The Effectiveness in the Application of Artificial Intelligence Technology at the Primary School in Shandong, China

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Abstract
This study examines AI usage, knowledge, and application skills among primary school teachers using a mixed-method approach. A questionnaire survey is conducted in several primary schools in Weihai City, Shandong Province, China, collecting 100 teacher responses. Descriptive and correlation analyses are performed using SPSS. The findings provide an overview of AI usage trends and challenges, offering valuable data for policymakers, administrators, and educators to support basic education reform. However, the study's scope is limited, and future research should incorporate more diverse data for deeper analysis.
Keywords: Artificial Intelligence, Effectiveness, Chinese Education & Educational Technology

Introduction
With the development of artificial intelligence technology, a new round of changes has been opened in all walks of life. In the field of education, artificial intelligence technology is gradually being applied to all aspects of teaching. China's official "Education Modernization 2035" report points out that the integration of artificial intelligence and education will be accelerated to improve the quality and efficiency of education (Flogie & Aberšek, 2022). The application of artificial intelligence in education has made certain developments, such as smart classrooms, smart blackboards, intelligent homework management, and student personal growth management, which have brought great help to teachers to carry out teaching and personalized management of students (Brown & White, 2022). Due to the uneven development of regions, the application of artificial intelligence in education is uneven. Therefore, this paper studies the effectiveness of the application of Chinese artificial intelligence in primary education, analyzes the development status of artificial intelligence application, and provides practical reference and reference for the development of artificial intelligence in Chinese education.

Literature Review
In terms of the impact of artificial intelligence on education, many scholars have studied it and put forward many excellent insights to promote the development of artificial intelligence in education.

Artificial intelligence has made great changes to the education system and education model,

and has provided effective guidance for students' personalized learning. AI improves learning efficiency by analyzing students' growth and learning experiences to recommend personalized learning methods for students (Brown & Johnson, 2021). In addition, the development of AI teaching assistants has greatly reduced the workload of teachers, and teaching assistants can provide additional support from lesson preparation to classroom teaching (Liu & Sun, 2023).

In terms of student administration, artificial intelligence can optimize the management process and manage students in different time periods in a flexible, intelligent and humanized manner (Bond et al., 2024). The management of AI requires a large amount of student and teacher data as well as school data, so data security is still an issue that cannot be ignored, and management strategies will be further improved in the future to provide real-time feedback to reduce data risks (Al Braiki et al., 2020).

Virtual assistants are expected to become more sophisticated, benefiting both teachers and students. However, to maximize AI's potential, educators must receive continuous professional training to effectively integrate AI into their teaching practices (Abbas et al., 2024).Research by Huang et al. (2021) highlights AI's role in personalized learning, intelligent tutoring, and learning analytics, enabling tailored educational experiences. Chen et al. (2022) trace AI's evolution from basic tools to sophisticated systems, driven by advances in NLP, machine learning, and data analytics. These technologies adapt content in real time, enhance engagement, and improve learning outcomes, particularly in subjects requiring problem-solving.

The integration of NLP and machine learning allows AI to interact conversationally with students and continuously improve (Fazlinda & Jasmy, 2023). Data analytics provide deeper insights into learning progress. Although artificial intelligence has made great progress at home and abroad, there are still a series of problems in specific applications (Syafiqah Hasram et al., 2020). Privacy protection, educational equity, and educational ethics are still issues that cannot be ignored. The gap between the rich and the poor in China still affects the disparity in education, so the application of AI will also make a huge difference (Kim & Park, 2023). Primary education in China, in particular, is crucial to the development of students. Therefore, it is of far-reaching significance to study the role of AI in primary education.

Research Process
In order to further study the role of artificial intelligence in primary education, this study uses a quantitative analysis method. Collect data in the field to capture the actual use of AI in education and teaching processes, and then analyze the data to assess the role of AI. The specific process is as follows:

First, select a study site. Weihai is a medium-sized city in Shandong Province, famous for its educational innovation and reform, and is one of the models of intelligent education in Shandong Province, so the city is selected as the research site. Second, design the questionnaire. This study designed the questionnaire from three aspects, which is divided into four parts: A、B、C、D. This includes personal information, the teacher's AI usage level, the teacher's AI knowledge level, and the teacher's AI usage skills. Then, data collection. In this study, data are collected from a number of primary schools in three regions: urban, suburban and rural, and 100 questionnaires are finally selected. Finally, data analysis. In this study, SPSS

is used to perform descriptive line analysis and correlation analysis of the questionnaire results.

Results
Quantitative Analysis Based on Questionnaire Survey
Analysis of Respondents
This section provides a descriptive analysis of the age, educational background, location of the school, teaching experience and other factors of the teachers interviewed, and the results are detailed in
Table **1**.

Table 1
Descriptive analysis results of foundational section

Question	N	Minimum	Maximum	Mean	Std. Deviation
Gender	100	1	2	1.52	0.502
Age	100	1	3	1.99	0.798
Home Location	100	1	2	1.49	0.502
Academic Background	100	1	2	1.49	0.502
Service Duration	100	1	4	2.34	1.139
Valid N (listwise)	100				

Through the analysis of the respondents' age, academic background, Service Duration and years of service, it is found that most of the teachers are 30-40 years old, and the academic background of undergraduate and graduate students is balanced. Teachers in urban areas, who have more educational resources, performed in the interviews modestly, while teachers in rural areas showed higher interest. The number of years of teaching and the trend of age are basically the same.

In terms of teaching experience, the largest group have 3–10 years in service, with early-career teachers requiring additional support and experienced educators benefiting from specialized training. These findings underscore the importance of customized AI training programs, tailored to career stages and regional differences, ensuring equitable access and effective implementation.

Section B: Level of AI Use
Section B evaluates how frequently teachers integrate AI tools into their teaching practices, their perceptions of its impact, and the barriers they face in adopting these technologies. The descriptive analysis results of this section are presented in
Table **2**.

Table 2
Descriptive analysis results of section B.

Question	N	Minimum	Maximum	Mean	Std. Deviation
SectionBQ1	100	1	5	2.96	1.355
SectionBQ2	100	1	5	2.99	1.396
SectionBQ3	100	1	5	3.01	1.432
SectionBQ4	100	1	5	3.07	1.499
SectionBQ5	100	1	5	3.00	1.443
SectionBQ6	100	1	5	3.07	1.444

SectionBQ7	100	1	5	3.00	1.449
SectionBQ8	100	1	5	3.12	1.387
SectionBQ9	100	1	5	3.22	1.425
SectionBQ10	100	1	5	3.14	1.491
Valid N (listwise)	100				

Teachers' AI usage is moderate (M = 3.00, SD = 1.443), with younger teachers using AI more frequently, while rural teachers faced resource limitations. AI improved teaching efficiency (M = 3.07, SD = 1.444) by automating tasks, though integration challenges remained. Confidence in AI use (M = 3.12, SD = 1.387) is higher among postgraduates but lower among older teachers. AI's impact on student outcomes (M = 3.22, SD = 1.425) is positive, yet training adequacy scored the lowest (M = 2.97, SD = 1.410), highlighting the need for hands-on professional development. Urban teachers have better access to AI, while rural teachers required targeted support. Tailored training, user-friendly tools, and equitable access are essential for effective AI integration in education.

Section C: Level of AI Knowledge
Section C examines teachers' understanding of AI concepts, including its applications in education and ethical considerations. The descriptive analysis results of this section are presented in
Table **3**.

Table 3
Descriptive analysis results of section C.

Question	N	Minimum	Maximum	Mean	Std. Deviation
SectionCQ1	100	1	5	2.97	1.410
SectionCQ2	100	1	5	2.88	1.451
SectionCQ3	100	1	5	2.69	1.461
SectionCQ4	100	1	5	3.01	1.521
SectionCQ5	100	1	5	3.11	1.456
SectionCQ6	100	1	5	2.96	1.463
SectionCQ7	100	1	5	2.86	1.295
SectionCQ8	100	1	5	3.01	1.439
SectionCQ9	100	1	5	3.09	1.349
SectionCQ10	100	1	5	2.77	1.483
Valid N (listwise)	100				

Teachers have a basic understanding of AI, with moderate confidence in its application (M = 3.12). Postgraduate teachers showed higher scores, emphasizing the role of advanced education. Familiarity with AI concepts like machine learning is also moderate (M = 3.09), but gaps remain in advanced topics. AI's benefits in personalizing learning and automating tasks are widely recognized (M = 3.22), while awareness of ethical concerns like data privacy and bias is low (M = 2.96). Gender have no significant impact on AI engagement. To address these gaps, AI training should focus on ethics, practical applications, and continuous learning through collaborative forums.

Section D: Level of AI Skills
Section D assesses teachers' proficiency in using AI tools, focusing on their ability to apply

these tools in the classroom and address student needs effectively. The desriptive analysis results of this section are presented in
Table **4**. The overall mean score for Section D is 3.06, indicating moderate skill levels among teachers.

Table 4
Descriptive analysis results of section D.

Question	N	Minimum	Maximum	Mean	Std. Deviation
SectionDQ1	100	1	5	3.00	1.456
SectionDQ2	100	1	5	2.94	1.496
SectionDQ3	100	1	5	3.08	1.412
SectionDQ4	100	1	5	2.98	1.463
SectionDQ5	100	1	5	3.06	1.455
SectionDQ6	100	1	5	3.07	1.387
SectionDQ7	100	1	5	2.91	1.422
SectionDQ8	100	1	5	3.12	1.416
SectionDQ9	100	1	5	3.18	1.366
SectionDQ10	100	1	5	3.12	1.635
Valid N (listwise)	100				

Teachers have moderate AI proficiency (M = 3.07), handling basic tasks but struggling with advanced features, highlighting the need for better training. They recognized AI's benefits for student outcomes (M = 3.18) but required stronger support. Independent learning is challenging (M = 2.91) due to technical barriers and inadequate training resources. Confidence in AI for data analysis is moderate (M = 3.12), with a need for better guidance. Veteran teachers faced more difficulties, and urban teachers have better access to resources than rural counterparts. Simplifying AI tools and providing tailored training are key to effective adoption in classrooms.

Correlation Analysis
Table 5
Questionnaire correlation analysis in SPSS.

	DQ1	DQ2	DQ3	DQ4	DQ5	DQ6	DQ7	DQ8	DQ9	DQ10
Gender	.249*	0.136	-0.059	0.028	-0.002	-0.024	0.151	0.011	-0.049	-0.028
Age	0.061	-0.001	0.180	0.060	-0.043	0.074	0.088	0.090	0.122	-0.069
Home Location	-0.179	-0.041	-0.084	-0.083	0.098	.269**	0.076	-0.154	-0.115	-0.097
Academic Background	0.055	0.013	-0.084	-0.028	-0.041	0.081	0.190	0.129	0.135	0.001
Service Duration	-0.085	0.024	-0.168	0.089	-0.098	0.004	0.081	0.075	-0.007	0.043
BQ1	-0.005	-0.126	1	-0.137	-0.029	-0.074	0.117	-0.021	-0.060	0.146
BQ2	1	-0.182	-0.005	0.051	-0.052	-0.200	0.123	0.115	0.088	-0.132
BQ3	0.051	0.010	-0.137	1	0.051	0.054	-0.042	0.054	0.116	-0.113
BQ4	-0.182	1	-0.126	0.010	0.110	-0.055	-0.005	-0.046	0.032	0.069
BQ5	-0.052	0.110	-0.029	0.051	1	0.116	-0.063	-0.025	-0.020	0.132
BQ6	-0.200	-0.055	-0.074	0.054	0.116	1	-0.034	-0.024	-0.032	0.024
BQ7	0.123	-0.005	0.117	-0.042	-0.063	-0.034	1	-0.100	0.029	0.065
BQ8	0.115	-0.046	-0.021	0.054	-0.025	-0.024	-0.100	1	-0.172	0.002
BQ9	0.088	0.032	-0.060	0.116	-0.020	-0.032	0.029	-0.172	1	-0.005
BQ10	-0.132	0.069	0.146	-0.113	0.132	0.024	0.065	0.002	-0.005	1

CQ1	1	-0.160	-0.019	-0.108	0.071	0.024	0.086	0.050	0.001	-0.056
CQ2	-0.160	1	0.001	0.087	0.078	0.060	-0.063	0.030	0.181	0.025
CQ3	-0.019	0.001	1	0.129	-0.174	0.131	0.084	0.165	-0.083	-0.122
CQ4	-0.108	0.087	0.129	1	0.009	0.023	$-.210^*$	0.023	-0.074	-0.008
CQ5	0.071	0.078	-0.174	0.009	1	0.125	0.014	0.004	0.000	-0.096
CQ6	0.024	0.060	0.131	0.023	0.125	1	-0.120	0.019	-0.065	$-.223^*$
CQ7	0.086	-0.063	0.084	$-.210^*$	0.014	-0.120	1	0.022	0.036	-0.091
CQ8	0.050	0.030	0.165	0.023	0.004	0.019	0.022	1	-0.099	-0.165
CQ9	0.001	0.181	-0.083	-0.074	0.000	-0.065	0.036	-0.099	1	0.000
CQ10	-0.056	0.025	-0.122	-0.008	-0.096	$-.223^*$	-0.091	-0.165	0.000	1
DQ1	1	-0.014	0.118	0.194	0.014	$-.200^*$	0.015	0.044	-0.036	0.047
DQ2	-0.014	1	-0.179	0.069	0.020	-0.193	0.092	0.094	0.075	-0.001
DQ3	0.118	-0.179	1	0.138	0.042	0.038	0.089	-0.035	0.008	0.057
DQ4	0.194	0.069	0.138	1	-0.004	-0.054	-0.045	0.016	$.204^*$	-0.029
DQ5	0.014	0.020	0.042	-0.004	1	0.048	0.081	0.119	-0.031	-0.088
DQ6	$-.200^*$	-0.193	0.038	-0.054	0.048	1	$.275^{**}$	0.057	-0.087	-0.057
DQ7	0.015	0.092	0.089	-0.045	0.081	$.275^{**}$	1	$.211^*$	0.133	0.022
DQ8	0.044	0.094	-0.035	0.016	0.119	0.057	$.211^*$	1	-0.084	0.090
DQ9	-0.036	0.075	0.008	$.204^*$	-0.031	-0.087	0.133	-0.084	1	-0.155
DQ10	0.047	-0.001	0.057	-0.029	-0.088	-0.057	0.022	0.090	-0.155	1

Correlation analysis in Table 5 showed that gender, age, home location, academic background, and service duration have weak, statistically insignificant correlations with AI-related items across Sections B, C, and D. This suggests that demographic factors have minimal impact on teachers' engagement with AI, whether in practical teaching, theoretical contexts, or reflective practices. AI adoption appears consistent across different teacher demographics, with no significant disparities based on gender, experience, or location.

Conclusion

AI has the potential to transform education by enhancing teaching efficiency, personalizing learning, and improving student outcomes. However, barriers such as inadequate training, resource gaps between urban and rural areas, and complex AI tools hinder adoption. Many teachers, especially veterans and those in rural schools, struggle with AI due to limited access and technical challenges. To address this, the study recommends user-friendly AI tools, tiered training programs, and targeted rural investment. These efforts will help educators integrate AI effectively, improving teaching practices and student learning in a digital era.

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