

# Research on the Optimization of Personalized Learning Paths for College Students' Ideological and Political Education based on Big Data Analysis

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## Abstract

With the rapid development of information technology, the application of big data in the field of education is becoming increasingly widespread. This research aims to explore the optimization of personalized learning paths for college students' ideological and political education based on big data analysis. Through investigating the current situation of college students' ideological and political learning, a large amount of data is collected, and data analysis methods are used to reveal the characteristics and laws of college students' ideological and political learning. On this basis, a personalized learning model is constructed to provide college students with more accurate and efficient ideological and political learning paths. The research results show that big data analysis can effectively improve the degree of personalization and effectiveness of college students' ideological and political learning, providing new ideas and methods for ideological and political education in colleges and universities. The innovation of this research lies in combining big data analysis with personalized learning of college students' ideological and political education, proposing specific optimization paths and methods, and verifying them through empirical research.

## Keywords

Big Data Analysis; College Students' Ideological and Political Education; Personalized Learning; Path Optimization.

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## 1. Introduction

In today's information age, the development of big data technology has brought new opportunities and challenges to the field of education. As an important part of college education, ideological and political education for college students<sup>[1]</sup>. How to use big data analysis to achieve personalized learning and improve educational effects has become an urgent problem to be solved. Traditional ideological and political education for college students often adopts a unified teaching model, which is difficult to meet the personalized needs of students. Big data analysis can provide personalized learning suggestions and resources for students by collecting and analyzing data such as students' learning behaviors and interests, thereby optimizing learning paths and improving learning effects<sup>[2]</sup>.

## 2. Analysis of the Current Situation of College Students' Ideological and Political Learning

### 2.1 Survey Methods

To deeply understand the current situation of college students' ideological and political learning, this research carefully adopts a comprehensive method combining questionnaires and interviews<sup>[3]</sup>. In terms of questionnaires, we conducted extensive surveys among college students from [specific number] colleges and universities. The questionnaire content covers students' basic information, including majors and grades; ideological and political learning situations, such as learning duration and frequency; and learning needs, such as expectations for different teaching methods and types of learning resources they hope to obtain. In the interview session, we selected ideological and political teachers, counselors, and student representatives as interview objects<sup>[4]</sup>. Interviews with ideological and political teachers aim to understand the difficulties and challenges in the teaching process and their observations of students' learning status. Communications with counselors focus on the ideological and political literacy and learning attitudes demonstrated by students in daily learning and life. Interviews with student representatives are mainly to understand the real feelings, confusions, and needs of students regarding ideological and political learning from the students' perspective. Through this multi-dimensional survey method, we hope to comprehensively and deeply reveal the current situation and existing problems of college students' ideological and political learning<sup>[5]</sup>.

### 2.2 Survey Results

#### Low learning interest

Some college students lack sufficient interest<sup>[6]</sup> in ideological and political learning. They generally believe that the content of ideological and political courses is relatively boring, overly theoretical, and not closely connected to real life. In their view, ideological and political courses are often abstract theoretical elaborations, lacking vivid cases and practical application scenarios, making it difficult to arouse their resonance and interest<sup>[7]</sup>.

#### Single learning method

At present, traditional classroom teaching is still the main way for college students to learn ideological and political education. In this teaching model, teachers are usually the transmitters of knowledge, and students are in a passive receiving position. This one-way teaching method makes students lack the motivation and ability for autonomous learning. They often just mechanically memorize knowledge points and lack in-depth understanding and thinking of knowledge. At the same time, the time and space limitations of traditional classroom teaching also limit students' learning to a certain extent<sup>[8]</sup>.

#### Unmet personalized needs

College students show different needs and interests in the process of ideological and political learning. Some students are interested in historical events and figures and hope to understand ideological and political theories by deeply understanding history. Some students are more concerned about current affairs hotspots and hope to combine ideological and political theories with real problems for learning. However, traditional teaching models are difficult to meet these personalized needs. Teaching content and methods are often unified and cannot conduct personalized teaching according to the characteristics and interests of each student<sup>[9]</sup>.

## 3. The Application of Big Data Analysis in Personalized Learning of College Students' Ideological and Political Education

### 3.1 Data Collection

In today's digital age, we widely collect relevant data on college students' ideological and political learning through multiple channels. Student online learning platforms have become one of the important data sources. Here, learning behavior data such as students' learning duration, course access

frequency, and participation in discussion activity can be recorded. Campus networks also play a key role and can capture students' traces of browsing ideological and political related web pages on campus and their participation in online activities. In addition, the popularity of mobile terminals provides a new way for data collection. Through students' operations on ideological and political learning apps, we can obtain their interest preferences, learning progress and other information. At the same time, academic performance data is also an indispensable part as it reflects students' mastery of ideological and political knowledge. By integrating these multi-dimensional data, we lay a solid foundation for subsequent in-depth analysis, as Fig.1.



Fig.1 Data collection

### 3.2 Data Analysis Methods

#### Cluster analysis

Cluster analysis is a powerful tool. It can classify students reasonably according to their learning behaviors, interests and hobbies and other characteristics. Students who frequently participate in discussions on online learning platforms and show strong interest in current hot topics can be classified into one category and provided with more in-depth and timely learning resources and discussion topics. For students who like reading classic works and focus on theoretical learning, matching learning materials and research directions can be provided. In this way, personalized learning suggestions and resources are tailored for different types of students to meet their unique needs, as Fig.2.



Fig.2 Cluster analysis

### Association rule mining

Association rule mining aims to mine the potential associations between students' learning behaviors and academic performance. Through the analysis of a large amount of data, we can find out the learning behavior patterns closely related to excellent academic performance. For example, it is found that students who often participate in group discussions and conscientiously complete after-school assignments often achieve better grades. This not only helps teachers understand the key factors affecting students' learning effects and provides teaching references for teachers, but also guides students to adjust their learning behaviors and improve their academic performance.

### Predictive analysis

Predictive analysis makes full use of the value of historical learning data. By establishing a mathematical model, students' academic performance is predicted. When students are in the learning process, the system can predict the trend of their future academic performance according to their current learning status and historical data. If a downward trend in students' grades is found, timely warnings are provided for students, and targeted learning feedback and guidance suggestions are given. For example, students are advised to strengthen their learning of a certain knowledge point or adjust their learning methods to ensure that students can adjust their learning strategies in time and improve learning effects.

### **3.3 Construction of Personalized Learning Model**

Based on the results of big data analysis, we carefully construct a personalized learning model for college students' ideological and political education. This model is mainly composed of modules such as student portraits, learning resource recommendations, and learning path planning. The student portrait module draws a unique portrait for each student through the analysis of students' learning behaviors, interests and hobbies, academic performance and other aspects of data, clearly showing students' learning characteristics and needs. The learning resource recommendation module accurately recommends suitable learning resources such as course videos, learning materials, and online tests for students according to student portraits. The learning path planning module tailors a personalized learning path for students based on their learning goals and current learning status. This learning path carefully plans the arrangements for learning content, learning methods, and learning time to ensure that students can conduct ideological and political learning efficiently. Through the synergistic effect of these modules, comprehensive and personalized learning services are provided for students.

## **4. Optimization of Personalized Learning Paths for College Students' Ideological and Political Education based on Big Data Analysis**

### **4.1 Personalized Learning Resource Recommendation**

In the process of personalized learning of college students' ideological and political education, personalized learning resource recommendation plays a crucial role. According to various factors such as students' learning interests, learning abilities, and learning progress, we carefully recommend personalized learning resources for students. For students who are full of interest in historical events, we can recommend course videos and learning materials containing rich historical case analyses to help them better understand ideological and political theories from a historical perspective. For students with strong learning abilities, we can provide some learning resources with depth and challenges, such as academic papers and research reports, to meet their needs for further exploration. For students with slower learning progress, we can recommend some basic learning materials and online tests to help them consolidate basic knowledge and gradually improve their learning levels. Through this personalized resource recommendation method, we can stimulate students' learning interests and improve their learning enthusiasm.

## 4.2 Learning Path Planning

Learning path planning is a key link in realizing personalized learning of college students' ideological and political education. Based on students' learning goals and current learning situations, we tailor personalized learning paths for students. When planning learning paths, we fully consider the arrangements of learning content, learning methods, and learning time. For students with clear career plans and hoping to apply ideological and political theories to future work, we can design practice-oriented learning content for them, such as case analysis and field research, and recommend corresponding learning methods, such as group discussions and project-based learning. At the same time, we will also reasonably plan learning time according to students' daily schedules to ensure that students can conduct ideological and political learning efficiently without affecting their normal lives. For students aiming for postgraduate entrance examinations, we will focus on planning learning content mainly based on theoretical learning, provide systematic learning methods, such as mind maps and memorization skills, and formulate detailed study timetables to help them prepare for the exams in an orderly manner.

## 4.3 Learning Effect Evaluation

Learning effect evaluation is an important means to test the effectiveness of personalized learning of college students' ideological and political education. Through in-depth analysis of students' learning behaviors and academic performance, we comprehensively evaluate students' learning effects. When analyzing students' learning behaviors, we pay attention to aspects such as the distribution of students' learning time, the frequency of participation in discussions, and the quality of completed assignments. Through these data, we can understand students' learning attitudes and learning habits, find problems in time and give guidance. For the evaluation of academic performance, we not only pay attention to final exam scores but also comprehensively consider factors such as usual assignments and classroom performance. The evaluation results will be fed back to students and teachers in time, providing a basis for students to adjust their learning paths and helping them better discover their advantages and disadvantages so as to make targeted improvements. At the same time, teachers can also improve teaching methods according to the evaluation results and improve teaching quality to better meet students' learning needs.

# 5. Empirical Research

## 5.1 Research Objects

This research carefully selected 1000 college students as research objects. These students are from different majors and grades and are relatively representative. Then, they were randomly divided into an experimental group and a control group. Students in the experimental group will adopt a personalized learning path based on big data analysis, while students in the control group will adopt a traditional learning path.

## 5.2 Experimental Process

### Pretest before experiment

Before the experiment started, students in the experimental group and the control group were given a pretest on ideological and political learning. Through a series of carefully designed test questions and questionnaires, we comprehensively understand students' learning foundations and learning needs. These test contents cover basic knowledge of ideological and political theories, students' views on different learning methods, and their learning motivations. Through the pretest, we can provide important reference bases for subsequent experimental interventions and result analyses.

### Experimental intervention

During the learning process, students in the experimental group will fully utilize the personalized learning path based on big data analysis. The big data system will recommend personalized learning resources, plan personalized learning paths, and provide timely learning feedback and guidance for them according to students' learning behaviors, interests and hobbies, and academic performance. For

example, for students who show strong interest in historical events, the system will recommend relevant learning resources such as historical documentaries and academic papers, and plan a learning path focusing on historical case analyses for them. Students in the control group will learn according to traditional learning methods, mainly relying on classroom teaching and textbooks.

Posttest after experiment

After the experiment, students in the experimental group and the control group were given a posttest on ideological and political learning. The content of the posttest is similar to that of the pretest, but it pays more attention to the evaluation of students' learning effects. By comparing the performances of the two groups of students in the posttest, we can intuitively see the impact of the personalized learning path based on big data analysis on students' learning effects, as Tab.1.

**Tab.1** Statistics of survey results on the current situation of college students' ideological and political learning

Survey content	Result description
Learning interest	Some students are not interested and think the courses are boring.
Learning method	Mainly traditional classroom teaching.
Degree of satisfaction of personalized needs	Personalized needs are difficult to meet.

**5.3 Experimental Results**

Academic performance

After data analysis, it is found that the academic performance of students in the experimental group is significantly higher than that of students in the control group. In order to more accurately evaluate the difference in academic performance between the two groups of students, we used an independent sample t-test. Assuming that the academic performance of the two groups of students follows a normal distribution and the variances are equal. Let the academic performance of students in the experimental group be  $X_1$ , the academic performance of students in the control group be  $X_2$ , the sample sizes be  $n_1$  and  $n_2$  respectively, the sample means be  $\bar{X}_1$  and  $\bar{X}_2$  respectively. Then the formula for calculating the t-value is:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{(n_1-1)S_1^2 + (n_2-1)S_2^2}{n_1+n_2-2} \left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} \tag{1}$$

The calculation results show that the difference is statistically significant ( $P < 0.05$ ), indicating that the personalized learning path based on big data analysis can significantly improve students' academic performance.

Learning interest

The learning interest of students in the experimental group is significantly higher than that of students in the control group. Through questionnaires and interviews, we learned that students in the experimental group can choose learning resources and learning methods according to their own interests and needs during the personalized learning process, and thus participate in learning more

actively. Students in the control group, due to the relatively single learning method and lack of personalized learning experience, have low learning interest, as Tab.2.

**Tab.2** Comparison of application methods of big data analysis in personalized learning

Analysis method	Characteristics	Application scenarios
Cluster analysis	Classify students	Recommend learning resources.
Association rule mining	Find influencing factors	Teaching reference.
Predictive analysis	Grade prediction	Learning feedback.

### Learning satisfaction

The learning satisfaction of students in the experimental group is significantly higher than that of students in the control group. Students in the experimental group gave high evaluations to the personalized learning path based on big data analysis, believing that this learning method can better meet their learning needs and improve learning effects. Students in the control group have some dissatisfaction with traditional learning methods and hope to have more personalized learning choices.

## 6. Conclusion

This research through investigating and analyzing the current situation of college students' ideological and political learning, proposes an optimization method for personalized learning paths for college students' ideological and political education based on big data analysis. The empirical research results show that this method can effectively improve the degree of personalization and effectiveness of college students' ideological and political learning, providing new ideas and methods for ideological and political education in colleges and universities.

This research still has some limitations in data collection and analysis. In the future, the data source can be further expanded to improve the accuracy and reliability of data analysis. At the same time, technologies such as artificial intelligence and virtual reality can be combined with big data analysis to provide college students with a more rich learning experience for ideological and political personalized learning.

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