Research on the Construction and Application of Planning Intelligent Agent Model for Personalized Ideological and Political Learning Path Generation of College Students from the Perspective of Ideological and Political Education

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ABSTRACT High-quality ideological and political education in universities requires a shift from homogeneous supply and standardized promotion to personalized and precise learning support. Planning intelligent agents, with autonomous perception, dynamic planning, and closed-loop optimization capabilities, are well aligned with the generation of individualized ideological and political learning paths for college students. Based on ideological and political education theory, constructivist learning theory, and intelligent agent theory, this study defines personalized ideological and political learning paths and builds a four-layer planning agent model consisting of perception, decision, execution, and feedback layers, supported by ideological guidance, data security, and user interaction modules. The model collects multidimensional learner data, constructs dynamic learner portraits, generates differentiated learning paths, matches ideological and political resources, evaluates learning effects, and optimizes paths through feedback. Empirical testing shows significant improvement in knowledge mastery, ability development, value internalization, and learning behavior. The model also provides a reference for secure wireless campus platforms, intelligent data transmission, and electromagnetic-compatible learning environments.

INDEX TERMS planning intelligent agent, personalized learning, ideological education, wireless campus, data security

I. INTRODUCTION

A. RESEARCH BACKGROUND

THE report of the 20th National Congress of the Communist Party of China clearly proposes to "implement the fundamental task of cultivating morality and talents, and cultivate socialist builders and successors with comprehensive development of morality, intelligence, physical fitness, aesthetics, and labor", anchoring the core direction for the development of ideological and political education in universities in the new era. As the core carrier of implementing the fundamental task of cultivating morality and talents, ideological and political education in universities undertakes the key mission of shaping the correct worldview, outlook on life, and values of college students [1-2]. With the deepening of the construction of Digital China, the integration of new generation information technologies such as artificial intelligence, big data, and cloud computing with education and teaching continues to deepen, providing new technological support for the reform and innovation of ideological and political education. It has become an inevitable trend to promote the transformation of ideological and political education from the traditional offline mode to the "online+offline" integration mode, from experiential teaching to intelligent decision-making, and from homogeneous supply to personalized services.

B. RESEARCH SIGNIFICANCE

1) Theoretical significance

Firstly, enrich the theoretical system of integrating artificial intelligence with ideological and political education in universities. Existing research mostly focuses on the shallow application of artificial intelligence technology in the construction of ideological and political resources and online teaching, lacking systematic theoretical research on the generation of personalized ideological and political learning paths empowered by intelligent agent technology

[3,4]. This article deeply integrates the theory of planning intelligent agents with ideological and political education theory and learning science theory, defines the core connotation and operational logic of the model, and constructs a theoretical analysis framework for personalized ideological and political learning path generation, filling the theoretical gap in existing research [5].

Secondly, improve the research paradigm of personalized ideological and political learning for college students. The current research on personalized learning in the field of ideological and political education mainly focuses on qualitative analysis, lacking theoretical exploration of quantitative modeling and technological implementation. This article constructs a four-dimensional integrated planning intelligent agent model to clarify the core elements, operational mechanisms, and technical paths for generating personalized ideological and political learning paths, achieving an organic combination of qualitative analysis and quantitative modeling, and improving the research paradigm of personalized ideological and political learning [6].

Thirdly, expand the application theory of planning intelligent agent technology in the field of education. The existing planning based intelligent agent technology is mostly applied in industrial manufacturing, intelligent transportation and other fields. Its application in the field of education is mainly focused on resource recommendation for professional courses, lacking in-depth application in personalized path generation for ideological and political education. This article combines the value and practical characteristics of ideological and political education to optimize the functional architecture and algorithm model of planning intelligent agents, expanding their theoretical boundaries in the field of ideological and political education.

2) Practical significance

Firstly, provide practical technical solutions for universities to achieve precise ideological and political education. The model constructed in this article can achieve precise perception of ideological and political learning needs, dynamic planning of learning paths, and closed-loop optimization of learning effects, effectively solving the problem of “insufficient precision and weak targeting” in traditional ideological and political education. It provides operational and scalable technical support for universities to promote the transformation of ideological and political education from “flood irrigation” to “precision drip irrigation”.

Secondly, promote the digital and intelligent transformation of ideological and political education in universities. The construction and application of models can promote the deep integration of artificial intelligence and big data technology in the field of ideological and political education, facilitate the digital reconstruction of ideological and political education resources, intelligent control of educational processes, and precise evaluation of educational effects, and help universities build an intelligent ideological and political education system.

Thirdly, provide intelligent decision-making support for ideological and political education workers. The model can achieve full process data-driven tracking of the ideological and political learning process of college students, providing multi-dimensional data support for ideological and political education workers in terms of students’ learning needs, progress, effectiveness, problems, etc., helping them accurately grasp students’ ideological dynamics, carry out targeted education guidance, and improve the scientific level of ideological and political education work.

II. DEFINITION OF RELEVANT THEORETICAL FOUNDATIONS AND CORE CONNOTATION

A. DEFINITION OF CORE CONCEPTS

1) Defined Framework for Individualized I&P Learning

The personalized ideological and political learning path for college students from the perspective of ideological and political education is a dynamic and optimizable action plan tailored for college students, with the fundamental goal of cultivating morality and educating people, guided by ideological and political education theory, fully considering their individual differences in professional background, ideological and political knowledge foundation, cognitive level, value demands, learning styles, learning scenarios, and other aspects. Its core connotation includes four aspects: firstly, personalized goals, differentiated goals are formulated based on the ideological and political foundation and value demands of college students, achieving an organic unity of “knowledge learning ability cultivation value shaping” [7]; The second is personalized content, which matches the learning content with professional characteristics and cognitive levels. For example, science and engineering majors focus on serving the country through science and technology and the spirit of craftsmanship, while humanities majors focus on ideals, beliefs, and humanistic qualities; The third is to personalize the pace of methods, respect the learning style of college students, match differentiated methods such as online autonomy, offline discussions, and practical experiences, and dynamically adjust the learning pace; The fourth is personalized scene resources, combining learning scenarios with diverse resources such as graphics, audio and video, and practical projects to enhance learning convenience and adaptability. This path has four characteristics of dynamism, adaptability, systematicity, and value, always guided by ideological and political values, and promoting the internalization of values among college students [8-10].

2) Planning based intelligent agent model

A planning intelligent agent is an intelligent decision-making system with core capabilities of environmental perception, goal modeling, behavior planning, autonomous execution, and feedback optimization. It can perceive external environmental information through sensors, autonomously plan the optimal action path based on preset goals and environmental changes, and implement actions through actuators. At the same time, it can provide real-time feedback on the action effect and dynamically optimize the path [11]. The proposed planning agent model represents a synthesis of intelligent systems and student-centric pedagogical requirements. By integrating agent-based planning with specific educational needs, the model achieves precise demand perception and real-time path optimization. It relies on artificial intelligence and big data technology to construct an intelligent decision-making model, which can achieve precise perception of ideological and political learning needs, intelligent construction of learner portraits, dynamic planning of personalized learning paths, intelligent matching of ideological and political learning resources, real-time feedback of learning effects, and closed-loop optimization of learning paths. This model has five characteristics: ideological and political leadership, precise demand, dynamic path, resource adaptation, and real-time feedback. It is a targeted application of planning intelligent agent technology in the field of ideological and political education, and all decisions and planning are carried out around the fundamental goal of cultivating morality and talents [12-14].

3) Planning based intelligent agent model empowers personalized ideological and political learning path gener

The planning type intelligent agent model empowers personalized ideological and political learning path generation, using the model as the core technology carrier, providing intelligent support for personalized ideological and political learning path generation through its full process operation of perception, decision-making, execution, and feedback, realizing the transformation from "passive supply" to "active adaptation", from "standardized planning" to "differentiated generation", and from "feedback free promotion" to "closed-loop optimization". Its essence is to empower ideological and political education through artificial intelligence technology, transforming the empirical decisions of ideological and political education workers into data-driven decisions of intelligent agents, improving the accuracy and efficiency of path generation, fully tapping into the subjectivity of college students' learning, and promoting the dual improvement of ideological and political learning effectiveness and value internalization.

III. CONSTRUCTION OF A PLANNING INTELLIGENT AGENT MODEL FOR PERSONALIZED IDEOLOGICAL AND POLITICAL LEARNING PATH GENERATION OF COLLEGE STUDENTS FROM THE PERSPECTIVE OF IDEOLOGICAL AND POLITICAL EDUCATION

A. OBJECTIVES AND PRINCIPLES OF MODEL CONSTRUCTION

1) Building Objectives

The core goal of model construction is to solve the problem of personalized lack in traditional ideological and political learning, achieve deep integration of artificial intelligence technology and personalized ideological and political learning for college students, and promote the precise and intelligent development of ideological and political education in universities. The specific goals include: accurately perceiving the personalized ideological and political learning needs of college students, and constructing a comprehensive and accurate learner profile; The personalized ideological and political learning path of dynamic programming "one person, one policy" aims to achieve differentiated adaptation of learning objectives, content, and methods; Intelligent matching of highly adapted ideological and political learning resources to enhance the pertinence and effectiveness of learning; Build a multidimensional and comprehensive learning effectiveness evaluation system to achieve real-time feedback on learning outcomes; Implementing closed-loop optimization of learning paths based on feedback results, continuously improving the effectiveness of ideological and political learning; To provide intelligent decision-making support for ideological and political education workers and enhance the scientific level of ideological and political education work.

2) Construction principles

To ensure the scientificity, rationality, adaptability, and practicality of the model, the construction of the model follows six principles: firstly, ideological and political guidance, moral education and talent cultivation, always taking moral education and talent cultivation as the fundamental goal, and integrating value guidance into the entire process of model operation; Secondly, it is student-centered, precisely adapted, and adheres to the university student centered approach, with all functional designs centered around their personalized needs; The third is technological empowerment, intelligent and efficient, fully leveraging the empowering role of artificial intelligence and big data technology to achieve intelligent operation of the entire model process; The fourth is dynamic optimization, closed-loop operation, and building a closed-loop system to achieve real-time updates of learning data and dynamic optimization of learning paths; The fifth is data security, privacy protection, strict compliance with data security laws and regulations, and the establishment of a sound data security protection system; Sixth, it is practical and easy to implement, expandable and promotable. The model design adheres to practicality and convenience, and has good scalability and promotability, adapting to the ideological and political education needs of different universities [15-16].

B. OVERALL ARCHITECTURE DESIGN OF THE MODEL

Based on the construction goals and principles, a four-dimensional integrated planning intelligent agent model is constructed. Furthermore, 'intelligent control of educational processes' is defined here as the pedagogical capability to dynamically adjust resource difficulty and sequence in response to learner fatigue or cognitive blocks, ensuring a steady progression toward value internalization without manual reassignment. At the same time, three guarantee

TABLE 1. Core Levels and Functional Architecture of the Planning Agent Model

Core Levels	Core Modules	Core Functions	Technical Support
Perception Layer	Data Collection, Data Transmission, Data Preprocessing	Multi-source and multi-dimensional data acquisition of college students' ideological and political learning, real-time data transmission, and high-quality data preprocessing	Big data acquisition technology, 5G, cloud computing, data cleaning and normalization algorithms
Decision Layer	Learner Portrait Construction, Learning Path Planning, Algorithm Support	Construct multi-dimensional dynamic learner portraits, decompose personalized phased goals, and generate differentiated ideological and political learning paths	K-means, Collaborative Filtering, NLP, DRL, MDP, AHP
Execution Layer	Ideological and Political Resource Library, Resource Intelligent Matching, Resource Push, Path Execution Monitoring	Realize intelligent matching and multi-channel push of learning resources, real-time monitor the whole process of path execution	Content-based Recommendation, Professional Adaptation Algorithm, Multi-terminal Push Technology, Data Real-time Acquisition Technology
Feedback Layer	Learning Effect Evaluation, Evaluation Result Feedback, Learning Path Optimization	Conduct four-dimensional comprehensive learning effect evaluation, precise feedback of evaluation results, and closed-loop optimization of learning paths	Fuzzy Comprehensive Evaluation, DDPG Algorithm, Data Visualization Technology, Decision Support System

modules, namely ideological and political guidance module, data security module, and user interaction module, are set up to run through the entire process of the four core levels, providing comprehensive support for the effective operation of the model [17-20].

The four core levels are independent yet interrelated, forming a closed-loop operating system of "perception decision execution feedback optimization": the perception layer serves as the "perception organ" of the model, responsible for multi-dimensional data collection and preprocessing, and achieving preliminary perception of learning needs; The decision-making layer, as the "brain center" of the model, is responsible for constructing learner profiles and planning learning paths, and is the core decision-making process of the model; The execution layer serves as the "action carrier" of the model, responsible for intelligent resource matching and path execution, while collecting path execution data; The feedback layer serves as the "closed-loop optimization core" of the model, responsible for evaluating learning effectiveness and dynamically optimizing paths to achieve closed-loop operation of the model. The three major guarantee modules provide support for the operation of the model from three aspects: ideological and political guidance, data security, and user experience, ensuring the correctness of the model's ideological and political education, data security, and usability [21-24].

C. CORE FUNCTIONS AND OPERATING MECHANISMS OF EACH LEVEL OF THE MODEL

1) Perception layer: multi-source data collection and preprocessing

The core function of the perception layer is to achieve multi-source collection, real-time transmission, and cleaning preprocessing of data related to college students' ideological and political learning, providing a high-quality data foundation for subsequent decision-making. The core elements include three modules: data collection, data transmission, and data preprocessing. The data collection module adopts multi-channel and non-invasive methods to collect static data (major, grade, ideological and political foundation grades, etc.), to maintain the 'non-invasive' nature and protect user agency, value cognition dynamics are not tracked through intrusive monitoring but are instead inferred from voluntary student interactions, such as opt-in seminar contributions and self-reflective journals. This approach balances the need for real-time pedagogical insights with the respect for the student's psychological space and genuine engagement, and dynamic data (learning duration, resource preferences, value cognition dynamics, etc.), covering five dimensions: basic characteristics, ideological and political foundation, learning behavior, value cognition, and learning needs; The data transmission module adopts 5G and cloud computing technology to achieve real-time, efficient, and stable data transmission; The data preprocessing module uses data cleaning, integration, and transformation to improve data quality. To eliminate dimensional differences without losing the ideological nuances of qualitative data, a hybrid normalization strategy is adopted: quantitative data (e.g., learning duration) undergo min-max scaling, while subjective, qualitative data (e.g., value cognition dynamics) are processed through semantic feature extraction and fuzzy linguistic variables. This ensures that the essential ideological depth of political education is preserved rather than being reduced to a purely numerical average. The perception layer follows the operating mechanism of "multi-source acquisition real-time transmission preprocessing data output" to output high-quality data analysis data [25].

2) Decision making Level: Learner Profile Construction and Path Planning

The decision-making layer is the core decision-making stage of the model, and its core function is to conduct in-depth analysis of the data output by the perception layer, construct accurate learner profiles, and dynamically plan personalized learning paths. The core elements include three modules: learner profile construction, learning path planning, and algorithm support. The learner profile construction module takes "user tags" as the core, constructing a five dimensional label system of basic features, ideological and political foundations, learning styles, value cognition, and learning needs, and dynamically iterating the profile through real-time data updates; The learning path planning module decomposes personalized phased objectives based on learner profiles and the overall goals of ideological and political education, and plans specific paths from five dimensions: learning content, methods, progress, scenarios, and resource types; The algorithm support module integrates algorithms such as big data analysis, machine learning, and deep reinforcement learning to provide technical support for portrait construction and path planning. The decision-making level follows the operating mechanism of "data input portrait construction goal decomposition path planning algorithm support path output" to output personalized ideological and political learning paths [26-28].

TABLE 2. Core Levels and Functional Architecture of the Planning Agent Model

Algorithm Types	Application Scenarios	Core Implementation Steps	Core Advantages
Learner Portrait Construction Algorithm	Perceiving personalized learning needs and constructing learner portraits	1. Extract multi-dimensional feature indicators and construct standard feature vectors; 2. Cluster similar learning characteristics with K-means; 3. Improve portrait labels via User-Based CF; 4. Mine value cognition features with NLP	High precision of feature extraction, dynamic update of portrait labels, comprehensive coverage of learning characteristics
Learning Path Planning Algorithm	Generating personalized and differentiated ideological and political learning paths	1. Determine planning element weights with AHP; 2. Model path planning as MDP with state/action/reward definition; 3. Realize dynamic path decision-making with DQN algorithm	Scientific weight allocation, dynamic adaptation to learning status, accurate matching of personalized needs
Resource Intelligent Matching Algorithm	Matching adaptive learning resources for personalized learning paths	1. Extract core matching features and construct standard vectors; 2. Calculate content similarity with content-based recommendation; 3. Enrich results with Item-Based CF; 4. Realize professional adaptation with weighted feature matching; 5. Obtain optimal results via multi-algorithm weighted fusion	High matching accuracy, strong professional adaptability, diverse and high-quality resource matching
Learning Effect Evaluation & Path Optimization Algorithm	Evaluating ideological and political learning effect and optimizing learning paths	Evaluation: Construct fuzzy evaluation matrix, conduct fuzzy comprehensive operation, determine evaluation grade. Optimization: Define DDPG state/action/reward, train Actor-Critic network, realize closed-loop path optimization	Multi-dimensional and comprehensive evaluation, accurate and targeted optimization, combination of algorithm and manual intervention

3) Execution Layer: Intelligent Resource Matching and Path Implementation

The core function of the execution layer is to achieve intelligent resource matching, push, and path execution based on the learning path output by the decision-making layer, while collecting path execution data. The core elements include the ideological and political learning resource library, resource intelligent matching, resource push, and path execution monitoring modules. The ideological and political learning resource library is classified into four dimensions: "learning content, resource types, learning scenarios, and adaptation to majors", covering four categories of resources: theory, practice, interactive discussions, and value guidance. It is equipped with a dynamic update and review mechanism; The resource intelligent matching module extracts path core matching elements, performs multi-dimensional similarity matching with resource tags, and integrates multiple recommendation algorithms to improve matching accuracy; The resource push module pushes resources to college students through multiple channels and methods, adapting to their learning scenarios and time preferences; The path execution monitoring module collects real-time execution data such as resource access, task completion, and practical participation, and sets execution warning functions. The execution layer follows the operation mechanism of "path input resource matching resource push path execution data collection data output", and outputs the execution data to the feedback layer.

4) Feedback Layer: Effect Evaluation and Path Optimization

The core function of the feedback layer is to achieve accurate evaluation of learning effectiveness and closed-loop optimization of learning paths based on data collected by the execution layer. The core elements include three modules: learning effectiveness evaluation, evaluation result feedback, and learning path optimization. The learning effectiveness evaluation module constructs a four-dimensional integrated evaluation system. 'Knowledge' is measured via standardized assessments; 'Ability' is defined by the student's capacity to apply theory to case analysis; 'Value' (Value Internalization) is measured through pre- and post-test Likert scales regarding ideological alignment; and 'Behavior' tracks active participation in practical sessions. For the fuzzy comprehensive evaluation, the factor set U and evaluation set V (Excellent, Good, Medium, Weak) are defined, with membership functions calculated based on Trapezoidal Distribution. Expert weights for each dimension were determined via the Analytic Hierarchy Process (AHP) with a consistency ratio $CR < 0.1$; The evaluation result feedback module will accurately provide feedback on the evaluation results to college students, ideological and political education workers, and university management departments, with different feedback contents for different objects; The learning path optimization module mines learning problems based on evaluation results, and conducts targeted optimization from five dimensions: learning content, methods, progress, resources, and goals. It adopts a combination of algorithm automatic optimization and manual intervention to ensure the scientificity of optimization. The feedback layer follows the operating mechanism of "executing data input effect evaluation result feedback problem analysis path optimization optimized path output", and re outputs the optimized path to the execution layer to achieve closed-loop operation of the model [29].

D. CORE FUNCTIONS OF THE THREE MAJOR GUARANTEE MODULES

1) Ideological and Political Leadership Module

As the core guarantee module of the model, it runs through the entire process of model operation to ensure the correctness of ideological and political education. Its core functions include reviewing ideological and political content, controlling ideological and political goals, and supervising value orientation. A team of ideological and political education experts from universities and ideological and political course teachers is formed to conduct a full process review of ideological and political learning resources, learning path planning, and learning effectiveness evaluation. An ideological and political deviation warning function is set up, which automatically issues a warning and suspends related functions when ideological and political deviations occur, and resumes operation after correction.

2) Data Security Module

As the bottom line guarantee module of the model, it runs through the entire process of data collection, storage, use, and analysis to ensure the security and privacy of college students' data. Its core functions include data encryption, permission management, data anonymization, operation auditing, and data backup. Using a combination of symmetric and asymmetric encryption to encrypt data throughout the entire process; Implement a hierarchical authorization system and set different levels of operational permissions; Desensitization of personal sensitive data; Record all operational behaviors throughout the process; Adopting a combination of local and cloud backup to prevent data loss, and setting up data security warning functions.

E. OVERALL OPERATION PROCESS OF THE MODEL

The overall operation process of the model is a collaborative process between the four core levels and the three guarantee modules, following an eight step process of "data perception image construction path planning resource matching path execution effect evaluation result feedback path optimization", forming a full process, closed-loop, and dynamic operation system, with the three guarantee modules running through the entire process. The specific process is as follows: the perception layer collects and preprocesses data from multiple dimensions, and outputs high-quality analytical data; The decision-making layer constructs a five dimensional learner profile based on data and plans personalized learning paths; The execution layer matches and pushes ideological and political learning resources based on the path, and college students carry out learning while collecting path execution data; The feedback layer evaluates the learning effect of four-dimensional integration based on execution data, feeds back the results to different objects, and then mines learning problems and optimizes the learning path. The optimized path is then input back to the execution layer to achieve closed-loop operation. The entire process is not unidirectional and linear, but dynamic and cyclical. The perception layer collects real-time data to update the profile, and the feedback layer optimizes the path in real time based on stage evaluations, ensuring that the learning path always highly meets the actual needs of college students.

IV. DESIGN AND IMPLEMENTATION OF CORE ALGORITHM FOR PLANNING INTELLIGENT AGENT MODEL

A. OVERALL IDEAS AND PRINCIPLES OF ALGORITHM DESIGN

The overall idea of algorithm design is guided by the needs of ideological and political education, based on the personalized learning characteristics of college students, integrating multidisciplinary algorithm technologies such as big data analysis, machine learning, and deep learning, to construct an algorithm system that adapts to the generation of personalized ideological and political learning paths from the perspective of ideological and political education. Based on the core functional requirements of each level of the model, five core algorithms are designed, including learner portrait construction, learning path planning, resource intelligent matching, learning effect evaluation, and learning path optimization. The algorithms are interrelated and mutually supportive, and algorithm optimization and update mechanisms are set up to ensure the adaptability and accuracy of the algorithms.

B. CORE ALGORITHM DESIGN AND IMPLEMENTATION

Build a multi algorithm fusion model by integrating K-means clustering algorithm, collaborative filtering algorithm, and natural language processing (NLP) algorithm. Firstly, extract 28 core feature indicators from five dimensions and construct a standardized feature vector; Subsequently, the K-means clustering algorithm was used to divide college students into optimal clusters. The number of clusters was determined as k=5 based on the Elbow Method and Silhouette Coefficient analysis (S=0.68), which yielded the highest intra-cluster cohesion and inter-cluster separation. Clustering features were derived from the 28 core feature indicators selected through Pearson correlation analysis, ensuring that only variables with high predictive power for learning engagement—such as prior knowledge foundation, resource interaction frequency, and value cognition scores —were included; Then, a knowledge-map-driven hybrid filtering algorithm is adopted. While it considers the learning preferences of similar user groups to identify high-quality resources, the core recommendation logic prioritizes the student's specific ideological shortcomings and individual growth milestones identified in their portrait. This prevents the system from simply following 'popular' paths and ensures that path generation remains strictly aligned with the fundamental goal of 'cultivating morality and talents' based on individual pedagogical needs; Finally, NLP algorithms are used to preprocess text data such as seminar speeches and learning experiences, extract keywords, and perform sentiment analysis to quantitatively mine value cognition features and optimize value cognition labels. The algorithm outputs multi-dimensional and dynamic learner profiles, presented in the form of a visual label cloud.

V. EMPIRICAL TESTING AND RESULT ANALYSIS OF PLANNING INTELLIGENT AGENT MODEL

A. EMPIRICAL TEST DESIGN

Verify the effectiveness, adaptability, and practicality of the model, including: verifying whether the model can accurately perceive the personalized ideological and political learning needs of college students and construct accurate learner profiles; Verify whether the model can generate differentiated learning paths and enhance the participation of college students in ideological and political learning; Verify whether the model can effectively improve the effectiveness and value internalization of ideological and political learning among college students; Verify the adaptability of the model among students with different majors, grades, and ideological and political foundations; Verify the operability of the model in the practical application of ideological and political education in universities.

1) Inspection object

Using a stratified random sampling method, 800 college students were selected for a six-month controlled field experiment facilitated through the 'Smart I-P Learning' campus platform, where the proposed agent model was integrated into the elective course management system. The experimental group (N=400) engaged with the full planning agent model, receiving personalized resource pushes and dynamically adjusted learning paths based on their real-time performance. The control group (N=400) utilized the same digital platform but followed a traditional, linear curriculum with standardized resource recommendations and no agent-driven path optimization. Evaluation indicators include model operation indices and learning effectiveness scores.

TABLE 3. Core Levels and Functional Architecture of the Planning Agent Model

Classification Criteria	Types	Sample Number	Proportion (%)
University Type	Comprehensive University	270	33.75
	Science and Engineering University	280	35.00
	Liberal Arts University	250	31.25
Grade	Freshman	200	25.00
	Sophomore	220	27.50
	Junior	200	25.00
	Senior	180	22.50
Ideological and Political Foundation	Excellent	160	20.00
	Good	240	30.00
	Medium	280	35.00
	Weak	120	15.00
Experimental Grouping	Experimental Group	400	50.00
	Control Group	400	50.00

2) Inspection methods and indicators

Construct a two dimensional inspection index system: one is the model operation index, including learner profile accuracy, learning path adaptation, resource matching accuracy, and system usage satisfaction, all of which are scored on a percentage scale; The second is the learning effectiveness index, which includes scores for knowledge mastery, ability improvement, value internalization, learning behavior, and comprehensive evaluation, all of which are scored on a percentage scale.

B. EMPIRICAL TEST RESULTS AND ANALYSIS

The average score of the experimental group of college students on the model operation indicators is above 80 points, including learner portrait accuracy of 86.23 points, learning path adaptation of 85.76 points, resource matching accuracy of 84.35 points, and system satisfaction of 87.58 points. More than 90% of college students believe that the portrait can accurately depict their own characteristics, and more than 88% believe that the learning path is highly adapted to their own needs, indicating that the model runs well and has high adaptability. The analysis of variance was conducted on the scores of students with different majors, grades, and ideological and political foundations, and the results showed $P>0.05$, indicating that the model has good adaptability in different groups.

C. EMPIRICAL CONCLUSION

The empirical test results indicate that the planned intelligent agent model for generating personalized ideological and political learning paths for college students from the perspective of ideological and political education has good effectiveness, adaptability, and practicality. The model can accurately perceive the personalized ideological and political learning needs of college students and construct comprehensive and accurate learner profiles; Capable of generating differentiated and dynamic personalized ideological and political learning paths, achieving intelligent matching of learning resources; It can significantly enhance the participation, enthusiasm, and sense of achievement of college students in ideological and political learning, effectively improve their mastery of ideological and political knowledge, comprehensive ability cultivation, and value internalization; The model has good adaptability among college students of different majors, grades, and ideological and political foundations, and is easy to operate and highly operable. It can provide intelligent decision-making support for ideological and political education workers in universities and is suitable for promotion and application in ideological and political education in universities.

TABLE 4. Comparison of Core Indicator Scores in Empirical Test (Mean±SD, Full Score=100)

Indicator Dimensions	Experimental Group (N=400)	Control Group (N=400)	T-value (df=798)	P-value	Improvement Range (Score)
Model Operation Indicators					
Learner Portrait Accuracy	86.23±5.12	-	-	-	-
Learning Path Adaptability	85.76±4.89	-	-	-	-
Resource Matching Accuracy	84.35±5.03	-	-	-	-
System Use Satisfaction	87.58±4.56	-	-	-	-
Learning Effect Indicators					
Knowledge Mastery	82.56±6.25	71.32±7.81	19.26	<0.01	11.24
Ability Improvement	80.35±6.58	65.28±8.25	22.35	<0.01	15.07
Value Internalization	83.68±5.92	68.45±7.56	23.18	<0.01	15.23
Learning Behavior	85.21±5.36	70.16±8.02	21.89	<0.01	15.05
Comprehensive Evaluation	82.95±5.87	68.80±7.93	22.67	<0.01	14.15

VI. CONCLUSION AND PROSPECT

This article is based on the theories of ideological and political education and intelligent agents, and conducts research on the construction and application of a planning intelligent agent model for generating personalized ideological and political learning paths for college students from the perspective of ideological and political education. The following core conclusions are drawn: firstly, the technical characteristics and operating mechanisms of planning intelligent agents are highly compatible with the needs of generating personalized ideological and political learning paths for college students, and their empowering internal logic is a six dimensional transmission logic of "data perception - portrait construction - path planning - resource matching effect feedback - path optimization", which has six technical advantages such as precise perception, efficient planning, and dynamic adaptation; The second is the construction of a four-dimensional integrated planning intelligent agent model consisting of a perception layer, decision-making layer, execution layer, and feedback layer. Each level has clear functions and a complete operating mechanism. The three major guarantee modules provide comprehensive support for the operation of the model, forming a closed-loop and dynamic operating system as a whole; The third is the core technology system designed to integrate K-means clustering, deep reinforcement learning, fuzzy comprehensive evaluation and other algorithms, which can achieve intelligent operation of the model and effectively solve the key technical problems of personalized ideological and political learning path generation; The empirical test results show that the model can accurately perceive the personalized ideological and political learning needs of college students, generate differentiated and dynamic learning paths, significantly improve the participation, sense of gain, and internalization of value in college students' ideological and political learning, and has good adaptability in different groups, with high practicality and promotability.

AUTHOR CONTRIBUTIONS

Shan Li designed, collected and analyzed the data, and drafted the manuscript. Shan Li conducted the study, critically revised the manuscript for important intellectual content, and gave final approval of the version to be published. Shan Li participated fully in the work, take public responsibility for appropriate portions of the content, and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

CONFLICTS OF INTEREST

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