Universe Scientific Publishing

DOI:10.18686/ahe.v7i31.11556

# Personalized Learning Strategies and Effect Evaluation Based on Education Big Data Analysis

**Jiezhang Min**

Guangxi University for Nationalities , Nanning Guangxi 530006 China

**Abstract:** This study focuses on personalized learning strategies based on educational big data analysis. It delves into the conceptualization, design, and efficacy assessment of these strategies. Educational big data analysis involves ensuring data quality, dealing with outliers and missing values, and mining key indicators for designing personalized strategies. The study explores three main personalized learning methods—content-based recommendation, collaborative filtering, and deep learning—and their advantages and limitations. The research emphasizes the importance of evaluating personalized learning strategies based on multi-dimensional indicators, including academic performance, learning satisfaction, and efficiency.

**Keywords:** Personalized learning; Educational big data analysis; Data preprocessing; Key indicators; Learning strategies

## 1. Introduction

In the contemporary digital landscape, educational big data has emerged as a pivotal force shaping the future of education. Advancements in technology enable the collection and comprehensive analysis of extensive student data, unveiling intricate patterns and evolving trends within the learning journey. Simultaneously, personalized learning stands as a strategic cornerstone for tailoring educational experiences, progressively steering the trajectory of the educational sphere. This study is dedicated to delving into the conceptualization, design, and efficacy assessment of personalized learning strategies within the realm of educational big data. Its goal is to offer profound insights aimed at optimizing the learning experience and augmenting learning effectiveness.[1]

## 2. Education big data analysis

In the field of education, big data analysis has become a compelling field with great potential for optimizing the educational process and improving student learning outcomes. However, before conducting big data analysis in education, the quality and reliability of the data used must be ensured. This requires the adoption of a series of advanced technologies and methods from the perspective of data preprocessing and cleaning to ensure the accuracy and credibility of subsequent analysis.

First, data cleaning is one of the key steps to ensure the accuracy of educational big data analysis. Data collected in education systems often contain a variety of formats and sources, so there may be redundant, erroneous or inconsistent information. This requires data cleaning, including removing duplicate data, resolving format inconsistencies, and fixing data entry errors. Through data cleaning, you can ensure that the data used for subsequent analysis is accurate and consistent.

Secondly, outlier processing is also an important part of the data preprocessing stage. In educational big data, there may be some outliers or outliers, and these data points may have a negative impact on the analysis results. Therefore, it is crucial to identify and deal with these outliers. This may involve the use of statistical methods, machine learning techniques, or domain expertise to identify and correct these outliers to ensure the accuracy and representativeness of the data.

In addition, missing value filling is also an issue that needs attention during data preprocessing. In the actual collected education data, there are often some missing data, which may be due to recording errors, system failures or other reasons. Methods of dealing with missing values usually include deleting data containing missing values, using statistical methods to estimate and fill, or using machine learning models to predict and fill. The purpose of this step is to ensure data integrity and availability and avoid bias or misleading results during the analysis process.[2]

In educational big data, the mining of key indicators and features is the basis for the design of personalized learning strategies.

These indicators and characteristics may include students' learning behavior patterns (such as study time, learning methods), subject interests (selected courses, activity participation), subject performance, and learning progress (progress in completing tasks, knowledge points mastered, etc.). Through in-depth research and analysis of these data, students' individual differences and learning needs can be better understood, providing basis and support for the development of personalized learning strategies.

## 3. Personalized learning strategies

When it comes to personalized learning methods in the context of education big data, we explore several key approaches, each with its own unique advantages and limitations that need to be evaluated and selected based on the specific situation.

Content-based recommendation is a personalized learning method that relies on analyzing and matching the content characteristics of learning resources. This approach can improve the personalization of learning by recommending similar or related learning resources based on students' interests and preferences. However, it may face content representation challenges, namely how to accurately represent and capture the characteristics of learning resources and how to handle emerging interests and changes.

Collaborative filtering is another commonly used personalized learning method that uses similarities between students to recommend learning resources. This method relies on the behavior and preferences of students to make recommendations by analyzing the relationship patterns between students. However, collaborative filtering may be limited by data sparsity and cold-start problems, especially for new users or students with little behavioral data.[3]

Deep learning is a more complex and powerful personalized learning method that uses a multi-level neural network structure to learn and understand students' behavior patterns and learning needs. Deep learning can process large-scale, high-dimensional data and has advantages in mining complex relationships and patterns among students. However, deep learning models often require large amounts of data and computing resources, and their black-box nature may lead to insufficient model interpretability.

When building a personalized learning model based on educational big data, the particularity of the data and the applicability of the model need to be considered. Parameter selection and optimization strategies are important links in the process of building a model, and reasonable selections need to be made based on data characteristics and model performance. The feasibility in practical applications involves model deployment and effect verification, and needs to be evaluated in conjunction with actual scenarios.

For the design and implementation of personalized learning strategies, the division of student groups, the push of learning resources and the customization of learning tasks are key steps. With the support of education big data, student groups can be more accurately divided and targeted learning resource push and task customization can be achieved. It is important to conduct a quantifiable evaluation of the degree and effect of personalization to verify the effectiveness of the strategy and the room for optimization.

## 4. Effect evaluation and analysis

Evaluating the effectiveness of personalized learning strategies requires multi-dimensional evaluation indicators that cover all aspects of learning, from academic performance to student satisfaction and learning efficiency to provide a comprehensive assessment.

First of all, subject performance is a key assessment indicator, which can reflect students' mastery and performance in a specific subject area. By comparing the changes in subject performance before and after the implementation of personalized learning strategies, the impact of the strategies on academic performance can be evaluated and the effectiveness of the strategies can be judged.

Secondly, learning satisfaction is an important indicator to evaluate students' acceptance and satisfaction with personalized learning strategies. Students' attitudes and feelings about the learning process are critical to the success of assessment strategies. Collecting student satisfaction data through questionnaires, feedback, etc. can better understand students' attitudes and opinions towards personalized learning strategies.

In addition, learning efficiency is also an important evaluation indicator, which reflects the amount of knowledge and understanding gained by students in a unit of time. One of the goals of personalized learning strategies is to improve learning efficiency, so evaluating changes in learning efficiency can help determine the effectiveness and impact of the strategy.

Evaluating the learning effects after the implementation of personalized learning strategies requires detailed analysis of the learning outcomes of different student groups. This includes analyzing the performance differences of different student groups (such as age, gender, academic level, etc.) under personalized learning strategies, as well as the degree of impact of strategies on the learning effects of different groups. This kind of analysis can reveal the pertinence and universality of strategies and help adjust and optimize strategies to better meet the needs of different student groups.[4]

The use of statistical methods and data visualization tools is essential in data analysis and interpretation of results. Statistical methods can help verify the significance and credibility of data, while data visualization can intuitively display evaluation results and help decision-makers better understand the trends and patterns behind the data. Through in-depth analysis of the evaluation results,

key information and insights in educational big data can be extracted, providing actionable suggestions and guidance for subsequent research and practice.

## 5. Conclusion

In the study of personalized learning strategies under education big data analysis, we found a series of important results. First, personalized learning has a significant positive impact on student learning outcomes. [5]Through personalized learning strategies based on educational big data, students can obtain a learning experience that is more in line with their needs and ability levels, improve learning motivation and engagement, and achieve better academic results. In addition, personalized learning can also promote students' understanding and mastery of learning content, thereby improving learning efficiency and depth.

This research makes significant contributions both theoretically and practically. Theoretically, through in-depth exploration of the combination of educational big data analysis and personalized learning, the understanding and application of personalized learning strategies in the field of education are expanded. In practice, the research provides feasible methods and frameworks to guide educators and policymakers in designing and implementing personalized learning strategies in actual teaching environments, providing strong support for educational practice.

However, the study also has certain limitations. First, the design and implementation of personalized learning strategies rely on large amounts of data and precise algorithm models, and some educational environments may not be able to meet these requirements, thus affecting the effectiveness of the strategies. Secondly, personalized learning involves the consideration of individual differences among students, but may face privacy and ethical challenges in actual operation. How to achieve effective personalized learning while protecting personal information still needs further exploration.

For future research prospects, we can conduct in-depth research on how to better integrate educational big data from different types and sources to further improve the accuracy and effectiveness of personalized learning strategies. In addition, more advanced algorithms and technologies can also be explored to address the challenges of personalized learning in different educational scenarios, such as how to effectively implement personalized learning when faced with small-scale data sets or privacy protection requirements.

Therefore, future research can focus on solving the practical application problems of personalized learning strategies and seek more innovative methods and technologies to promote further development and innovation in the field of educational big data and personalized learning.

## References:


[1]Chen Minghong, Han Jing, Yang Xinyu, Li Zhihuan, Wu Yimeng and Lian Xiaoli. Visual analysis of teaching reform research driven by big data - based on CSSCI journal papers from 2013 to 2022. Resource Information and Engineering .2023(05),115-121.

[2]Ren Yang. Evaluation and optimization of the effect of multimedia-assisted teaching in English language acquisition. (eds.) Proceedings of the 4th Academic Conference on Innovative Education and Development Beijing Foreign Studies College of English for University Purposes.2023(2):(pp.9-17).

[3]Luo Huiyuan. Analysis of teaching application characteristics and application scenarios of big data technology. China Information Technology Education .2023(18),79-82.

[4]Cong Hongyan and Dong Shimei.The development status and evolution trend of educational statistical data research in my country - Visual analysis based on CNKI journal data from 2000 to 2022. Heilongjiang Science .2023(11),66-69.

[5]Wu Chuanrong, Liu Yajie, Li Jianxin and He Hao. Research on students' personalized learning behavior and precise teaching strategies based on big data. Journal of Science and Education .2023(17),149-152.