Research on the Overall Architecture and Practical Mode of Intelligent Education System based on Java

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Abstract

To promote intelligent education, the key is to accurately grasp its essence and do a good job in the top-level design of intelligent education. Through induction and comparative analysis, the connotation of intelligent education can be clarified, and it can be found that intelligent education is a new educational model that uses intelligent technology as an environment and tool to promote the transformation of talent cultivation models and teaching methods. The overall architecture of an intelligent education system based on Java consists of intelligent infrastructure, core technology platform, intelligent learning system, intelligent application scenarios, and comprehensive support system. It realizes the reconstruction of information education from the aspects of intelligent education concept, intelligent teachers, refined teaching, personalized learning, precise management, and appropriate services.

Keywords

Intelligent Education; Personalized Learning; Java; Top-level Design.

1.　Research Background

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In July 2017, the State Council released the "Development Plan for the New Generation of Artificial Intelligence", which first proposed the concept of "intelligent education" and clearly stated the need to accelerate the integration and development of artificial intelligence technology and education, and build a new ecological education system. In April 2018, the Ministry of Education issued the Action Plan for Artificial Intelligence Innovation in Higher Education Institutions, focusing on three aspects: technological innovation in artificial intelligence in universities, talent cultivation in artificial intelligence, and the transformation and application of artificial intelligence technological achievements. This has made the education ecosystem in Chinese universities more perfect and provided strong support for the innovative development of intelligent education. In September 2021, in accordance with the relevant requirements of the Ministry of Education, the second batch of pilot projects using artificial intelligence technology to strengthen the construction of the teacher team were officially implemented. The deep integration of the two has become the focus of the pilot work,

helping teachers adapt to the requirements of educational development in the intelligent information age, improve their intelligent education literacy, and focus on building a new paradigm of intelligent education. These policies not only set new goals for the development of intelligent education in China, but also put forward specific requirements:

One is to promote the comprehensive implementation and innovative improvement of artificial intelligence;

Secondly, artificial intelligence empowers education and teaching;

Thirdly, enhance the intelligent literacy ability of university teachers;

The fourth is to implement a personalized intelligent education model.

From the current development of education and the focus of academic attention, modern education is moving towards intelligence, personalization, autonomy, precision, and collaboration. It is moving from peripheral educational management scenarios to classroom teaching, gradually empowering the entire educational scene. Chen Li et al. pointed out that artificial intelligence technology can promote teaching interaction, achieve personalized learning for learners, and assist teachers in teaching, thereby helping teachers save time costs and enhancing students' active learning abilities. Huang Lizhi et al. believe that teachers can use AI technology and multimedia teaching methods to create an open and interactive teaching system, develop more refined teaching mechanisms based on student needs and weaknesses, and provide timely feedback. Sun Yan stated that "human-machine collaboration" is an innovative teaching model jointly completed by teachers and AI teaching assistants. Teachers help students inspire and promote teaching resources, stimulate their learning potential, while AI teaching assistants assist in pre class preparation, in class supervision, and post class evaluation, providing assistance for personalized learning for students. The essence of education is to promote learners to become intelligent agents who develop themselves, improve their personality, and ultimately achieve the unity of value and practice.

2. Research Status

In recent years, research and practice on intelligent education in China have shown explosive development.

In July 2017, the State Council released the "Development Plan for the New Generation of Artificial Intelligence"[7], proposing to use artificial intelligence to build a new education system.

In April 2018, in the "Education Informatization 2.0 Action Plan"[8] released by the Ministry of Education, a total of 36 words related to "intelligence" appeared, indicating that promoting intelligent education is an important content of the "2.0 Plan".

In April 2018, the Ministry of Education released the "Action Plan for Artificial Intelligence Innovation in Higher Education Institutions" [9].

In July 2018, iFlytek, together with experts from seven renowned universities including Peking University, Tsinghua University, Beijing Normal University, and East China Normal University, jointly established the Intelligent Education Expert Committee and issued the 2018 Kwun Tong Declaration on Intelligent Education[10].

In August 2018, the first "China Intelligent Education Conference" was held in Beijing, jointly hosted by the Chinese Artificial Intelligence Society, the China Education Technology Association, Capital Normal University, and the China Language Intelligence Research Center, a research base of the National Language Commission[11].

In November 2018, the Future Education High Precision and Advanced Innovation Center of Beijing Normal University released the blue book "Artificial Intelligence+Education"[12].

It can be seen that using intelligent technology to solve problems in educational development and promote educational reform has become a consensus错误!未找到引用源。.

3. Research Content

3.1. Technological Innovation Accelerates the Iteration of Educational Content

Intelligent technologies such as the Internet, metaverse, and educational robots have shaped new laws of knowledge production and dissemination: knowledge has shifted from being "subject specific, static, with long production cycles, difficult evolution, and the wisdom of a few intellectuals" to being "comprehensive, dynamic, production spreads, strong evolutionary power, and all human intelligence" (Chen Li, 2020). The transformation of knowledge application methods also poses challenges to educational content. On the one hand, emphasizing interdisciplinary teaching that breaks down disciplinary barriers is a new trend in the current development of education, with typical representatives such as STEM education and maker education. The compulsory education curriculum plan and standards (2022 version) issued by the Ministry of Education (2022a) emphasize the need to actively explore changes in learning environments and methods under the background of new technologies, strengthen inter disciplinary connections and knowledge integration, and actively carry out interdisciplinary teaching. On the other hand, sometimes the way knowledge is acquired is more important than the knowledge itself. According to the "big concept" concept, the vast majority of basic knowledge principles will not change, but the way knowledge is presented and shared with the support of intelligent technology will become diversified. Currently, people clearly feel that knowledge application has become difficult, and work-related knowledge is rapidly being eliminated or created (Albert et al., 2022).

3.2. Social and Cultural Changes Lead to the Reshaping of Teacher-student Relationships

Intelligent technology has driven the transformation of human social structure from a binary structure of "physical space social space" to a ternary structure of "physical space social space information space", constructing a new social system (Pan Yunhe, 2018). The education system is a component of the social system, and the teacher-student relationship is closely related to the social changes caused by technological changes, presenting distinct characteristics of the times (Zhao Leilei et al., 2021). The educational application of intelligent technologies such as educational robots, intelligent tutoring systems, and learning analytics not only redefines the role of teachers, but also reshapes the teacher-student relationship.

The traditional teacher-student relationship has been greatly impacted, shifting from authoritative obedience and independent equality to two-way symbiosis (Wang Guo et al., 2021). The reason behind this is that on the one hand, intelligent technology has replaced some of the functions of teachers, reducing their sense of need and weakening their motivation for communication; On the other hand, the normalization of online education has led to indirect characteristics in teacher-student interactions, fragmented time and space, and reduced interaction density (Cao Yanan, 2021).

3.3. The Inherent Needs of Education Force the Restructuring of Teaching Processes

During the COVID-19 epidemic, the world was forced to carry out large-scale online education. This not only breaks the time and space limitations of teaching, but also breaks the psychological "wall" of people, that is, anyone can learn at any time and anywhere, promoting the transformation of educational forms. At present, blended learning, which combines online education and classroom teaching, has become the new norm. However, both the quality of

online education and the cost-effectiveness of using intelligent technology in face-to-face classrooms have always been questioned. The key reason is that actual teaching often only shifts the offline classroom to the online classroom, lacking the reconstruction of teaching processes. The application of intelligent technology also enriches the ways for learners to obtain information, making it a new challenge to acquire knowledge from massive amounts of information. Therefore, using intelligent technology as a carrier to reconstruct teaching processes and constructing a deep teaching model with literacy development as the core has become an inherent demand for the development of education in the intelligent era (Yu Shengquan, 2022).

4. Innovation Points and Project Characteristics

4.1. Theoretical Construction of Intelligent Education System

The intelligent education system is a complex ecosystem with multiple elements, levels, and dynamic development. Overall, intelligent education is different from general intelligent teaching systems. It cannot be separated from the construction and application of intelligent infrastructure, technological resources, and intelligent environment; But it is not only a technological system and environment, but also includes multiple elements such as the integration of intelligent technology and education, new educational and teaching applications, ethics and security guarantees. It is a complete new type of educational ecosystem. In the actual construction and application of intelligent education systems, they are also distinguished into different specific systems. For example, according to the level of educational and teaching applications, it can be divided into regional intelligent education systems, intelligent campus systems, and intelligent teaching systems, etc; According to the type of education and teaching business, it can be divided into intelligent teaching systems, intelligent learning systems, intelligent examination systems, intelligent evaluation systems, intelligent management systems, and intelligent service systems; According to the type of subject teaching application, it can also be divided into intelligent teaching systems for subjects such as Chinese, mathematics, English, society, and nature. Therefore, in practice, targeted intelligent education systems can be constructed according to the actual application needs of education and teaching.

4.2. The Overall Architecture of an Intelligent Education System

Based on the analysis of the research objects and methods mentioned above, combined with practical research needs, a five level overall architecture model of the intelligent education system was constructed using an overall structured description method, as shown in the following figure. The overall architecture of the intelligent education system consists of five layers, including infrastructure layer, core technology layer, intelligent system layer, intelligent application layer, and comprehensive support layer, forming an ecosystem for the construction and application of intelligent education.

4.2.1. The Infrastructure Layer

Including IoT perception systems, high-performance computing and cloud services, big data infrastructure, etc., provides intelligent information perception, intelligent cloud computing, massive data support, and efficient computing support for intelligent education;

4.2.2. The Core Technology Layer

It is the "brain" of intelligent education. Based on key technologies such as artificial intelligence and big data analysis, it establishes data centers, knowledge centers, resource centers, and capability centers, possessing core technology capabilities such as algorithms, data, and analysis;

4.2.3. At the Intelligent System Layer,

By developing and establishing education and teaching support systems such as regional education cloud platforms, intelligent campuses, three-dimensional comprehensive teaching fields, intelligent online learning platforms, and intelligent education analysis systems, a networked, digital, intelligent, and personalized education new environment is constructed;

4.2.4. The Intelligent Application Layer

It supports the integration and application innovation of educators, learners, educational content, and educational media, achieving the intelligence of educational and teaching scenarios, including teaching, learning, research, management, examination, evaluation, and regional governance;

4.2.5. The Comprehensive Guarantee Layer

It is a diversified guarantee system for intelligent education, including standards and regulations, ethical safety, talent cultivation, and industrial collaboration. Acknowledgements Natural Science Foundation.

5. Optimization Path of Intelligent Education System

5.1. Developing Intelligent Thinking and Establishing a Correct Educational Ecosystem

In the era of artificial intelligence, the greatest change brought to humanity is the transformation of thinking and concepts. Therefore, as the main factor in the education ecosystem, university teachers should actively adapt and seek change, explore intelligent thinking, and build a comprehensive, coordinated, balanced, and sustainable development of the education ecosystem. Firstly, to transform their thinking, it is necessary for teachers to conduct in-depth research on the current information-based teaching model and master its methods, content, and implementation approaches. They should be brave enough to accept the challenges of new things and maintain an open and shared mindset, constantly learning, researching, absorbing, and thinking, and timely paying attention to the latest educational trends and future educational development trends in order to better serve teaching. Secondly, university teachers should establish the educational concept of human-machine symbiosis, leverage the respective advantages of humans and machines, and empower the value-added of education and teaching. Teachers have the ability to innovate, reflect, and perceive emotions that machines cannot achieve, and adjust their teaching plans in a timely manner based on problems that arise during the teaching process. Artificial intelligence, as an advanced technology, can not only improve classroom teaching effectiveness through data crawling, cleaning, processing, and analysis, but also gain recognition from students through personalized development of teaching services. This not only promotes lifelong education, but also achieves a new education ecosystem of balance and benign development.

5.2. Building a Community of Innovative Teaching and Expanding the Ecological Niche of Teachers

"Ecological niche" is one of the important basic concepts in the field of ecology, referring to the spatial and temporal conditions occupied by a specific population in the ecosystem, its ecological relationships with other populations, and its own ecological functions. It can also be understood as the sum of different resources utilized by a population. The ecological niche of teachers refers to the status and relationship between individual teachers, teachers and students, and educational resources. University teachers should find an ecological niche that is suitable for their own development needs.

Only by achieving sustainable development, fully utilizing one's own advantages, and being adept at tapping into various resources both inside and outside the school for my own use, including international exchanges and cooperation, financial resources, education and teaching research, school enterprise cooperation, inter school cooperation, virtual simulation experiments and practical training, can we jointly build and share high-quality teaching resources. University teachers use internet resource sharing platforms to promote the integration and interoperability of information flow, resource flow, and energy flow, with the aim of actively cultivating innovative talents and focusing on cultivating students' innovative abilities, to build a teaching ecosystem of "teacher guidance student exploration" co created by teachers and students. In teaching practice, a collaborative and mutual aid talent cultivation model is constructed through curriculum construction, integration of industry and education, on-the-job course certification competition, and innovation and entrepreneurship. The model is led by teachers and students, and an innovative teaching community centered on collaborative development between teachers and students is constructed.

5.3. Breaking the Flower Pot Effect and Enhancing Teachers' Informatization Teaching Ability

The "flowerpot effect" reflects the special effects of local habitats. As a specific niche, flower pots have half of the natural and half of the artificial conditions. If sufficient temperature, humidity, and nutrients are artificially provided, plants can grow well. However, once the superior environment changes, their natural ecological adaptation threshold weakens and their ecological niche decreases. With the widespread application of intelligent education, university teachers must step out of their comfort zone, actively respond and reconstruct.

The education and teaching ecosystem should adapt to the future education ecological pattern. Teachers are practitioners of digital transformation in education, and the digital processing ability and information-based teaching ability of the practitioners are key. Firstly, schools should increase investment in digital teaching products, maintain teaching resource libraries, provide technical guidance to teachers, and solve problems that arise during teaching operations; Secondly, schools and technology companies carry out joint training or training, linking training with teacher assessment, and ensuring the effectiveness of training through systems and standards; Finally, teachers should proficiently master the functions, characteristics, advantages and disadvantages of teaching software such as the Smart Vocational Education Cloud Platform, Rain Classroom, Learning Pass, MOOC, and Xuetang Online, improve their information processing ability in the teaching process, timely release teaching resources according to the needs of the learning situation, and achieve good teaching effects such as pre class guidance, in class interaction, and post class feedback for teachers and students.

5.4. Collaborative Development between Teachers and Students, Awakening the Return of Educational Value

Co evolution in the education ecosystem refers to the competition, cooperation, and symbiotic relationship between individuals and groups within the system. The ecological factors of education ultimately tend towards the direction of co evolution in this relationship, in order to achieve people's common educational ideals. Although there are often negative outcomes caused by improper competition in this process, collaborative development and coexistence have always dominated the entire education ecosystem. In the intelligent education environment, the emotional education responsibility and other educational values that teachers undertake will be more prominent, because the essence of education lies in the communication and integration of mind and spirit, and teacher-student interaction and communication will always have irreplaceable significant value. In the future, teachers should pursue a sense of mission and responsibility in cultivating virtue and talent, cultivate

themselves internally, and achieve comprehensive improvement in professional teaching ability and teacher's comprehensive literacy; Improve outward, pay attention to the inner thoughts of students, focus on developing their strengths, provide maximum care and assistance to students, work together with students to enhance their abilities, reshape themselves, and truly achieve the cultivation and return of educational value.

Acknowledgments

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