Research Status and Prospects of the Popularization of Artificial Intelligence Curriculum Education in Primary and Secondary Schools ——Taking a District in G City as an Example

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Abstract. AI tech growth makes the country highly value AI education. However, there are problems in its implementation. It finds that teachers' age and teaching experience are unevenly distributed, there are few full-time teachers, teaching methods are single. The courses are offered in various forms but not standardized, resources are insufficient, the hardware conditions vary greatly between urban and rural areas, equipment is generally insufficient, and the participation in teaching and research activities is low and the content is superficial. Therefore, this study proposes strategies of policy guidance, implementation of school education and classroom optimization to solve the existing problems, promote the balanced development of AI education and lay a solid foundation for cultivating innovative young people in the future.

Keywords: Primary and secondary schools, Artificial intelligence, Artificial Intelligence Curriculum Education, Practice strategy

1 Introduction

Artificial intelligence is transforming human society and driving future development, fostering AI curriculum education. In recent years, China has actively promoted AI education in primary and secondary schools. The State Council's *New Generation Artificial Intelligence Development Plan* mandated universal AI education, curriculum implementation, infrastructure development, and competition support[1]. The Ministry of Education's *Education Informatization 2.0 Action Plan* emphasized integrating information literacy into student evaluations and enriching AI and programming curricula[2]. On November 18, 2024, the Ministry further issued a notice aiming to universalize AI education in basic education by 2030, outlining implementation frameworks and youth innovation cultivation [3]. While policy frameworks exist, academic empirical studies are needed to address implementation challenges in core tasks and strategies.

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This study investigates AI education popularization in a G City district, identifies core challenges, and proposes actionable solutions to support high-quality AI education development in primary and secondary schools.

2 Survey on the Current Status of the Popularization of Artificial Intelligence Course Education in Primary and Secondary Schools

2.1 Survey Design

2.1.1 Background to the Survey.

On July 11, 2022, G City launched an AI education initiative for grades 1-8, integrating AI curricula into school schedules with standardized teaching materials, schedules, equipment, venues, and qualified teachers. The program includes regular teaching/research activities, AI excellence programs, and establishes 100 model AI schools. Since September 2022, AI education has been delivered using local textbooks and a virtual "AI Teaching Platform for Schools." After two years of implementation, G City has accumulated significant experience and achievements in AI education. This study investigates a district in G City to assess current practices, identify challenges, and provide evidence-based insights for refining AI education policies.

2.1.2 Survey Respondents.

The survey covered a total of 310 teachers of AI courses in primary and secondary schools in a district of G city, covering a group of teachers of different age groups, teaching ages and school types (including urban schools, urban-centered schools, and rural schools), and striving for comprehensive and representative data.

2.1.3 Questionnaire Development and Research Tools.

The questionnaire focused on teachers' demographics (age, teaching experience), course delivery (methods, formats), infrastructure, and teaching/research participation. A mixed-methods approach combining quantitative data and qualitative questions was used. Data collection involved online surveys (304 valid responses) supplemented by in-depth interviews to analyze results. Findings were categorized and analyzed across four dimensions: teacher demographics, course implementation, infrastructure, and teaching/research activities, revealing current practices and challenges.

2.2 Statistics of Results and Analysis of the Current Situation

2.2.1 Status of the Teaching Profession.

First, Uneven distribution of age and teaching experience. AI teachers exhibit polarized age distribution: 41.42% are under 30, while 35.52% are over 40 in G City's district.

Younger teachers demonstrate strong technical adaptability but lack classroom management expertise; senior teachers possess teaching experience but face challenges adopting AI tools, limiting their effectiveness in AI education.

AI teachers are predominantly young, with 37.83% having under 5 years' experience—enthusiastic but needing curriculum implementation support. Conversely, 23.36% have over 21 years' experience but may face tech-adoption challenges. Additionally, only 38.82% of surveyed teachers are full-time AI instructors; most part-time educators juggle other subjects (e.g., IT, math), limiting their capacity to refine AI course depth and quality due to workload pressures.

Third, Single teaching methodology. While teachers employ varied methods, lectures dominate (90.46%), with task-driven (62.5%), project-based (38.82%), and gamified (26.32%) approaches used less frequently. This limits course engagement and practicality, reflects insufficient emphasis on experiential learning, and hinders student motivation and hands-on skill development. Finally, Significant differences exist in how urban and rural teachers organize AI content. Rural teachers reported higher reliance on textbook-only instruction (45.3%) compared to urban/town schools, while fewer rural educators adapted content to context or blended textbooks with original materials. This suggests rural schools face resource constraints, training gaps, or infrastructure limitations hindering curricular innovation. Despite these disparities, over 80% of all teachers supported integrating generative AI into curricula and using it for teaching assistance. (see Fig.1.and Fig.2.)

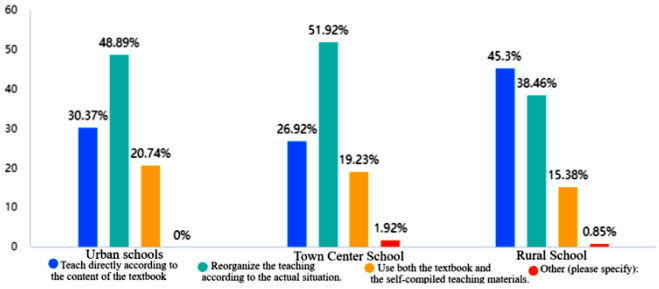

Fig. 1. Statistical chart of the way the teaching content of artificial intelligence courses is organized.

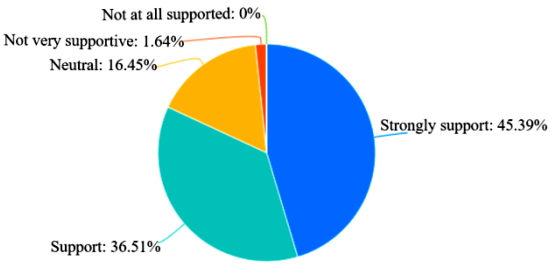

Fig. 2. Statistical chart of teachers' perceptions of generative AI in instructional applications.

2.2.2 Status of Curriculum Development and Implementation.

First, various forms of delivery but lack of harmonized norms. The survey shows that the main ways of offering AI courses include integrating them in information technology courses (70.39%) and offering them independently (65.13%), which responds to the fact that there is a greater tendency to educate AI on the basis of existing disciplines when AI courses are offered. In addition, the teaching objectives, teaching contents, evaluation standards and other aspects have not yet formed a unified standardization, and there are large differences in the way and content of curriculum implementation among different schools. Such differences may lead to an imbalance in the quality of the curriculum and even affect student learning outcomes.

Second, Inadequate teaching resources. The lack of teaching resources is a common problem in the current implementation of the curriculum. 23.03% of teachers said that although they are currently equipped with teaching books, the existing content cannot fully meet the demand, and some schools are not even equipped with specialized AI teaching materials. In addition, the depth and appropriateness of the content of the curriculum is also a concern, as some teachers consider the content of some modules to be too complex and mismatched with the actual cognitive level of students.(The detailed data is shown in Table 1, which comes from the questionnaire survey we conducted.)

Table 1. Artificial Intelligence Course Teaching Resources Statistics.

Availability of textbooks	percentage	Subtotal
Yes, and the content fulfills the requirements	47.04%	143
Yes, but the content does not meet pedagogical requirements	23.03%	70
No, there is currently no accompanying teacher's book	29.93%	91

2.2.3 Hardware.

Inadequate equipment is a common problem. 76.64% of teachers believe that the hardware facilities are insufficient, which has largely become a major obstacle to the promotion of AI courses. In addition, 55.92% of the teachers reflected that the low configuration and poor running performance of students' computers directly affected teaching efficiency.

Significant urban-rural disparities exist in AI education resources. Survey data reveals 24% of rural teachers report inadequate equipment hindering instruction, with 19% facing severe shortages and nearly no AI-specific hardware. Consequently, 42% of rural educators cite resource gaps as major barriers to AI curriculum implementation, compared to 28% in urban schools and 17% in township centers. This hardware inequality exacerbates educational inequity. (see Fig.3.)

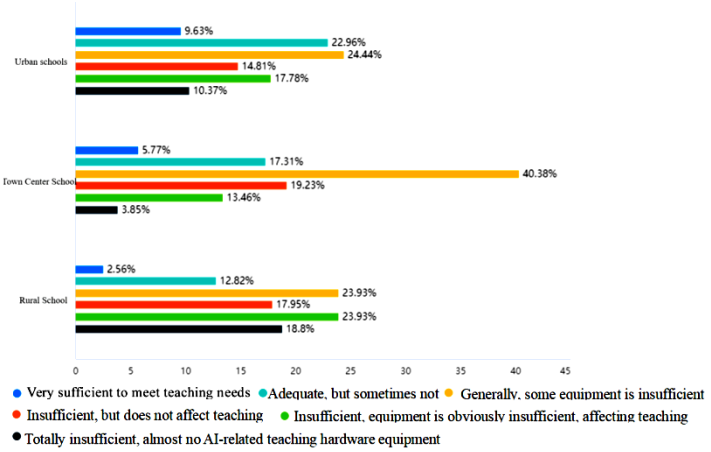

Fig. 3. Artificial Intelligence Course Hardware Resources Statistics for Urban and Rural Areas.

2.2.4 Teaching and Research Activities.

A survey on the problems of participation in teaching and research activities found that time conflict accounted for the highest proportion of 49.67%, and the lack of collaborative team support was the second most prominent problem accounting for 42.43%. There are also problems such as teaching and research activities being a formality, failing to effectively solve practical teaching problems, superficial content of teaching and research activities, and difficulty in providing substantive help. Some teachers lacked effective guidance and support from experts in teaching and research, and the actual effects of teaching and research activities need to be improved. (see Fig.4.)

Survey findings identify key challenges in K-12 AI education: inadequate teacher expertise, unstandardized curricula, urban-rural resource disparities, and ineffective teaching research practices. Solutions require prioritized teacher training, equitable resource allocation, and curriculum standardization to advance equitable, quality AI education.

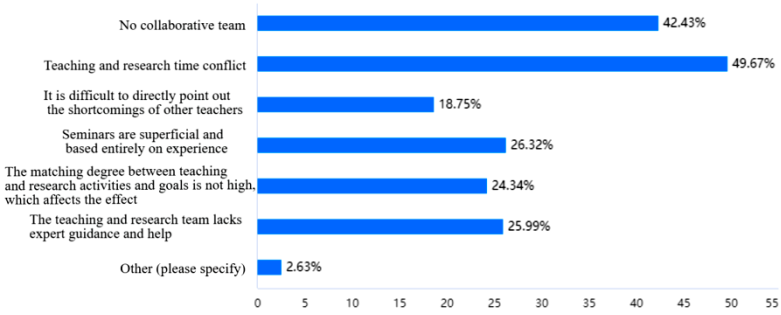

Fig. 4. Statistical chart of teaching and research activities of AI teachers.

3 Outlook of the Strategy of Popularizing Artificial Intelligence Curriculum Education in Primary and Secondary Schools

In order to comprehensively promote the popularization of AI curriculum education in primary and secondary schools so as to better realize the high-quality development of AI education in primary and secondary schools, this study explores a proven strategy around the macro, meso and micro levels.

3.1 Macro-top Level Design Implementation Pathway

To advance AI education in schools, focus on three areas within top-level planning: policy design and governance, curriculum development, and teacher training and support.

Implement policy-driven frameworks establishing clear K-12 AI education objectives, curriculum standards, and evaluation systems [4]. Prioritize rural schools through resource allocation and standardized curricula to reduce equity gaps. Foster cross-sector partnerships to co-create AI resources [5]. Design age-specific curricula: elementary (sensory experiences), middle school (applied learning), high school (innovative projects with cutting-edge tech) [6]. Integrate AI ethics education for responsible tool usage. Develop multi-level teacher training programs in AI pedagogy through systematic courses and practice [7], supported by sustained professional development systems with tailored training for diverse educator needs.

3.2 Pathways for the Implementation of Education in Medium-Sized Schools

At the mesoscopic school level, in order to effectively promote the implementation of AI education in primary and secondary schools, it is necessary to start from the construction of hardware facilities, the development of teaching resources and the innovation of teaching methods.

AI Infrastructure: Establish K-12 AI lab standards, upgrade facilities, and bridge urban-rural resource gaps to ensure equitable access[8]. Expand hardware-sharing networks and regional AI centers to mitigate disparities and enhance equity.

Teaching Resources: Develop cognitively aligned materials, case banks, and interactive tools using engaging formats. Foster teacher collaboration through cross-school platforms and integrate AI modules into national education portals for centralized resource access.

Pedagogical Innovation: Train educators in project-based/gamified methods via workshops. Pilot AI co-teaching models[9]combining adaptive learning, human-AI interaction, and inquiry projects to drive innovation.

3.3 Micro Classroom Teaching Implementation Path

At the micro level of classroom teaching implementation, in order to improve the quality and effectiveness of AI education in primary and secondary schools, efforts need to

be made in three aspects: the application of teaching methods, the use of platforms and technologies, and the optimization of teaching and research activities[10].

First, in the application of teaching methods, teachers should promote task-based, project-based and problem-based learning, design challenging tasks to guide students to explore and communicate, cultivate problem-solving skills, and allow students to master knowledge in depth. Enhance teacher training on generative AI tools for lesson design, engagement, and assignments to enable personalized learning. Optimize AI platforms by expanding resource diversity, refining planning tools, and improving support features to boost teaching efficiency and address student needs. Optimize teaching and research activities through a blended online-offline model, combining virtual seminars and resource-sharing (to overcome spatiotemporal constraints) with in-person exchanges for deeper collaboration. Employ data-driven problem analysis to refine solutions, and establish regional collaboratives to foster cross-school partnerships and expert-guided training for pedagogical innovation. These micro-level strategies address AI classroom challenges, elevate teaching quality, and advance holistic student development.

4 Conclusion

Amid AI's rapid advancement, integrating AI education into schools cultivates future-ready talent, strengthening national educational capacity. This study examines AI education implementation in a G City district, identifying challenges and proposing three-tiered strategies: macro policy guidance, meso school execution, and micro classroom optimization to address imbalances and foster innovation-driven youth development. Collaborative efforts across these levels can propel AI education breakthroughs, advancing educational modernization.

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