidance and individualized suggestions as per learners' recognition capacity.

5. Conclusion

In the *China's Education Modernization Plan Towards 2035*, it is also pointed out that, big data, cloud computation, internet of things and other modern technologies should be utilized to accelerate reform of talents calculation mode and achieve organic combination of scaled education and individualized cultivation. The extensive application of big data in education brought great space for education development. Under the background of precision education, the in-depth application of big data and cloud computation will help teachers set accurate education objectives, providing effective data support to individualized learning. It not only satisfies the individualized demand of learners, but also gives play to the roles of teachers in providing guidance, whereby new technological support is provided to promote individualized self-adaptive learning of learners.

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