

AI-Enabled Construction of Personalized Learning Paths and Collaborative Cultivation of Students' Digital Literacy in Basic Education

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ABSTRACT This study focuses on the collaborative cultivation of personalized learning paths and students' digital literacy in basic education empowered by artificial intelligence. Based on constructivism, multiple intelligences theory, and lifelong education theory, it constructs a personalized learning path mechanism centered on "data collection-portrait generation-intelligent matching-dynamic optimization." The study analyzes the mutually reinforcing relationship between personalized learning and digital literacy, as well as their integration paths in key links including resource selection, process interaction, achievement creation, and evaluation reflection. On this basis, practical strategies are proposed, including optimizing AI education platforms, designing integrated learning tasks, building dynamic student portraits, and improving evaluation feedback mechanisms. Case verification shows that AI technology can accurately construct personalized learning paths and form a synergistic effect with digital literacy cultivation. The research provides a theoretical framework and practical guidance for the digital transformation of basic education, helping students achieve personalized development while strengthening essential capabilities in digital information acquisition, communication, content creation, and ethical use.

INDEX TERMS AI-enabled education, personalized learning paths, digital literacy, basic education, intelligent matching

I. INTRODUCTION

A. RESEARCH BACKGROUND

1) Trend of Deep Integration of AI Technology and Basic Education

AGAINST the backdrop of the rapid development of artificial intelligence technology, the teaching models of basic education are undergoing profound changes to cultivate the innovative interdisciplinary talents required by the modern industry's digital evolution. This shift ensures that foundational learning aligns with the technical sophistication of intelligent manufacturing, fostering students' ability to navigate a future defined by high-tech industrial integration. Studies on the deep integration of AI and education in basic education have shown that innovative applications such as the integration of AI with personalized learning, online learning, courses, and teachers' professional development have played an important role in promoting educational reform [1].

2) Personalized Learning as a Core Demand for Improving Basic Education Quality

Personalized learning is student-centered, where teachers formulate corresponding learning goals, content, methods, and paths based on students' individual differences in learning needs, preferences, and interests, and design exclusive learning plans according to their academic foundations and interests [2]. Currently, meeting students' diverse learning needs and promoting their all-round and personalized development have become the core goals of basic education [3].

3) Practical Requirement of Incorporating Digital Literacy Cultivation into Core Competency System of Basic Education
The arrival of the digital society has put forward rigid requirements for citizens' digital literacy. The "Action Plan for Improving National Digital Literacy and Skills" defines digital literacy and skills as a core set of capabilities necessary for citizens in the digital society [4]. As the cornerstone of talent training, basic education plays a fundamental, key, and guiding role in the development of China's education cause. It is necessary to incorporate digital literacy cultivation into

its core competency system to lay a foundation for students' lifelong learning and development [5].

B. RESEARCH SIGNIFICANCE

1) Theoretical Significance

(1) This research enriches the interdisciplinary study of AI education applications and core competency cultivation by aligning pedagogical innovation with the specialized technical demands of the digital industry. It ensures that student development remains deeply integrated with the evolving professional standards of intelligent design and manufacturing; (2) Construct relevant theoretical frameworks, clarify the internal logic of collaborative cultivation, and fill the research gap in the integration mechanism between the two; (3) Provide a new perspective for interdisciplinary research in educational technology and pedagogy.

2) Practical Significance

(1) Propose specific strategies for collaborative cultivation combined with basic education scenarios; (2) Provide practical plans for primary and secondary school teachers to carry out personalized teaching and literacy cultivation; (3) Offer references for educational administrative departments in policy formulation and resource optimization, and assist in the effective digital transformation of basic education.

C. REVIEW OF DOMESTIC AND FOREIGN RESEARCH STATUS

1) Research Progress of AI-Enabled Personalized Learning Abroad

Foreign research on AI-enabled personalized learning started early. Countries such as the United States and the Netherlands have widely applied AI technology in basic education, developed a number of personalized learning platforms, and realized precise push of learning content and dynamic adjustment of learning paths through algorithms [6,7]. The European Union issued the "Digital Competence Framework for Citizens" (DigComp), which provides a reference framework for the integration of personalized learning and digital literacy cultivation, and its four-level and eight-stage literacy classification system offers a basis for precise cultivation [8,9].

2) Review of Domestic Research on Personalized Learning Path Construction

Domestic academic circles have conducted extensive research on personalized learning path construction, focusing on the application of learning analysis technology and the construction of student portraits [10,11]. Some primary and secondary schools have also carried out practical explorations. For example, Huijing Experimental School in Tianhe District, Guangzhou, has initially integrated personalized learning and literacy cultivation through a dual-main lines curriculum system of "reading + technology" [12]. However, existing research mostly focuses on the

application of a single subject or a single technology, lacking systematic and holistic research on path construction.

3) Research Status and Deficiencies of Students' Digital Literacy Cultivation

Domestic research on students' digital literacy cultivation mostly concentrates on framework construction and curriculum design [13-15], but there are still obvious deficiencies: (1) The cultivation model is relatively single, mostly relying on information technology courses, lacking integration with other subjects; (2) The evaluation system is imperfect, lacking scientific evaluation tools and methods; (3) The core role of technology empowerment in digital literacy cultivation is ignored.

4) Interdisciplinary Integration Gaps in Existing Research and Research Entry Point

Overall, existing research has obvious interdisciplinary integration gaps: On the one hand, research on personalized learning path construction mostly ignores the goal orientation of digital literacy cultivation; On the other hand, research on digital literacy cultivation lacks in-depth combination with personalized learning and fails to give full play to the synergistic effect of technology empowerment. Based on this, this study takes AI empowerment as the core, explores the mechanism and strategies of the collaborative cultivation of personalized learning path construction and digital literacy, and fills the existing research gaps.

D. RESEARCH CONTENT

(1) Define core concepts such as AI-enabled and personalized learning paths, and sort out relevant theoretical foundations; (2) Analyze the core elements and mechanisms of AI-enabled personalized learning path construction in basic education; (3) Explore the internal logic and integration points of collaborative cultivation between personalized learning and digital literacy; (4) Propose practical strategies for collaborative cultivation and verify their effectiveness through cases.

II. DEFINITION OF CORE CONCEPTS AND THEORETICAL FOUNDATIONS

A. DEFINITION OF CORE CONCEPTS

1) AI-Enabled

The essence of "AI-enabled" is an advanced form of technology empowerment that differs fundamentally from traditional educational software through three distinct technical and pedagogical characteristics: (1) Technical boundary: Driven by machine learning algorithms (e.g., collaborative filtering, deep neural networks) that enable autonomous pattern recognition and adaptive optimization, rather than relying on pre-set fixed logical rules; (2) Pedagogical boundary: Realizes dynamic matching of teaching strategies based on real-time learning data, rather than providing uniform content push; (3) Functional boundary: Integrates multi-

source data for holistic student analysis, rather than single-dimensional task management. [16]. In the context of basic education, it refers to the supporting and driving role of AI technology in personalized learning and digital literacy cultivation, with the core of achieving precise empowerment through data collection, algorithm optimization, and intelligent interaction rather than simple technology substitution [17].

2) Personalized Learning Paths

Dynamic learning plans designed based on students’ individual differences such as academic foundations and in-

terest preferences [18], with core characteristics of precise adaptation, dynamic adjustment, and consideration of both knowledge and literacy goals.

3) Students’ Digital Literacy

Combined with the characteristics of basic education, it is defined as a set of essential capabilities for students, including digital acquisition, use, evaluation, innovation, and safety ethics. The core composition dimensions are shown in Table 1.

TABLE 1. Core Composition Dimensions of Digital Literacy

Dimensions	Core Connotation	Key Cultivation Points (Measurable Metrics)
Information Literacy	Ability to acquire, screen, organize, and analyze digital information	1. Can accurately identify and screen 3+ types of digital information sources 2. Can complete logical analysis of 2+ sets of related digital data within a specified time
Communication and Collaboration Literacy	Ability to communicate, interact, and collaborate through digital media	1. Can effectively complete 2+ person collaborative tasks via digital platforms 2. Can express opinions clearly and appropriately in digital communication scenarios
Content Creation Literacy	Ability to create and innovate content using digital tools	1. Can use 2+ types of digital tools to complete standardized content creation 2. Can propose 1+ innovative points in digital works based on learning themes
Safety and Ethics Literacy	Digital security protection capabilities and digital ethics awareness	1. Can identify 3+ common digital security risks (e.g., phishing, privacy leakage) 2. Can abide by digital ethics norms in 3+ typical online scenarios (e.g., information sharing, online communication)

4) Collaborative Cultivation

Collaborative cultivation refers to the organic integration of personalized learning path construction and digital literacy cultivation, forming a mutually promoting mechanism of "personalized learning supporting literacy improvement and literacy improvement promoting learning deepening". Its core goal is to realize students’ all-round and personalized development.

B. THEORETICAL FOUNDATIONS

1) Constructivist Learning Theory

Its core viewpoint is that knowledge is actively constructed by learners, emphasizing the initiative and situationality of learning. It provides core theoretical support for the design of personalized learning paths [19] and is consistent with the situational needs of digital literacy cultivation.

2) Multiple Intelligences Theory

Gardner’s Multiple Intelligences Theory holds that individuals have multiple dimensions of intelligence differences. It

provides a basis for the differentiated design of personalized learning paths and guides the hierarchical cultivation of digital literacy [20].

3) Lifelong Education Theory

It emphasizes the continuity and integrity of education, provides a long-term value orientation for digital literacy cultivation, and requires basic education to balance the current and lifelong development needs of students.

III. CONSTRUCTION MECHANISM OF AI-ENABLED PERSONALIZED LEARNING PATHS IN BASIC EDUCATION

A. ANALYSIS OF CORE ELEMENTS FOR PERSONALIZED LEARNING PATH CONSTRUCTION

The construction of personalized learning paths involves four core elements, which are interrelated and interact to form an organic whole. The specific content is shown in Table 2.

TABLE 2. Core Elements of Personalized Learning Path Construction

Core Elements	Core Content	Role of AI Empowerment
Student Portraits	Covering dimensions such as academic foundation, interest preferences, cognitive characteristics, and digital literacy level	Multi-dimensional data collection and intelligent analysis to achieve precise and dynamic portraits
Learning Goals	Hierarchical and classified knowledge goals, ability goals, and literacy goals	Intelligent matching of goals based on portraits to achieve personalized and differentiated goals
Learning Content	Diversified resources such as texts, videos, and interactive courseware adapted to students’ needs	Intelligent screening and reorganization of resources to generate personalized learning resource packages
Learning Evaluation	Comprehensive evaluation combining process evaluation and outcome evaluation	Real-time collection of learning data to generate dynamic evaluation reports and support path optimization

B. CORE MECHANISM OF AI IN PERSONALIZED LEARNING PATH CONSTRUCTION

1) Data Collection and Analysis

Collected data include students’ classroom interaction data, homework completion data, online learning data, and digital

literacy performance data. This study was approved by the Ethics Committee of Baise University, and was performed in accordance with the principles of the Declaration of Helsinki. All eligible participants signed an informed consent form. Through big data analysis technology, data are cleaned, classified, and mined to extract students' learning characteristics and needs.

2) Intelligent Generation and Dynamic Update of Student Portraits

Based on the collected multi-dimensional data, AI algorithms can generate precise student portraits covering both learning and literacy dimensions. Different from traditional portraits, AI-enabled student portraits have a dynamic update function, which can capture students' learning progress and behavioral performance in real time through learning platform data, while supplementing the assessment of non-real-time capabilities such as 'Safety and Ethics' through periodic situational tests, teacher observations, and parent feedback. It adjusts portrait content in a timely manner to ensure accuracy and timeliness.

3) Intelligent Matching Algorithm for Learning Goals and Content

AI technology constructs intelligent matching algorithms to achieve precise matching between learning goals and student portraits, and screens appropriate learning content according to learning goals. For example, for students with low digital literacy, algorithms will match basic digital skills learning content; for students with weak academic foundations, algorithms will give priority to matching basic knowledge consolidation content.

4) Real-Time Optimization and Dynamic Adjustment of Learning Paths

AI technology can real-time track students' learning processes and dynamically adjust learning paths according to their learning performance (such as homework completion, test scores, and interaction participation). When students encounter learning difficulties, the learning time of basic content is automatically increased; when students perform well, the learning difficulty is automatically raised to ensure that the learning path is always adapted to students' learning needs.

C. TECHNICAL FRAMEWORK AND IMPLEMENTATION PROCESS OF PERSONALIZED LEARNING PATH CONSTRUCTION

1) Core Technical Architecture

(1) Data layer: Responsible for the collection and storage of multi-dimensional data, including student data, resource data, and evaluation data. Multi-dimensional data integration adopts ETL (Extract-Transform-Load) tools to standardize data from different sources (e.g., learning platforms, school management systems) into a unified data format, and

realizes interoperability with existing school management systems through API interfaces complying with national educational data standards (e.g., CELTS). In terms of data privacy, it strictly abides by the "Personal Information Protection Law of the People's Republic of China" and relevant educational data security regulations: student data is encrypted during transmission and storage, access rights are classified and managed, and data desensitization is carried out for non-essential information to ensure data security and privacy; (2) Algorithm layer: Responsible for data processing, student portrait construction, path matching, and optimization, which is the core of the technical architecture; (3) Application layer: Facing teachers and students, providing application tools such as personalized learning platforms and teaching management systems.

2) Whole-Process Implementation Steps

The construction of personalized learning paths follows a closed-loop design idea, including five core steps: (1) Demand analysis: Clarify students' learning needs and digital literacy cultivation needs through a combination of AI technology and questionnaires. To reconcile these two data sources, the study adopts a weighted fusion algorithm based on the analytic hierarchy process (AHP): AI analyzes objective behavioral data (e.g., learning duration, task completion rate) with a weight of 0.6, and questionnaires collect subjective needs (e.g., interest preferences, learning difficulties) with a weight of 0.4, integrating them into a unified student demand model; (2) Student portrait construction: Generate precise portraits based on multi-dimensional data; (3) Path design: Match learning goals and content through algorithms to design initial learning paths; (4) Path implementation: Students carry out learning according to the designed paths, and AI real-time tracks the learning process; (5) Path optimization: Dynamically adjust paths according to learning data to form a closed loop.

IV. COLLABORATIVE CULTIVATION LOGIC AND INTEGRATION POINTS OF PERSONALIZED LEARNING AND DIGITAL LITERACY

A. ANALYSIS OF INTERNAL LOGIC OF COLLABORATIVE CULTIVATION

1) Supporting Role of Personalized Learning in Digital Literacy Cultivation

Personalized learning provides a precise and personalized implementation path for digital literacy cultivation. Through the design of personalized learning paths, digital literacy cultivation goals can be decomposed into specific learning tasks to achieve hierarchical cultivation. For example, design special information screening and analysis tasks for students with weak information literacy, and digital work creation tasks for students with weak content creation literacy to improve the pertinence of cultivation.

2) Promotional Value of Digital Literacy Improvement for Personalized Learning

The improvement of digital literacy can significantly enhance students' personalized learning abilities. Students with good digital literacy can more efficiently use digital resources for autonomous learning, more proficiently use various functions of personalized learning platforms, and more accurately express their learning needs, thereby improving the efficiency and quality of personalized learning.

3) Core Goal of Collaborative Cultivation

The core goal of collaborative cultivation is to break the separation between knowledge learning and literacy cul-

tivation, and realize students' all-round and personalized development. Through AI empowerment, the construction of personalized learning paths and digital literacy cultivation are integrated, which not only meets students' individual learning needs but also cultivates their core abilities to adapt to the digital society, laying a foundation for their lifelong development.

B. KEY INTEGRATION POINTS OF PERSONALIZED LEARNING AND DIGITAL LITERACY CULTIVATION

There are four key integration points between personalized learning and digital literacy cultivation, as shown in Table 3.

TABLE 3. Key Integration Points

Integration Points	Collaborative Cultivation Content	Practical Methods
Resource Selection	Cultivation of information awareness, information screening, and analysis capabilities	Design personalized resource screening tasks to guide students to distinguish the authenticity and value of resources
Process Interaction	Cultivation of digital communication and collaboration capabilities	Conduct group learning through online collaboration platforms to complete interactive tasks
Achievement Creation	Cultivation of digital content generation and innovation capabilities	Encourage students to create works using digital tools, such as PPTs, short videos, and research reports
Evaluation and Reflection	Cultivation of digital ethics and critical thinking	Guide students to conduct self-reflection using evaluation tools and standardize digital behaviors

C. CONSTRAINTS AND BREAKTHROUGH PATHS OF COLLABORATIVE CULTIVATION

1) Technology Adaptability: Simplification and Adaptation of AI Technology in Basic Education Scenarios

(1) Constraints: Existing AI technologies are mostly oriented to higher education or enterprise scenarios, with complex operations that are difficult to adapt to the use needs of teachers and students in basic education; Some schools lack necessary technical equipment and network support. (2) Breakthrough Paths: Adopt a "hardware + software" integrated solution: On the one hand, promote the construction of shared hardware resources (e.g., regional educational cloud platforms, mobile learning terminals allocated by governments, "three-teacher classroom" equipment sharing mechanisms) to solve the problem of hardware shortage; on the other hand, develop simplified AI tools adapted to basic education scenarios and low-end hardware configurations to reduce operational difficulty and hardware performance requirements. At the same time, increase investment in educational informatization, improve the construction of technical infrastructure, and narrow the digital divide.

2) Teachers' Capabilities: Improvement of Teachers' AI Application and Collaborative Guidance Capabilities

(1) Constraints: Most teachers lack AI technology application capabilities and are unable to effectively use personalized learning platforms for teaching; They have an insufficient understanding of the concept of collaborative cultivation and lack relevant teaching design capabilities. (2) Breakthrough Paths: Carry out special training to improve teachers' technical application capabilities and collaborative guidance capabilities; Establish a teacher mutual assistance mechanism to share teaching experience and cases.

3) Educational Equity: Avoiding the Digital Divide Caused by Technology Empowerment

(1) Constraints: There is a large gap in the level of educational informatization between urban and rural areas and different regions. Some rural schools lack necessary technical resources, which may exacerbate educational inequality. (2) Breakthrough Paths: Establish an educational resource sharing mechanism to realize cross-regional sharing of high-quality resources through forms such as "three-teacher classrooms"; Increase investment in educational informatization in rural areas, and improve the allocation of technical equipment and teachers.

V. PRACTICAL STRATEGIES AND CASE ANALYSIS OF COLLABORATIVE CULTIVATION

A. PRACTICAL PRINCIPLES OF COLLABORATIVE CULTIVATION

1) Personalization-Oriented Principle
In practice, fully respect students' individual differences, and design personalized learning paths and literacy cultivation plans based on student portraits; At the same time, balance the common requirements of digital literacy to ensure that students have basic digital capabilities and ethical awareness.

2) Technology Empowerment Principle
Adhere to the concept of technology serving teaching, and give full play to the advantages of AI tools in data collection, path design, and evaluation feedback; Avoid the abuse of technology, prevent AI from replacing teachers' core guidance role, and realize human-machine collaborative teaching.

3) Progressive Principle

Digital literacy cultivation should follow the law of students' cognitive development, gradually transitioning from low-level abilities (such as digital acquisition and use) to high-level abilities (such as digital innovation and ethical judgment); The difficulty of personalized learning paths should also be gradually increased to ensure that students can make steady progress.

4) Collaborative Linkage Principle

Construct a "family-school-society" trinity collaborative cultivation system: Schools play a leading role in designing cultivation plans; Families cooperate with schools in education to guide students to use digital devices standardizedly; Society provides practical resources, such as science and technology museums and enterprises, to offer digital practice opportunities for students.

B. SPECIFIC PRACTICAL STRATEGIES

1) Functional Optimization of AI Education Platforms

Embed digital literacy cultivation modules to realize the organic integration of personalized learning and literacy cultivation. Modules should include functions such as digital literacy evaluation, special training, and achievement display, and realize precise push of cultivation content through algorithms. For example, set up a special information screening training module on the platform, and push training tasks of different difficulties according to students' information literacy levels.

2) Design of Personalized Learning Tasks

Combine the teaching content of different subjects to design personalized learning tasks integrated with digital literacy

training goals. Chinese subjects can design digital work creation tasks (such as writing electronic manuscripts and making short videos) to cultivate students' content creation literacy; Mathematics subjects can design data collection and analysis tasks to cultivate students' information analysis capabilities; Science subjects can design virtual experiment tasks to cultivate students' digital operation capabilities.

3) Improvement of Teachers' Guidance Capabilities

Establish a hierarchical and classified teacher training system: Basic-level training focuses on the basic operation of AI technology to improve teachers' platform use capabilities; Intermediate-level training focuses on teaching design to improve teachers' ability to integrate digital literacy cultivation into personalized teaching; Advanced-level training focuses on research capabilities to guide teachers to carry out research on collaborative cultivation. At the same time, build a teacher exchange platform to share excellent teaching cases.

4) Reconstruction of Evaluation System

Construct a three-dimensional collaborative evaluation system with clear technical definitions: the three dimensions refer to "learning performance dimension (process + outcome)", "literacy level dimension (knowledge + ability)", and "development potential dimension (current level + growth trend)". The system covers both learning outcomes and literacy levels, and combines process evaluation with outcome evaluation (Table 4).

TABLE 4. Collaborative Evaluation Index Framework

First-Level Indicators	Second-Level Indicators	Evaluation Content	Evaluation Methods
Personalized Learning Performance	Learning Participation	Classroom interaction, online learning duration, homework completion quality, etc.	AI platform data collection + teacher evaluation
Digital Literacy Level	Learning Outcomes	Test scores, task completion effect, knowledge mastery level, etc.	Test + work evaluation
	Information Literacy	Information screening, analysis, and integration capabilities	Task test + self-evaluation
	Communication and Collaboration Literacy	Digital communication and online collaboration capabilities	Group evaluation + teacher evaluation
	Content Creation Literacy	Digital work creation and innovation capabilities	Work evaluation + expert evaluation
	Safety and Ethics Literacy	Digital security awareness and ethical judgment capabilities	Questionnaire + situational test

C. CASE ANALYSIS

1) Case Selection

Huijing Experimental School in Tianhe District, Guangzhou, is selected as the case study object. It is a typical representative of AI-enabled personalized learning and digital literacy collaborative cultivation in basic education. Through multi-dimensional practices such as "interconnection of reading and technology, integration of disciplines and technology, collaboration between schools and enterprises, and connection between primary, middle, and university education", the school has achieved remarkable results, and its experience has important reference value.

2) Case Implementation

The school's collaborative cultivation practice mainly includes three core measures: (1) Construct a dual-main lines curriculum system of "reading + technology", integrate digital literacy cultivation into reading teaching, and develop Chinese reading courses based on the Moodle platform to realize the integration of personalized learning and literacy cultivation; (2) Carry out interdisciplinary project-based learning, design real problem-driven project tasks relying on AI technology, such as the micro-research project "Water Quality Monitoring and Analysis", to cultivate students' digital literacy and comprehensive capabilities; (3) Establish a

hierarchical development model of teachers' digital literacy, and improve teachers' collaborative guidance capabilities through special training.

3) Case Effects

The school's collaborative cultivation practice has achieved remarkable results (Table 5):

TABLE 5. Comparison of Students' Digital Literacy Before and After Improvement in Huijing Experimental School (Unit: %)

Literacy Dimensions	Compliance Rate Before Improvement	Compliance Rate After Improvement	Improvement Range
Information Literacy	62.3	89.7	27.4
Communication and Collaboration Literacy	58.5	85.2	26.7
Content Creation Literacy	45.2	78.9	33.7
Safety and Ethics Literacy	72.1	92.3	20.2

(1) Students' academic performance and literacy level have improved simultaneously. According to the 2022 Guangzhou "Sunshine Evaluation" data, students' reading literacy is 15.9% higher than the city's average, and their mathematics and science literacy have increased by 29.7% and 17.3% respectively; (2) Students' innovation capabilities have been significantly enhanced. In the past five years, students have won more than 1,000 awards in science and technology innovation competitions, including 2 first prizes in the National Primary and Secondary School Information Technology Innovation and Practice Competition; (3) Teachers' teaching capabilities have been greatly improved. 60% of teachers have mastered the use of AI-related technical tools within one year, and teaching efficiency has increased by 40%.

4) Case Enlightenment

(1) The deep integration of technology and courses is the core path of collaborative cultivation. It is necessary to organically integrate AI technology into subject teaching to avoid "separation between technology and teaching"; (2) The improvement of teachers' digital literacy is the key guarantee for collaborative cultivation. It is necessary to establish a hierarchical and classified teacher training system; (3) An open and collaborative educational ecology is an important support for collaborative cultivation. It is necessary to integrate resources from schools, enterprises, research institutes, and other parties.

VI. RESEARCH CONCLUSIONS

A. CORE CONSTRUCTION MECHANISM OF AI-ENABLED PERSONALIZED LEARNING PATHS

Based on multi-dimensional data collection, the system utilizes a "data layer - algorithm layer - application layer" architecture to generate precise student portraits and match learning goals with the technical competencies required by modern engineering. This closed-loop process optimizes learning paths through algorithms to ensure that the cultivation of talent aligns seamlessly with the high-precision standards of the intelligent industry.

B. MUTUALLY PROMOTING COLLABORATIVE LOGIC BETWEEN PERSONALIZED LEARNING AND DIGITAL LITERACY

Personalized learning provides a precise path for literacy cultivation, and digital literacy provides capability support for learning deepening. They are core integrated in four links: resource selection, process interaction, achievement creation, and evaluation reflection.

C. EFFECTIVE PRACTICAL STRATEGIES AND KEY GUARANTEE CONDITIONS FOR COLLABORATIVE CULTIVATION

Effective practical strategies include optimizing the functions of AI education platforms, designing personalized tasks integrated with literacy goals, improving teachers' collaborative guidance capabilities, and reconstructing the collaborative evaluation system. Key guarantee conditions include the adaptability optimization of technology, the improvement of teachers' capabilities, the guarantee of educational equity, and the collaborative linkage of "family-school-society".

AUTHOR CONTRIBUTIONS

Conceptualization – Chaoyang Tan and Lini Huang; methodology – Chaoyang Tan and Lini Huang; investigation – Chaoyang Tan and Lini Huang; writing-original draft preparation – Chaoyang Tan and Lini Huang. All authors have read and agreed to the published version of the manuscript.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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HUMAN RESEARCH SUBJECTS

This study was approved by the Ethics Committee of Baise University, and was performed in accordance with

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