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Design of an Artificial Intelligence-Driven Student Management Platform: The "Digital Portrait File" System

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Abstract: With the in-depth advancement of the national education digitalization strategy, traditional university student management models face severe challenges in data integration, precise evaluation, and personalized support. Based on the specific needs of modern industrial colleges, this paper designs and implements an artificial intelligence (AI)-powered student management platform named the "Digital Portrait File" system. Adopting core technologies such as multi-source data fusion, dynamic competency portrait modeling, and intelligent analysis, the platform constructs a comprehensive management system encompassing functions like basic student information management, competency portrait analysis, achievement system, and learning resource recommendation. Pilot applications show that the platform effectively addresses the data silo issue, realizes panoramic perception, intelligent analysis, and personalized support throughout students' growth processes, and provides a replicable, practical path for the digital transformation of university student management.

Keywords: Artificial intelligence; Students; Management platform; Files

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1. Introduction

Against the backdrop of the high-quality development of higher education, the refinement and scientificity of student management directly affect the quality of talent cultivation. Traditional student management models suffer from prominent problems such as fragmented data, single-dimensional evaluation, and a lack of personalized support. The *Plan for Building a Leading Education Nation (2024–2035)* clearly proposes to "implement the national education digitalization strategy" and "promote artificial intelligence to assist educational reform," emphasizing that education digitalization is a crucial breakthrough for exploring new tracks and shaping new advantages in educational development. Studies have shown that artificial intelligence (AI) technologies can significantly improve the efficiency of educational management and reduce the workload

of administrative staff through intelligent chatbots, data analysis tools, and automated management systems [1].

This paper designs and implements a "Digital Portrait File" student management platform centered on "dynamic competency portraits." By leveraging AI technologies, the platform achieves comprehensive and multidimensional tracking and evaluation of students' growth processes, promotes the transformation of student management from experience-driven to data-driven, and provides systematic support for personalized education.

2. Literature review

The application of AI technologies in educational management is shifting from auxiliary tools to core support systems. In particular, advancements in machine learning, data mining, and large language models have provided a strong impetus for the intelligent upgrading of student management. Intelligent auxiliary decision-making systems can offer a scientific basis for student management through demand analysis, technical architecture design, and model optimization [2]. In the field of university student management, AI technologies have been widely applied in multiple scenarios. Intelligent systems can process and analyze student information in real time, ensuring data accuracy and reducing human errors [3]. AI-based personalized innovation education platforms for university students include core functions such as student portrait construction, personalized learning path recommendation, intelligent tutoring and feedback, and innovation practice support, which effectively improve students' learning efficiency, innovative capabilities, and comprehensive quality [4].

As an important application form of educational data mining and learning analytics, student digital portraits have received extensive attention in recent years [5]. Through the collection and analysis of multi-dimensional student data, student digital portraits construct comprehensive digital representations of students, providing a basis for precise intervention and support. The functional architecture of intelligent education platforms typically includes a data acquisition layer, an analysis and processing layer, and an application service layer. Through the collaborative operation of core modules, they realize personalized learning, intelligent teaching assistance, and collaborative educational governance.

Despite certain progress in student management system research, there are still multiple limitations [6]. First, technological fragmentation: data standards vary among systems, resulting in low integration and difficulty in forming a unified view of student development. Second, functional modularization: most platforms have single functions and lack coverage of the entire process of student development. Third, poor user experience: complex operations and unfriendly interfaces affect user acceptance. Fourth, inadequate data security and privacy protection mechanisms, with risks of data leakage [7].

3. Design of the "Digital Portrait File" platform

The design of this platform follows the core concepts of "student-centeredness," "data-driven decision-making," and "full-process closed-loop management" (analysis-learning-feedback-improvement), aiming to achieve a fundamental transformation from experience-based management to data-driven management. The platform design adheres to the following principles: integration, dynamism, personalization, security, and scalability.

The platform adopts a layered architecture design to ensure high cohesion, low coupling, and scalability of the system [8]:

Data layer: Responsible for the collection, cleaning, storage, and fusion of multi-source heterogeneous data (including educational administration data, research data, behavioral data, etc.). By building a unified

data middle platform and standardized interfaces, it solves the problem of data silos and provides reliable data support for upper-layer applications.

Business layer: Carries the core business logic of the platform, including competency portrait models, AI analysis engines, recommendation algorithms, etc. It uses LSTM neural networks to construct temporal models of student behavior, enabling analysis of student growth trajectories and risk prediction.

Application layer: Provides interfaces and services for various specific functional modules, supporting collaboration and data exchange between modules.

Presentation layer: Offers visual interfaces and interactions for different users (students, teachers, administrators). It adopts a responsive design to adapt to PC terminals, tablets, and mobile devices.

3.1. Core functional modules

Student Basic Information Management Module: Integrates students' basic files, academic registration information, etc., to provide fundamental data support for digital portraits.

Dynamic Competency Portrait Module: As the core of the platform, it constructs a dynamic competency radar chart covering six dimensions—"professional ability," "learning ability," "innovative ability," "practical ability," "organizational ability," and "execution ability"—based on data such as students' course grades, practical projects, and innovative competency assessments. Machine learning algorithms are used to analyze historical data and predict students' future competency development trends. Shortcomings and strengths are visualized via ECharts, with clickable access to detailed analysis reports.

Achievement System Module: Adopting gamification design concepts, it sets up virtual badges (e.g., "Research New Star," "Creative Talent") and a point reward mechanism. Students earn achievements by completing specific tasks (such as intensive literature reading, innovation proposals), with real-time updates to the achievement rankings. Students can share their accomplishments with the college community to enhance learning motivation and participation.

Personalized Learning Resource Recommendation Module: Based on student competency portraits, AI algorithms such as collaborative filtering and content-based recommendation are used to intelligently push matched learning materials from integrated internal and external resource libraries. Studies have shown that such personalized recommendation mechanisms can significantly improve students' learning efficiency and innovative capabilities [9].

Data Analysis and Decision Support Module: Provides managers with visual reports and data insights, supporting in-depth management needs such as efficient retrieval, early warning, precise positioning, and targeted notifications.

Home-School Communication and Feedback Module: Establishes channels for home-school communication and collects user experience and improvement suggestions through the platform's built-in feedback channel, forming a closed-loop optimization mechanism.

3.2. Key technology implementation

3.2.1. Multimodal data fusion technology

The platform integrates structured and unstructured data scattered across educational administration, student affairs, and research systems by building a unified data center and standardized interfaces. AI-driven data governance tools are adopted: NLP algorithms clean unstructured texts, while knowledge graphs complement missing knowledge points, achieving deep fusion and sharing of multi-source heterogeneous data. This provides

a comprehensive and accurate data foundation for generating panoramic student portraits [10].

3.2.2. Dynamic modeling of student portraits and competency prediction algorithms

A temporal model of student behavior is constructed based on LSTM neural networks to analyze growth trajectories and provide risk predictions. Through machine learning on historical data, the platform identifies patterns in students' competency development, predicts future trends, and offers a scientific basis for personalized interventions. Analysis results are intuitively presented via radar charts or ECharts visualizations for easy user understanding and application [11].

3.2.3. AI-assisted analysis and recommendation mechanisms

Integrating large AI models, the platform realizes intelligent data analysis and personalized resource recommendation. Technologies such as Retrieval-Augmented Generation (RAG) are used for data analysis, linking existing resources from the university and domestic public databases to provide feasible growth suggestions and predictive analysis. Recommendation algorithms comprehensively consider students' competency characteristics, historical behavioral preferences, and similar student cases to achieve precise resource and service delivery.

3.2.4. Data security and privacy protection mechanisms

During the aggregation and analysis of student data, the platform designs and implements strict data permission management and privacy protection mechanisms to ensure compliance with laws and regulations [12]. Multiple security measures—including data desensitization, access control, and encrypted transmission—balance data empowerment with safe and controllable usage. Studies have shown that students have great concerns about data privacy protection when using intelligent systems, and the platform must ensure its design aligns with their needs and values [13].

4. Platform implementation process and methods

The platform implementation adopts an action research approach, constructing a closed loop of "design-implementation-feedback-iteration": Platform deployment and initialization: The platform is deployed on the university's local servers, with data docking to existing systems and system initialization. Leveraging the university's independent servers ensures data security and system performance. Pilot operation and data collection: A pilot operation is conducted in the Modern Industrial College. User experience and improvement suggestions from students, teachers, and administrators are collected through the platform's built-in feedback channel and questionnaires. Continuous optimization: The platform's functions and user experience are iteratively improved based on feedback. Special optimization is focused on the comprehensiveness, timeliness, and accuracy of data collection, along with key improvements in platform operability and user experience [14,15].

5. Discussion and prospects

Compared with traditional student management platforms, this platform features the following innovations and characteristics: deep integration of AI and educational management; a multidimensional, dynamic evaluation system; and personalized training support tailored to individual needs.

Future research directions include: (1) Promoting the platform to the entire university and even national

colleges and universities to verify its applicability in different scenarios; (2) Exploring the platform's extended applications in fields such as teacher development evaluation and discipline construction monitoring; (3) Integrating more advanced AI models (e.g., Agent technology) to enhance the platform's autonomy and intelligence [2]; (4) Exploring blockchain-based academic certification and learning outcome management to further improve the platform's security and credibility.

6. Conclusion

This study designs and implements an AI-driven "Digital Portrait File" student management platform. Through core technologies such as multi-source data fusion, dynamic competency portrait modeling, and intelligent analysis, it constructs an integrated student management platform incorporating functions like multimodal data collection, dynamic competency portrait generation, AI analysis, and resource recommendation. In the pilot application at the Modern Industrial College, the platform demonstrates favorable effects, significantly improving student management efficiency and student participation, and realizing the transformation of student evaluation from result-oriented to process-oriented and developmental evaluation. The key experiences gained during platform development and implementation provide a replicable model and reference paradigm for other universities undertaking similar smart campus construction projects.

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Disclosure statement

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